RICES

RESEARCH INNOVATION COMMERCIALISATION & ENTREPRENEURSHIP SHOWCASE

2020

EXTENDED ABSTRACTS

MMU® MULTIMEDIA UNIVERSITY | PRESS

Published by
MMU Press
Research Management Centre
Multimedia University
2 nd Floor, Chancellery Building
Persiaran Multimedia
63100 Cyberjaya
Selangor Darul Ehsan

e-ISBN: 978-967-19560-6-9

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Research Innovation Commercialisation & Entrepreneurship Showcase
(2020 : Online)
RICES 2020 : RESEARCH INNOVATION COMMERCIALISATION &
ENTREPRENEURSHIP SHOWCASE : EXTENDED ABSTRACTS / Assoc. Prof. Ts.
Dr. Junaidi bin Abdullah, Putri Syaidatul Akma binti Mohd Adzmi.
Mode of access: Internet
eISBN 978-967-19560-6-9
1. Education, Higher--Malaysia--Abstracts.
2. Universities and colleges--Malaysia--Abstracts.
3. Electronic books.
I. Junaidi Abdullah, Prof. Madya, Dr., Ts.
II. Putri Syaidatul Akma Mohd. Adzmi. II. Title.
378.595

Cover design by Ms. Qistina Binti Ruslan.

RICES 2020 - EXTENDED ABSTRACTS

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FOREWORD

Vice President, RICES 2020

RICES 2020 is one of the numerous publications, including journals that MMU Press takes pride in. I am truly pleased that MMU Press have embarked on the initiative to publish this book.

Despite the global pandemic, the event RICES 2020 was successfully organised virtually, showcasing a multitude of exhibits reflecting research, innovation, commercialization and entrepreneurship activities and achievements. The RICES 2020 book is an extended compilation of MMU's researchers and entrepreneurs' fascinating insights on research ventures and idea creation for commercialising research output as well entrepreneurship. RICES is an excellent platform for MMU to interact with internal and external stakeholders. These interactions enable researchers to realise potentials for collaborations, IP exploitations, commercialisation and further research. It allows for industrial related viable research and feasible output. This RICES 2020 publication extends the present interactions even further, allowing for post-event interactions to materialise beyond the existing valued stakeholders.

RICES 2020 is evidence of the excellent effort by the RICES 2020 organisers and MMU Press. Their commitment and dedication have paid out with another hallmark achievement reflecting the division's synergy in the development of Research-Innovation- Commercialisation-Entrepreneurship (R-I-C-E) nexus in all research activities. I look forward to RICES 2020 publication.

Thank you.

Prof. Ir. Dr. Hairul Azhar bin Abdul Rashid
Vice President, Research and Industrial Collaboration and Engagement
Multimedia University

FOREWORD

Director, RICES 2020

On behalf of the Committee, it is my great pleasure to welcome you to RICES 2020, the fourth Research, Innovation, Commercialization, Entrepreneurship, Showcase. RICES is an annual event organized by Multimedia University to showcase research innovations, commercialization and entrepreneurship. RICES 2020, with the overarching theme of "Humanizing Innovation," is being held virtually on December 9-10, 2020, allowing for a borderless audience and safe interaction among inventors, venture capitalists, and industries in the midst of COVID-19. It is about ensuring that the results of research and innovation contribute to positive changes in people's lives, society, industry, and the country as a whole.

RICES 2020 pioneered the use of Virtual Reality technology to elevate the virtual exhibition experience by transforming in-person perspectives into an interactive and immersive virtual experience. For the first time, RICES 2020 hosted a virtual conference, disseminating the most recent research results and findings for researchers and academics to discuss. This year, 194 projects were accepted for presentation at RICES 2020, distributed across Project Showcase (Research Project, Social Innovation Project, and Startups), Embedding Entrepreneurial Learning, and Conference. Both internal and external judges who evaluated the showcases had used the judging criteria similar to those set for international exhibitions such as International Conference and Exposition on Inventions by Institutions of Higher Learning (PECIPTA) and International Invention, Innovation & Technology Exhibition (ITEX).

I would like to express my heartfelt gratitude to the organizing committee and everyone who helped make RICES 2020 a success in various ways. Last but not the least, I would like to thank everyone who submitted work and participated in RICES 2020.

Thank you all for contributing!

Mr. Cheong Soon Nyean
Director of RICES 2020
Deputy Director, Technology Transfer Office
Multimedia University

FOREWORD

Deputy Director, RMC
(Head, MMU PRESS)

I would like to humbly thank various people who made MMU Press publications a success especially in its RICES publications 2020. Congratulations to Mr. Cheong Soon Nyean, Director of RICES 2020 who has successfully organized the event despite the Covid-19 pandemic. The RICES 2020 hosted the Virtual Reality technology to ensure all participants and visitors immerse into this virtual experience and making the participation almost possible for everyone.

On top of that, RICES showcases the best technology, research innovation, R&I commercialization, receives valuable feedback and develops new partnerships that bring great value to society. MMU Press is proud to have produced a total of 5 publications in 2021 namely research on (i) Engineering, (ii) ICT and Multimedia (iii) Social Science, (iv) Entrepreneurship & Social innovation projects as well as (v) RICES Conference Extended Abstract.

It is our utmost hope that MMU Press mission will be an internationally recognized academic press. Its spirit is to connect Multimedia University (MMU) with the larger communities and institution through innovative and inspiring writings. We welcome all contributors to publish with MMU Press to better equip ourselves and the community at large with various new ideas and technologies.

Finally, all these achievements are made possible due to strong commitment by all especially the Coordinator of Special Publication – Dr. Tan Yi Fei, chief editors, editorial team members and the project leaders, who have contributed to the publication of RICES 2020. Kudos to all of you! Thank you and let's make MMU Press be the beacon of knowledge.

Assoc. Prof. Dr. Tan Siow Hooi
Deputy Director, Research Management Centre (Head, MMU Press)
Multimedia University

COMPUTING & INFORMATICS

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A DESIGN OF VIRTUAL REALITY MIRROR THERAPY FOR STROKE REHABILITATION

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***Abstract* - Mirror therapy requires the patient to perform physical movement with the non-affected limb and the movement is reflected in a mirror. This study aims to develop a mirror therapy that couples with virtual reality technology to provide a new approach for stroke recovery. In this study, a leap motion controller is introduced as a human machine interface to track movement of the upper limbs. A motion sensor is used to translate the physical gestures into instructions for the device. The Unity game engine is used to create a virtual 3D environment with objects to interact with, and a head mounted display is set up to provide a fully interactive virtual reality experience. Theoretically, a virtual mirror is placed within the virtual world and simulates a mirroring hand. This mirror hand will mimic the opposite hand in the same fashion as a mirror. The developed virtual environment provides the same function as a physical mirror while allowing a more interactive experience when undergoing therapy. 32 volunteers were invited to test play the program to measure its effectiveness. 90.6% of the volunteers rated it 3 and above when asked to rate the level of engagement on a scale of 1 to 5, with 5 being the most engaging. The volunteers were also asked to rate the helpfulness they think the program will have towards mirror therapy from a scale of 1 to 5, with 5 being the most helpful. 87.5% of the volunteers rated it highly from 4 and above. The results are promising based on the overall positive reviews from the participant evaluation.**

Keywords—mirror therapy, virtual reality, Unity software development

I. Introduction

Stroke is the third-largest cause of death in Malaysia, with an estimated 40,000 Malaysians suffering from stroke each year [1]. Stroke effects are highly dependent on the location it occurs and the volume of damaged brain tissue [2]. Most of the stroke patients suffer from motor dysfunction [4] and they are dependent on others for transportation to the medical facilities and usually limited by the schedule of the staff for rehabilitation therapy. Owing to the reasons provided, many patients who undergo therapy give up before results are even yielded. Hence this study proposed a home-based virtual reality mirror therapy to enable patients to carry out their own training. Mirror therapy is a type of stroke rehabilitation approach where the reflection of a moving non-affected limb gives the illusion of movement in the affected limb. The incorporation of virtual reality therapy into the field of mirror therapy rehabilitation displays the potential to improve the quality of life of patients. In the time of pandemic, a home-based mirror therapy also enables the patients who are confined at home to continue their own training without disruption.

II. methodology

The processes involved in the methodology aim to facilitate the translation of physical movement into digital data. Fig. 1 illustrates the path that data from hand movement translates across the system. Physical hand movement captured in the real world is converted into data by a leap motion sensor and the converted data is fed into the unity game engine where a virtual 3D environment is developed. A head mounted display (HMD) is set up to provide a fully interactive virtual reality experience for the user. In this program, a virtual mirror is placed within the virtual world to simulate a mirroring hand. The virtual mirror script works to reflect the movements of the hand and insert them into the opposite pair of hands. The Leap Motion Standard Developer Kit (SDK) for Unity provides the assets needed to build the game. There is a game object called 'Leap Rig' that includes the setup for a virtual arm pair in front of the camera. The location of the camera is set to be about eye level to render this game object best used with HMD for virtual reality. Next, a pair of hand model was bound to the game object. The 'LoPoly Rigged Hand' is chosen to build this project. The model for left and right hand needed to be bound individually for the game object to work. With this setup, when the scene is played, the user will be able to create a pair of virtual limbs with the leap motion controller. In this project, the configuration of the software consists of three components in which the Trinus VR is used to develop telephone-computer communication for the HMD, the Unity Game Engine is responsible for creating the interior of the virtual world and objects and the Microsoft Visual Studio is used to provide the game engine with C sharp scripting.

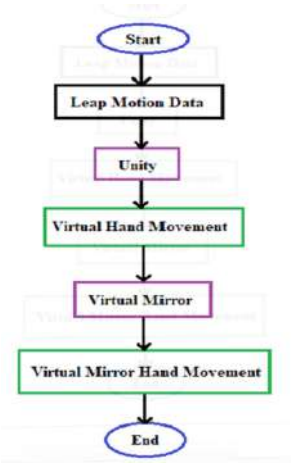

Fig. 1: Hand movement process flowchart

III. RESULTS/ FINDINGS

Fig. 2 shows the mirror hands when both hands of the user are active after the completion of the program. A survey was conducted with a total of 32 volunteers to measure the effectiveness of the program. 93.5% of the participants had some prior knowledge regarding virtual reality but had never experienced any in their life. While using the software, besides allowing them to explore the virtual environment, the participants were also required to perform upper limb exercises commonly conducted in traditional mirror therapy session. The implementation of leap motion controller in virtual reality training is observed to be an interesting experience for 84.4% of the participants as the game captures their attention for 5 to 10 minutes. 90.6% of participants rated the engagement level highly with a 3 and above on a scale of 1 to 5 with 5 being the most engaging. 87.5% of respondents rated it highly from 4 and above when asked to rate helpfulness level with 5 being the most helpful. All the participants were able to adapt to the virtual reality experience within 10 minutes when continuous attempts were given. A common request from the participants was the addition of more games in the program such as the use of swiping motion and pinching motion.

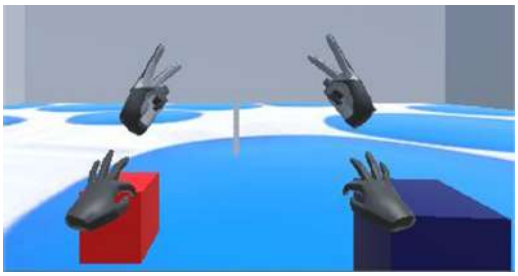

Fig. 2. Screenshot of the training program

IV. CONCLUSION

With new understanding in the field of virtual reality, a 3D virtual world is created for the purpose of developing mirror therapy to aid upper limb recovery training. Modern tools such as leap motion controller were used to implement a solution. From the overall positive feedback from the public testing, the result is considered to be promising. Further exploration can be conducted so that the end product is ready to be used in a telemedicine setting. A long term longitudinal study on stroke patients must be performed to obtain a definitive answer to whether mirror therapy in virtual reality is comparable or even superior to the traditional mirror box.

REFERENCES

[1] Effects of Stroke: American Stroke Association; 2017 [08.11.2020]. Available from: http://www.strokeassociation.org/STROKEORG/AboutStroke/EffectsofStroke/Effects-of-Stroke_UCM_308534_SubHomePage.jsp.

[2] N. National Stroke Association Malaysia, “How Stroke Is Diagnosed? | Stroke Prevention | National Stroke Association of Malaysia | NASAM.” [08.11.2020] Available from: http://www.nasam.org/english/prevention-what_is_a_stroke.php.

[3] American Speech-Language Hearing Association, “Stroke,” 2017. [08.11.2020]. Available from: http://www.asha.org/public/speech/disorders/Stroke/.

[4] Stroke Association, “What problems do people have after a stroke? | Stroke Association,” 2015. [08.11.2020]. Available from: https://www.stroke.org.uk/what-stroke/what-problems-do-people-have-after-stroke.

A NEW FRAMEWORK OF GENDER ESTIMATION IN THE UNCONTROLLED ENVIRONMENT FOR DOOH ADVERTISING

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Abstract - **The existing digital out-of-home (DOOH) advertising in Malaysia only broadcast the advertisement in a continuous and random manner without considering the presence of the audience. This causes the audience most likely to perceive some irrelevant advertisements. The recent advances of facial analysis unlock the potential of the DOOH media towards the targeted advertising manner. Therefore, the DOOH media is able to deliver a customised advertisement based on the facial attributes of the audience. However, the DOOH media is commonly operating in an uncontrolled environment. In such an environment, facial analysis faces two main challenges which are blurry faces and misaligned faces. These challenges are noises that increase the difficulty in feature extraction. In this paper, a designed gender estimation framework that incorporates handcrafted feature extraction method is proposed to handle the aforementioned challenges without going through the pre-processing stage. A series of experiments that compare the designed framework with a pre-trained model from cloud services such as Google Cloud's Vision API and Microsoft Azure Face. The designed framework outperforms Google Cloud's Vision API in terms of gender estimation.**

Keywords—gender estimation, uncontrolled environment, feature extraction, targeted advertising

I. Introduction

The current report stated that the DOOH growth is majorly from the conversion of traditional OOH to DOOH [1]. DOOH advertising can be data-driven in which the advertisement is selected based on the real-time variables [2]. The targeted advertisement allows publishers to reach a broader potential audience [3]. In order to improve the DOOH advertising efficiency, researchers apply facial analysis to achieve targeted advertising in DOOH advertising [4]. The DOOH media is commonly operating in an uncontrolled environment. Such an environment decreases the accuracy of facial analysis. The captured face from the uncontrolled environment is frequently blurred and is likely to be misaligned [5]. The responsiveness of DOOH media is important as the advertisement should be showcased immediately to the audience in the shortest time possible. An ideal gender estimation or face analysis method is able to accurately classify the image that is affected by noises. This paper proposed a gender estimation framework that improves the classification accuracy when dealing with the blurred face, misaligned face and low-resolution face without using image blur restoration, face alignment and any other image restoration method.

II. methodology

Fig 1 illustrates the proposed gender estimation framework. Firstly, the input image is converted into grayscale and splits the image into sub-blocks. Then, the individual texture information is extracted from the sub-blocks and concatenated into a feature vector. The feature vector is very long and high dimensional. Instead of directly utilise the feature vector, dimension reduction is then applied to shorten the feature vector. The first stage of dimension reduction is feature weighting, which is used to strengthen the important features and decline the least-used features. During the first stage, the important feature will be assigned with a larger weight, and vice versa. The second stage of dimension reduction is feature selection, which is used to discard the redundant features. The important features are classified using Support Vector Machine (SVM) with linear kernel.

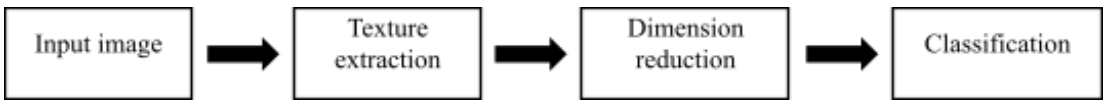

Fig 1: The proposed framework of gender estimation in uncontrolled environment

III. RESULTS/ FINDINGS

This experiment compares the proposed framework with the existing deep learning cloud services from the Google Cloud's Vision API and Microsoft Azure Face. Fig 2 illustrates the accuracy of gender estimation of cloud services, which take the unclassified face as a negative outcome. Significantly, Microsoft Azure Face performs better than Google Cloud's Vision API. Google Cloud's Vision API has the lowest accuracy in all aspects, especially the accuracy of female for both clear and blur faces are below 30%. The existing cloud services such as Google Cloud's Vision API and Microsoft Azure Face are using deep learning algorithm and trained with tons of samples. They are expected to be better than most of the handcrafted feature method. Surprisingly, the handcrafted feature extractor of the proposed framework outperforms Google Cloud's Vision API in terms of gender estimation's accuracy. Microsoft Azure Face has the best performance on clear faces. However, Microsoft Azure Face only performs slightly better than the proposed framework for an average of 2.5%on the gender estimation with the blur faces. The proposed framework is trained with a very small size training set, containing 269 males and 160 females. There is still room for improvement if the training sample size is added. Moreover, the proposed framework is able to work offline without an internet connection, which reduces the usage of bandwidth and avoids the side effects while encountering connection error.

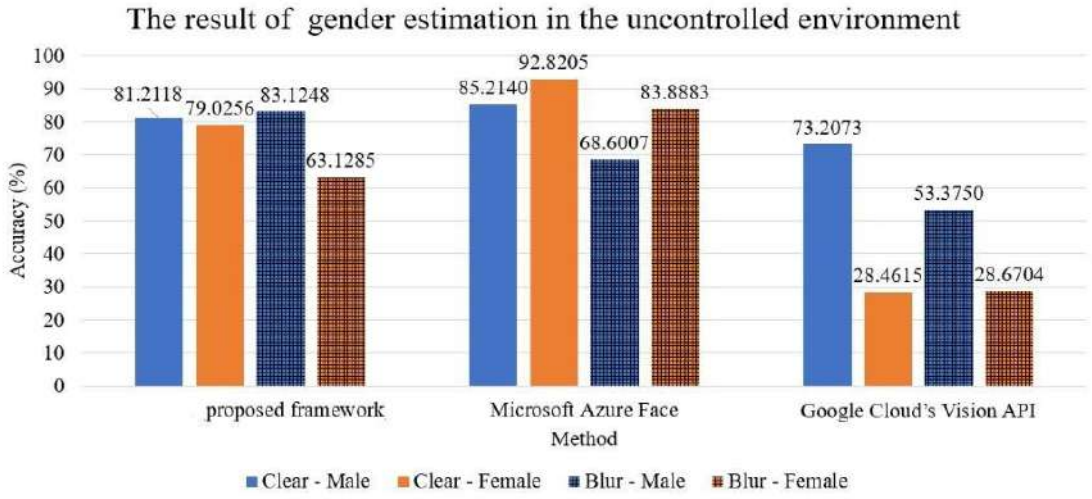

Fig 2: The comparative performance between proposed framework, Microsoft Azure and Google Vision.

IV. CONCLUSION

DOOH media is usually deployed under an uncontrolled environment where the performance of gender estimation is affected by the blurred face and misaligned face. The proposed framework is proven to overcome the challenges of an uncontrolled environment and fulfilled the needs of real-time targeted advertising. The proposed handcrafted feature extraction method is able to improve the accuracy of gender estimation without the use of the pre-processing method. The results show that the proposed framework outperforms the deep learning method from Google Cloud's Vision and achieves a competitive result as the Microsoft Azure Face.

ACKNOWLEDGEMENT

The authors would like to express appreciation for the support from Multimedia University internal research fund [MMUI/210028].

REFERENCES

[1] Dhesi, D. (2020). Outdoor advertising market to stay buoyant. Retrieved from *The Star*: https://www.thestar.com.my/business/business-news/2020/02/24/outdoor-advertising-market-to-stay-buoyant.

[2] Geraghty, G., & Conway, A. T. (2016). The Study of Traditional and Non-traditional Marketing Communications: Target Marketing in the Events Sector. *12th Annual Tourism and Hospitality Research in Ireland Conference (THRIC 2016)*. Limerick Institute of Technology.

[3] Zhao, S., Kalra, A., Wang, C., Borcea, C., & Chen, Y. (2019). Ad Blocking Whitelist Prediction for Online Publishers. *2019 IEEE International Conference on Big Data (Big Data)* (pp. 1711-1716). Los Angeles, CA, USA: IEEE.

[4] Turov, N., Shilov, N., & Teslya, N. (2019). Digital Signage Personalization Through Analysis of the Visual Information About Viewers. *2019 24th Conference of Open Innovations Association (FRUCT)* (pp. 444-450). Moscow, Russia: IEEE.

[5] Knežević, K., Mandić, E., Petrović, R., & Stojanović, B. (2018). Blur and Motion Blur Influence on Face Recognition Performance. *2018 14th Symposium on Neural Networks and Applications (NEUREL)* (pp. 1-5). Belgrade: IEEE.

A SURVEY OF GAIT RECOGNITION BASED ON INERTIAL SENSORS

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***Abstract* - Gait is defined as the way an individual walks and it has been proven as a unique biometrics. Wearable gait analysis has been an emerging topic especially with the support from the recent development of Inertial Measurement Unit (IMU) sensors. The technology has proliferated due to the fact that gait signal can be obtained conveniently from wearable sensors. Inertial sensors are embedded in smart devices and they can be used to record gait data continuously and unobtrusively. This paper provides a systematic review for state-of-the-arts in inertial sensor-based gait recognition. Studies have demonstrated that gait signal obtained from smartphone is sufficient for identity recognition. Inertial sensor-based gait recognition has shown great potential to be deployed in various biometrics or security related applications.**

Keywords— biometric, inertial sensors, gait analysis, gait recognition, survey

I. Introduction

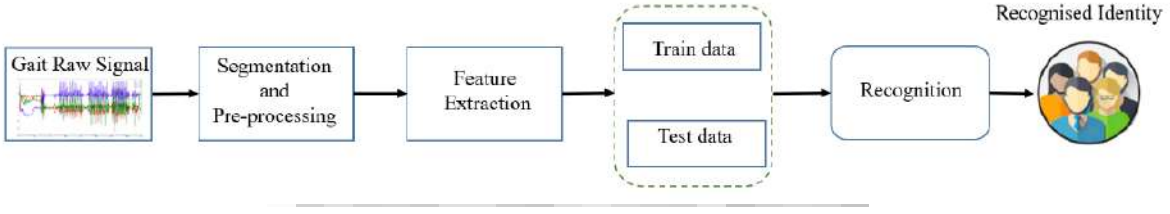
The rapid development of smartphones makes them not only a communication tool but also an important storage means for sensitive data such as banking information, emails, e-commerce and personal information. Therefore, security risks have become a critical issue and phone authentication plays an important role to keep the information private and secure.

There has been a great interest to develop biometric-based intelligence to improve smartphone users' experience. One of the emerging research is human gait recognition. The term gait recognition refers to a behavioral biometrics that identifies individuals based on the manner of walking. Biometric gait recognition can be classified into three categories namely: (1) machine vision-based, (2) floor sensor-based, and (3) wearable sensor-based. Among the three types of biometric gait recognition, wearable sensor-based methods have received increased attention because it is unobtrusive and user friendly. With the development of microelectromechanical system (MEMS), mobile devices have been equipped with more sensors and become much more powerful. Thus, gait can be recorded easily with the used of inertial measurement unit (IMU) sensors like accelerometer and gyroscope that are embedded in the smartphone. Gait recognition using different sensor modalities have become a revolutionary technology for real-time and autonomous monitoring in various domain such as activity of daily living (ADL), ambient assisted living, behavior analysis, healthcare system, security and many more.

A number of public inertial sensor datasets have been collected, namely 1) Pervasive dataset, 2) Human Activities and Postural Transitions Dataset (HAPT) from The UCI Machine Learning Repository, 3) Chonnam National University dataset (CNU), and 4) Osaka University-The Institute of Scientific and Industrial Research (OU-ISIR) gait database. The Pervasive and UCI HAPT datasets were initially collected for the purpose of evaluating HAR while OU ISIR and CNU datasets were collected to perform user recognition.

II. Overview of Gait Recognition Methods

In general gait recognition system using inertial sensors comprises of the following components: (1) Pre-processing (e.g. noise removal with filtering, interpolation), (2) Segmentation (e.g. gait cycle extraction), (3) Feature extraction (e.g. Extraction of discriminative gait features), (4) Recognition (e.g. pattern similarity matching or machine learning). A block diagram of a gait recognition system is illustrated in Figure 1.



Raw signal consisting of three axes from accelerometer and three axes from gyroscope are segmented and the pre-processing process is performed. Thereafter, training and testing data can be obtained from the extracted features. For recognition, the training data will be trained to predict the target in the testing data to identify the genuine user. There are studies that combine feature extraction with recognition; while the others directly perform recognition after segmentation without performing feature extraction. Thus, there are some variations from the standard processes. Gait recognition can be implemented either with pattern similarity matching or machine learning methods. For pattern similarity matching, similarity scores from the gallery and probe of predefined feature space of gait patterns are compared cross-wise. On the other hand, for machine learning methods, gait recognition is performed by learning discriminative feature set from the training feature space of gait patterns and the classification procedure is employed to predict the testing set input patterns.

The commonly used classification techniques for gait recognition are SVM [1], Logistic Regression [2], k-NN [3], Decision Trees [4], HMM [5], Adaboost [6]. Pattern similarity approach use distance metrics to compare the similarity between gait patterns such as, Euclidean distance [7], Weighted Manhattan [7], Manhattan distance [7], DTW [7], Cyclic Rotation Method (CRM) [7], Tanimoto distance [8], correlation coefficient [9].

However, conventional gait recognition methods are considered deterministic while the real world problems have to deal with stochastic models. In addition, it also depends on the nature of the data (i.e. how accurately the features are identified and extracted) and the choice of appropriate knowledge representations. Moreover, insufficient data quantity or quality will yield a poor model that gives poor performance. Therefore, research efforts have been expended to find methods that can deal with the limitations of conventional gait recognition methods. The recent techniques include Deep Learning [10] and Transfer Learning [11].

III. CONCLUSION

Gait recognition is behavioural authentication method that can be used for continuous authentication. A low-cost, unobtrusive and wearable gait analysis system can be realised in the real world by exploiting the embedded inertial sensors inside the smartphone. The identity of the user can be verified in the background without explicit user interaction. Gait authentication can be used in addition to primary physiologic-based biometric authentication methods such as fingerprint or face and traditional authentication methods such as password or PIN. If authentication or verification of continuous gait biometric fails to regenerate user identity, the primary authentication can be launched. It is revealed from the current state-of-the-art that inertial sensor-based gait recognition holds great potential for further development and can be applied in many practical applications.

REFERENCES

[1] D. Anguita, A. Ghio, L. Oneto, X. Parra, and J. L. Reyes-Ortiz, “A public domain dataset for human activity recognition using smartphones,” in *ESANN 2013 proceedings, 21st European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning*, 2013.

[2] M. Shoaib, S. Bosch, O. Durmaz Incel, H. Scholten, and P. J. M. Havinga, “Fusion of smartphone motion sensors for physical activity recognition,” *Sensors (Switzerland)*, vol. 14, no. 6, pp. 10146–10176, 2014.

[3] A. Stisen *et al.*, “Smart Devices are Different: Assessing and MitigatingMobile Sensing Heterogeneities for Activity Recognition,” *Proc. 13th ACM Conf. Embed. Networked Sens. Syst. - SenSys ’15*, pp. 127–140, 2015.

[4] Y. Watanabe, “Influence of holding smart phone for acceleration-based gait authentication,” in *Proceedings - 2014 International Conference on Emerging Security Technologies, EST 2014*, 2014.

[5] C. Nickel and C. Busch, “Does a cycle-based segmentation improve accelerometer-based biometric gait recognition?,” in *2012 11th International Conference on Information Science, Signal Processing and their Applications, ISSPA 2012*, 2012.

[6] E. Rastegari, S. Azizian, and H. Ali, “Machine Learning and Similarity Network Approaches to Support Automatic Classification of Parkinson’s Diseases Using Accelerometer-based Gait Analysis,” in *Proceedings of the 52nd Hawaii International Conference on System Sciences*, 2019.

[7] P. Bours and R. Shrestha, “Eigensteps: A giant leap for gait recognition,” in *2010 2nd International Workshop on Security and Communication Networks, IWSCN 2010*, 2010.

[8] R. Subramanian *et al.*, “Orientation invariant gait matching algorithm based on the Kabsch alignment,” in *2015 IEEE International Conference on Identity, Security and Behavior Analysis, ISBA 2015*, 2015.

[9] H. J. Ailisto, M. Lindholm, J. Mantyjarvi, E. Vildjiounaite, and S.-M. Makela, “Identifying people from gait pattern with accelerometers,” no. March, p. 7, 2005.

[10] S. Yao, S. Hu, Y. Zhao, A. Zhang, and T. Abdelzaher, “DeepSense: a Unified Deep Learning Framework for Time-Series Mobile Sensing Data Processing,” *Www*, pp. 17–4, 2017.

[11] M. A. A. H. Khan, N. Roy, and A. Misra, “Scaling Human Activity Recognition via Deep Learning-based Domain Adaptation,” in *2018 IEEE International Conference on Pervasive Computing and Communications, PerCom 2018*, 2018.

ClassDojo: Yay or Nay?

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Abstract - *This paper discovers the perception of lecturers in a private institution in using the ClassDojo application during their online teaching. ClassDojo is an educational platform specially designs to the lower level of education specifically primary education. It is a social media platform that allows students to communicate and interact with their classmates and teachers interactively blending their lesson with simple gamified features. The implementation of the ClassDojo application during the virtual learning for students is being foreseen from the lecturers' perspective in terms of the suitability for higher education, the active engagement of students towards their subjects and assessment measure. The finding showed that ClassDojo encourages students' involvement and engagement in online classes based on the acknowledgement given by the lecturers where the measure of such acknowledgement can be varied according to the lecturer's desirable observation. It is suitable to be used as a supplementary platform for every level of education. Thus, ClassDojo is meant to enhance active engagement of students towards the subject learned and not to measure their cognitive ability and performance.*

Keywords— ClassDojo, blended learning, online class engagement

I. Introduction

In the 21st century teaching and learning process, e-learning has become a new norm and traditional learning is no longer a vital part of the process [1]. Since educators tend to focus on different online tools for virtual teaching as there are varieties of choice in the market, the engagement in virtual classrooms becomes less important. Hence, the current availability of online tools for classroom engagement is very limited.

ClassDojo is a school communication platform that teachers, students and families use every day to build close-knit communities by sharing what is being learned in the classroom home through photos, videos and messages. Burger [2] in his research agrees that this application is one of the effective classroom management tools. According to Dillion [3], ClassDojo is proven to be effective for decreasing classwide disruptive and increasing academically engaged behavior in class. Ford [4] and Seager [5] through their studies affirm that the tools available in the application show a significant increase in positive behavior in a classroom.

This research explore on the suitability for higher education learners, the active engagement of students towards their subject and the application of available features for assessment via ClassDojo application.

II. methodology

The participants of this study were three lecturers with at least seven years' of experience teaching tertiary education ranging from foundation, diploma and undergraduate students from a private university in Malaysia. Participant 1 is an expert in multimedia related subjects and participant 2 is a mathematics lecturer. Both participants have been using the application through the physical and virtual lecture classroom for at least five years. Participant 3 with a law background has implemented the application of ClassDojo in one of the online semesters.

There are some limitations while conducting this study. While this research is a case study based on the lecturers' experience and observation, the ground limitation is the small sample size, cost and time. Due to the specific criteria of the background requirement of participants, the result of this study could be more accurate if the sample size is increased and varied. Moreover, the study could be more meaningful if it could be tested statistically.

III. results/ Findings

In answering the research questions, these participants have been interviewed from their experience of using the ClassDojo in their classrooms to gain more insights from the lecturers' perspective.

1. How do lecturers perceive the application of the ClassDojo term of suitability for higher education learners?

- Participant 1: She believes that there are limited sources of application to monitor the students' behavior, most available online applications focus on formative assessment which measure cognitive domain. She agrees that this application is significant in enhancing progressive performance based on the motivation given.
- Participant 2: She perceives the suitability of this application depends on the students' behavior (introvert/extrovert) and enthusiasm. Most students look forward to participating in class activities to collect points while some could not be bothered by it. This may be due to the large number of students with limited time to reach out to each and every student.
- Participant 3: In terms of motivating and engaging students, she highlighted that this application is a success. Engagements during classes were improved because the students were eager to participate and students joined Google Meet on time, volunteered during class activities and exercises to get points. However, she added that this application is more suitable to be used in small classes i.e. tutorials.

2. How do lecturers perceive the application of the ClassDojo in the active engagement of students towards their subject?
   - Participant 1: She is confident that this application is good in moulding behaviour, shaping a positive attitude as some students want to be acknowledged by a good repertoire and their efforts.
   - Participant 2: She mentioned that this application can be used as a tool in encouraging and motivating students to help their classmates, volunteer and as an acknowledgement to the students' effort during class. Students were being rewarded for a simple act of attending class early and helping other students in activities.
   - Participant 3: She profoundly valued the usage of the application to stimulate students' excitement during classes where the students volunteered to read cases or provisions of law, answering questions and attempting extra exercises.

3. How do lecturers perceive the application of the ClassDojo in applying the available features for assessment measures?
   - Participant 1: She was using this application as a social media platform as she believes that it does not give any significant impact and time consuming.
   - Participant 2: She did not use the application for assessment measures.
   - Participant 3: She conducted a quiz via this application by using drawing activity. It was a fun activity, where students can use their creativity to draw and explain the hierarchy of the court system in Malaysia. However, she noticed that she was unable to download the submission of her students on a large scale. Since students were unfamiliar with the application, some students failed to follow the instructions which caused their submission to be in the draft mode and went 'missing' for final submission. She emphasized that lecturers will have difficulties if they were to use this application for assessment with a large number of students.

IV. CONCLUSION

As engaging students in the classroom are a definite challenge for lecturers in tertiary education, one may opt to implement a rewarding system by ClassDojo. This will not only could shape the students' personality and attitude, but also as an acknowledgement to the students' achievement in terms of moulding their positive behaviour.

Although a more refined study needs to be done statistically to verify the effectiveness of ClassDojo in tertiary education in terms of assessment measure, it is shown that the ClassDojo application could serve as a supplementary platform in engaging students' attention in any classroom environment.

REFERENCES

[1] Edwards, C. H. *Educational change: From traditional education to learning communities*. R&L Education.(2011)

[2] Burger, Michael, "The Perception of the Effectiveness of Classdojo in Middle School Classrooms: A Transcendental Phenomenological Study" . *Doctoral Dissertations and Projects*. 1063. (2015)

[3] Dillon, M. M. The tootling intervention with ClassDojo: Effects on classwide disruptive behavior and academically engaged behavior in an upper elementary school setting. (2016)

[4] Ford, W. B. Evaluation of a positive version of the Good Behavior Game utilizing ClassDojo technology in secondary classrooms. (2017)

[5] Saeger, A. M. Using ClassDojo to promote positive behaviors and decrease negative behaviors in the classroom. (2017)

COMPARISON OF HYBRID AND SINGLE MACHINE LEARNING ALGORITHM ON DETECT DEPRESSION

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Abstract - *Depression has become a serious problem in this current generation and the number of people affected by depression is increasing day by day. However, some of them manage to acknowledge that they are facing depression while some of them do not know it. On the other hand, the vast progress of social media is becoming their "diary" to share their state of mind. Several kinds of research had been conducted to detect depression through the user post on social media using machine learning algorithms. Through the data available on social media, the researcher can able to know whether the users are facing depression or not. In this proposed work, we aim to detect depression of the user by their data, which is shared on social media. The Twitter data is then fed into two different types of classifiers, which are Naïve Bayes and hybrid model, NBTree which are made up from Naïve Bayes and Decision Tree. The results will be compared based on the highest accuracy value to determine the best algorithm to detect depression.*

Keywords—depression, NBTree, Naïve Bayes, detect, social media

I. INTRODUCTION

Depression is considered a mental health problem that weakens people's moods and interest in doing the task. Depression is becoming a common illness with some more than 264 million people affected worldwide [1]. Unidentified detection of depression or untreated depression leads to severe consequences such as dependent on medicine such as anti-depressants pills, self-harm behaviors such as involving in drugs, and suicidal thoughts. On the other hand, the number of social media users have covered 3.8 billion people per 4.5 billion people [2]. Social media networks become a comfort zone especially for young people to share their feelings, and updates about things that happen around them. The information obtained from the user updates on social media able to detect someone who is affected by depression by implementing machine learning techniques. The appropriate machine learning is compared to identify the best algorithm to detect depression.

II. METHODOLOGY

The dataset of Twitter is collected and obtained from Github [3]. The .csv file consists of 2 attributes which are ID in numeric data type, the message, and the label of the message which indicated the user is depressed or not. The indication is in binary form which 0 is not depressed and 1 is depressed. The data is loaded into Weka software for analysis purposes. Weka is open-source software that provides tools for data pre-processing, implementation of several machine learning algorithms, and visualization tools.

III. RESULTS/ FINDINGS

From the output results calculated by Weka Tool on the dataset, table 1 shows both algorithms have the same accuracy value which is 99.77%. However, when the algorithm is compared with the time take to build the model, Naïve Bayes outperforms well than NBTree. The mean absolute error for Naïve Bayes is smaller than the NBtree.

TABLE 1. OUTPUT RESULTS OF ALGORITHM

Algorithm	**Criteria**		
	Model Build-up Time	***Accuracy***	***Mean Absolute Error***
Naïve Bayes	0 seconds	**99.77%**	0.0022
NBTree	0.09 seconds	**99.77%**	0.0053

IV. CONCLUSION

Naïve Bayes shows better detection of depression compared to the NBTree which is the hybrid model in wise of the model build-up time and Mean Absolute Error. However, the research can be conducted with bigger datasets and clear data pre-processing which can read the emoticon in future work.

ACKNOWLEDGMENT

The author would like to express appreciation and gratitude to the lecturer who guided the project from scratch to future work. Also, the author would like to thank RICES 2020 for the opportunity.

REFERENCES

[1] "Depression," 30 January 2020. [Online]. Available: https://www.who.int/news-room/fact-sheets/detail/depression.

[2] S. Kemp, "Digital 2020: 3.8 Billion People Use Social Media," 30 January 2020. [Online]. Available: https://wearesocial.com/blog/2020/01/digital-2020-3-8-billion-people-use-social-media.

[3] Viritaromero, "Depression Detection in Tweets," 1 Feb 2019. [Online]. Available: https://github.com/viritaromero/Detecting-Depression-in-Tweets.

Engineering & Industrial Design

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ASSESSMENT AND OPTIMIZATION OF OUTDOOR LED LIGHTING FOR HIGH-PERFORMANCE STADIUM ILLUMINANCE

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***Abstract* - Over reliance to fossil fuel is detrimental. Hence the demand for energy efficiency is indispensable. Energy efficiency is typically achieved by the implementation of more efficient technology or production processes, or by the use of widely-recognized techniques to reduce energy losses. The usage of Light Emitting Diode (LED) lighting to promote energy-efficient design has been widely used. Tremendous advances in LED lighting technology in the recent years have created enthusiasm whether LED lighting can be applied to all lighting purposes inclusive stadium lighting. The visual performance of the LED lighting in stadium applications need to be determined to produce the optimum result. Hence, a study on the characteristics of LED lighting is required. In this paper, the objective was to study the effect of tilt angle and view angle of a luminaire to the visual performance of stadium lighting. These parameters need to be optimized to comply with lighting requirements with a minimum quantity of luminaires. A computational model of LED luminaire was developed using MATLAB. With the developed model, the effects of different tilt angles and different view angles of luminaires were investigated. As a result, an optimized architectural design of LED lighting was able to comply with FIFA average horizontal illuminance and uniformity requirements.**

Keywords—LED lighting, energy efficiency, stadium lighting

I. Introduction

Energy efficiency are usually accomplished by the introduction of more effective technologies or manufacturing processes or through the use of widely recognized strategies for minimizing energy losses. For the past decades, metal halide has been used to illuminate specifically football field in a stadium. These types of lighting were able to satisfy the needs for high luminous efficacy and intense white light in sports event application. Metal halide also have good maintenance performance with only 70% drop in performance at the end of life [1]. However, great advances in LED lighting technology in the recent years have driven the interest whether LED lighting can be applied to all lighting purposes including stadium lighting. The LED lighting is one of the technologies that able to satisfy the needs for low power consumption, environmental friendly and durable products. LED consumed 33.33% less energy compared to metal halide [2]. However the visual performance of LED lighting is yet to be determined. Preparing a lighting design for large outdoor areas is a complicated task. Furthermore, the variations of product in commercial market have made the selection of light source is wide open. Hence, the objective of this study is to determine the visual performance of LED lighting in terms of tilt angle and view angle of luminaires. The optimized architectural design was required to fulfill lighting requirements in [3].

II. methodology

The light output from LED chip was modeled based on product datasheet [4]. The LED chips were arranged rectangularly to form complete set of a luminaire. An output for a luminaire was assessed to evaluate the visual performance based on variation of tilt angle and luminaire's view angle. The quantity of luminaire will be increased one by one until it reaches the required average horizontal illuminance as in [3]. The architectural design needs to be optimized to ensure that the light irradiance is uniform based on the ratio permitted in [3].

III. results/ Findings

The optimized design that comply to FIFA lighting specifications findings are consolidated in Table 1. below.

Table 1. Result of optimized architectural design

FIFA Lighting Specifications	**Lighting Class**				
	Class I	***Class II***	***Class III***	***Class IV***	***Class III***
Average horizontal illuminance (lx)	238.6	544.3	1,106.0	3,404.0	3,516.0
Uniformity, U1	NA	NA	NA	0.7035	0.7049
Uniformity, U2	0.7864	0.7066	0.7973	0.823	0.8156

IV. CONCLUSION

A hybrid LED luminaires architectural design was required to comply with FIFA lighting specifications. The architectural design was able to meet the average horizontal illuminance and uniformity with minimum quantity of luminaires.

REFERENCES

[1] D. M. Hrubowchak, "The Development of a Metal Halide Discharge Source for Sports Lighting Applications," *Journal of the Illuminating Engineering Society*, vol. 26, pp. 35–43, 1997.

[2] A. Polycarpou, I. Yiannou, N. Christofides, "Comparison of MH and LED Performance For Sport Lighting Application," in *Mediterranen Conference on Power Generation , Transmission, Distribution and Energy Conversion (MedPower 2016). 2016*, pp. 132–136.

[3] FIFA, "Football Stadiums Technical recommendations and requirements 5th Ed.," (2011) .

[4] C. S. Package and L. Tx, "LUXEON V2." https://www.lumileds.com/wp-content/uploads/files/DS177-luxeon-v2-datasheet.pdf, last accessed 2020/7/6.

COLOUR-TUNEABLE STEPWISE GRADED-MIXED ORGANIC LIGHT-EMITTING DIODE

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***Abstract* - For the past decade, while organic light-emitting diode (OLED) has been widely used in the practical display area, the research of OLED in the lighting area has also been progressing. For lighting application, a stable white light source with colour quality that resembles natural daylight is preferable and great works have been reported. However, the research and the application of the OLED's colour-tuneable capability has been overlooked. This work demonstrates a colour-tuneable stepwise graded-mixed (SGM) OLED, by stacking layers of mixed electron-hole host materials at different mixture ratio. The fluorescent mixed-host layers are doped with different phosphor dopants to form a multicolour emissive unit, with the SGM structure confines the major recombination zone in the middle of the emissive unit. The fabricated SGM-OLED emits colours that change drastically from reddish-orange with CIE 1931 coordinates of (0.57, 0.34) at 9 V, to purplish-pink with (0.46, 0.31) at 13 V. This demonstration potentially provides more options for the OLED application in the future lighting technology.**

Keywords—OLED, Colour-Tuneable, Hybrid Fluorescent-Phosphorescent, Stepwise Graded-Mixed Structure

I. Introduction

Over the past decade, OLED technology has grown rapidly in the commercial industry. The energy-efficient OLED gives excellent colour quality with thin, light and flexible display. OLED also offers low-heat, large-area diffusive light source. Still, the commercialisation in the lighting industry is not common due to some difficulties and the research on stable natural white light are preferable in the current stage. Hence, the report on colour tuneability feature of OLED was rather uncommon. To realise colour-tuneable OLED, stacked-units with a complex driver was demonstrated, but the main objective was still to achieve white light emission [1]. Another simpler design with controlled emission between electromer and exciplex in single emission unit managed to cover colour from warm- to cool-white light [2]. As a complement, this work explores the colour tuneability of non-white OLED by employing a simple SGM design. The OLED is consisted of hybrid blue-fluorescent, red-phosphorescent emitter, and is assisted by exciplex to enhance energy transfer for better device performances.

II. methodology

The details of device fabrication, characterisation and measurements can be found in our previous article [3]. The functional layers are thermally deposited at a heating-current ramp rate of 0.1A/30s under base pressure of 1×10^{-4} Pa using Edwards Auto-306 evaporator. The SGM sublayers are deposited at 0.1A/60s. The mixture of NPB:$Bepp_2$ are in weight ratio (w/w), while the dopants are in weight percentage (wt%). The fabricated devices are:

HJ-B: ITO (100 nm) | HATCN (0.4 nm) | NPB (50 nm) | $Bepp_2$ (50 nm) | Liq (3 nm) | Al (100 nm)
SM-B: ITO | HATCN | NPB (20 nm) | NPB:$Bepp_2$ (3:1) (20 nm) | NPB:$Bepp_2$ (1:1) (20 nm) | NPB:$Bepp_2$ (1:3) (20 nm) | $Bepp_2$ (20 nm) | Liq | Al
SM-BR1: ITO | HATCN | NPB | NPB:$Bepp_2$ (3:1) | NPB:$Bepp_2$ (1:1) : $Ir(piq)_3$ (1 wt%) | NPB:$Bepp_2$ (1:3) | $Bepp_2$ | Liq | Al
SM-BR2: ITO | HATCN | NPB | NPB:$Bepp_2$ (3:1) | NPB:$Bepp_2$ (1:1) : m-MTDATA:$Ir(piq)_3$ (5:0.5 wt%) | NPB:$Bepp_2$ (1:3) | $Bepp_2$ | Liq | Al

III. results/ Findings

As summarised in Table 1, the blue-fluorescent SM-B emits brighter with better device efficiencies as compared to HJ-B due to the broadened, yet confined recombination zone (RZ) in the SGM structure [4]. A red phosphor dopant was then doped into the middle of the SGM device as SM-BR1. With the RZ shifts along with the supplied voltage, the emission of SM-BR1 is significantly changed from reddish-orange to purplish-pink as shown in Fig. 1. To further enhance the device performance, m-MTDATA was also doped into the middle of the SGM device as SM-BR2. The mixing of m-MTDATA and $Bepp_2$ was reported to form exciplex which can give better energy transfer and exciton utilisation to the red dopant [5]. As a result, the device efficiencies of SM-BR2 are improved by almost twice of SM-BR1 and is comparable with other reported colour-tuneable OLEDs [1,2]. The deeper red emission of SM-BR2 at lower brightness can be useful when higher colour contrast is needed for some specific applications. While the maximum brightness is relatively lower than

SM-BR1, SM-BR2 still manages to emit more than 3000 cd/m^2, which is sufficient for lighting application [6]. Unnecessary higher brightness can induce glaring effect, which is against one of the main features of an OLED.

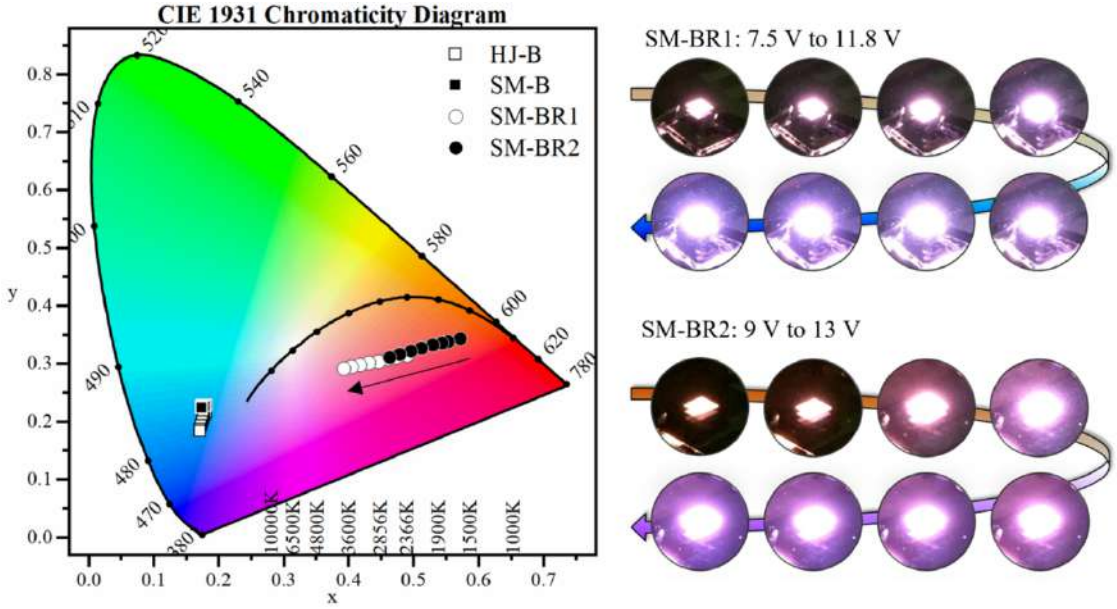

FIGURE 1. CHROMATICITY AND EMITTED COLOUR OF SM-BR1 AND SM-BR2.

TABLE 1. SUMMARY OF DEVICE PERFORMANCES AND CHANGES IN CHROMATICITY.

Device	L_{vmax} (cd/m^2)	γ_{max} (cd/A)	η_{max} (lm/W)	EQE_{max} (%)	CIE 1931 (x, y)
HJ-B	1903	0.8	0.3	0.5	(0.17, 0.20)[a]
SM-B	3357	1.1	0.5	0.7	(0.18, 0.23)[a]
SM-BR1	5238	2.3	1.3	2.1	(0.49, 0.32)[b] → (0.39, 0.29)[b]
SM-BR2	4590	4.0	2.3	3.7	(0.57, 0.34)[b] → (0.46, 0.31)[b]

L_{vmax} Maximum luminance
η_{max} Maximum power efficiency
γ_{max} Maximum luminance efficiency
EQE_{max} Maximum external quantum efficiency
a Average chromaticity coordinate
b Chromaticity coordinates measured from 200 cd/m^2 to 3000 cd/m^2

IV. CONCLUSION

A colour-tuneable hybrid fluorescent-phosphorescent OLED was demonstrated with emission changed from reddish-orange to purplish-pink along with the voltage. This gives potential to different lighting applications, for example, coupled with a sensor as an indicator. The exciplex assisted OLED has enhanced the device efficiencies by almost twice, with better energy transfer to the red phosphor.

ACKNOWLEDGEMENT

The authors wish to acknowledge the Ministry of Education, Malaysia for the award of FRGS grant (FRGS/1/2016/TK04/MMU/01/1) for this work.

REFERENCES

[1] F. Fries, M. Frobel, S. Lenk, and S. Reineke, "Transparent and colour-tunable organic light-emitting diodes with highly balanced emission to both sides," *Organic Electronics*, 41, pp. 315–318, 2017.

[2] L.Y. Chen, Y.J. Shiu, Y.J. Wu and W.Y. Huang, "Simple structured color tunable white organic light-emitting diodes utilizing an ambipolar anthracene derivative with low-lying LUMO," *Organic Electronics*, 76, 105454, 2020.

[3] T.S. Ong, G.L. Ong, Y.Y. Kee, S.S. Yap, and T.Y. Tou, "Optimisation of graded-mixed transport organic light emitting diode via mixed-source thermal evaporation technique," *Microelectronic Engineering*, 213, pp. 62-68, 2019.

[4] R. Chowdhury, T.S. Ong, Y.Y. Kee, S.S. Yap and T.Y. Tou, "Numerical and experimental studies of mixed-host organic light emitting diodes," *Current Applied Physics*, 15, pp. 1472-1477, 2015.

[5] Q. Wang, Q.S. Tian, Y.L. Zhang, X. Tang and L.S. Liao, "High-efficiency organic light-emitting diodes with exciplex host," *Journal of Materials Chemistry C*, 7, pp. 11329-11360, 2019.

[6] M. Hack, M.S. Weaver and J.J. Brown, "Status and opportunities for phosphorescent OLED lighting," *SID 2017 Digest*, pp. 187-190, 2017.

DESIGN OF A WIDEBAND MULTI-FREQUENCY AMBIENT RF ENERGY HARVESTER

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***Abstract* - To overcome the low conversion efficiency and limited RF power range of the ambient environment, a novel quad-band RF energy harvester for a wide input of RF power from -30 to 5 dBm with an improved matching network is proposed. In this article, an RF spectral survey is conducted in the semi-urban area of Malaysia for a realistic ambient RF energy scavenger and a broadband multi-frequency highly sensitive RF energy harvester has been designed using this result. It consists of a quad-band antenna, a new impedance matching network, a wideband multi-frequency rectifier and a storage element which covers all available frequency bands (i.e. GSM 900, GSM 1800, 3G and Wi-Fi) within the frequency bands of 0.8 - 2.6 GHz. Firstly, a new impedance matching network is introduced which aims to enhance the performance of the rectifying circuit in an unpredictable condition. Secondly, a self-complementary dual-armed log-periodic antenna is suggested which is compact and has high bandwidth within the operating frequency range of 0.8 - 2.6 GHz. Finally, a prototype of the proposed RF harvesting system is designed, fabricated and finally measured to examine its performance in the desired frequency bands. The measured DC rectification efficiency of the harvester is about 60% for a collective -15 dBm input RF power consistently universal over the four RF frequency bands and reaches 68.5% at -27 dBm. Measurements in an ambient environment at Multimedia University (MMU) depict that the proposed harvester is able to harvest dc energy up to 500 mV at -27 dBm.**

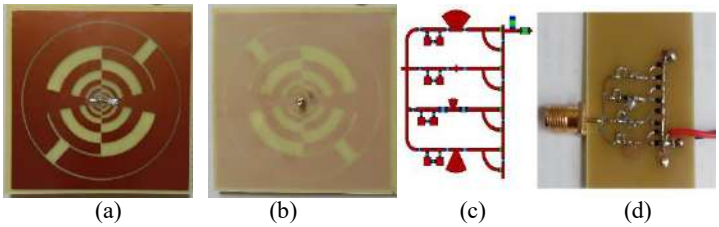
Keywords— Quad band, log periodic antenna, RF energy harvesting, RF spectral survey, broadband rectifier

I. INTRODUCTION

Due to its simplicity in construction, self-powered low power electronics devices have attracted remarkable attention for numerous wireless applications such as healthcare sensors, smart cities, Internet-of-Things (IoT), actuators and wireless sensor networks (WSNs) in the last couple of years. Despite significant development, the lifespan of batteries is still limited and their replacement is always complicated requiring regular maintenance. This limitation can be overcome by ambient energy harvesting techniques from various energy sources (i.e. radio frequencies, solar, thermal and vibration) available in an ambient environment [1]. Some RF harvesters have already been designed where dc rectification efficiency is more than 80%. But most of these rectennas were the single band and were able to harvest energy with higher input RF power densities such as 10 dBm [2], 0 dBm [3], and 13 dBm [4] that is not realistic for energy harvesting in ambient environment. Moreover, the input impedance of the rectifier circuit varies with different frequencies, input RF power density level and load impedance respectively. In this paper, a wideband multi-frequency RF harvester (i.e. wideband log-periodic antenna and broadband rectifier including novel RF filtering concept) is proposed to harvest energy from all available RF energy sources that exist in the outdoor environment. To illustrate the feasibility of implementing a multiband ambient RF energy harvesting technique, we initially depicted the detailed results of an RF power spectral survey in this research, specifying suitable urban locations and available frequency bands with associated RF input power levels for scavenging. Based on these RF survey results, a multi-frequency high sensitive RF harvester is then designed and fabricated and its performances under energy scavenging operation are considered employing in-situ field strength measurements.

II. METHODOLOGY

To determine available frequency bands with associated input RF power density levels existing in a typical urban ambient environment, an RF spectral survey within the frequency range of 0.8 to 3 GHz is conducted in MMU campus at Cyberjaya, Malaysia.



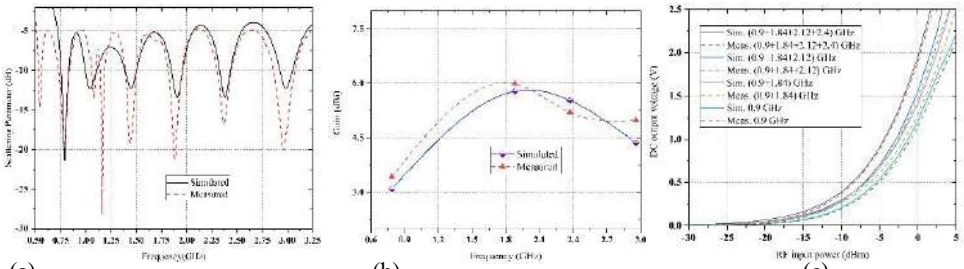
(a) (b) (c) (d)

Fig. 1. Prototype of proposed design antenna (a) font side, (b) back side, and rectifier (c) layout (d) prototype.

Based on the survey result, a self-complementary log-periodic frequency-independent toothed planar quad band antenna and a rectifier is design. The overall dimension of the antenna is 160 mm×1 60 mm which equals to 0.29λ0 × 0.29λ0 at 550 MHz. Beside, a quad-band rectifier is designed which consists of four parallel branches, and each branch is a combination of a bandpass filter, a rectifier, a low-pass filter, and a load section. Finally, the new harvester is prototype fabricated and tested both in lab and outdoor environment. The proposed design of antenna and rectifier prototypes are shown in Fig. 1.

III. RESULTS

The simulated and measured reflection coefficients S11 [dB] versus frequency of proposed antenna and dc output voltage VS RF input power of the rectifier are shown in Fig. 2, where overall performance is in good agreement. It is observed that, the S-parameter that the propagating electromagnetic wave crosses the -10dB line three times within the range of 0.7 GHz to 3.5 GHz. Which is good in antenna characteristic. Also, the measured maximum realized gain is almost 6 dBi across the entire RF operational frequency bands from 0.5 to 3.5 GHz.



(a) (b) (c)

Fig. 2. Antenna performance, (a) S-parameter (b) realized gain and (c) dc output voltage of the rectifier.

The measured dc voltage is determined as a function of ambient RF input power source for the first, second, third and fourth frequency signal. In this sense, the circuit generated resultant dc voltage has been verified in the presence of simultaneous multiple tones. The proposed RF harvester is placed in an outdoor environment and a digital multimeter is directly connected to the rectifier load branch for measuring the dc output voltage. The recorded dc output voltage varies 0.350 V to 0.687 V for the load value of 6.81kΩ. The various performances of the proposed harvested are stated in TABLE 1.

TABLE 1. THE HARVESTER PERFORMANCES

Pro.	Number of band	Frequency (GHz)	Dimension (mm)	RF input (dBm)	Max. efficiency (%)@ dBm	Max. effi. (%)	Dc volt. (V)	Load (kΩ)
Harvester	Quad	0.9, 1.8, 2.12, 2.4	160×160×1.6	-10 to -35	68.5 @-27	68.5	0.687	6.18~7.5

IV. CONCLUSION

A new multi-frequency broadband rectifying circuit with a new impedance matching element is designed to match with the ambient RF signals with a relatively low RF input power density. The energy sensitivity is developed by using a quad band full-wave rectifier circuit configuration. A self-complementary broadband log periodic antenna is designed in such a way that it receives more EM signals. The simulated and measured results have shown that the rectenna has a maximum conversion efficiency of around 68.5% for -27 dBm input power with the frequency ranging from 0.960 GHz to 2.5 GHz. The achieved DC power can be well above the incident power from any single resource due to the highly efficient design and the broadband multi-frequency operation. Considering the above performance, this multiband harvester can be used for efficient wireless energy scavenging for a wide range of wireless sensor and network applications.

ACKNOWLEDGEMENT

The authors would like to thanks TM R&D for funding the project. The project account: MMUE/190001 and Research Grant No. MMUE/190001.02.

REFERENCES

[1] C. Song *et al*., "A Novel Six-Band Dual CP Rectenna Using Improved Impedance Matching Technique for Ambient RF Energy Harvesting," in *IEEE Transactions on Antennas and Propagation*, vol. 64, no. 7, pp. 3160-3171, July 2016.

[2] R. Y. J. Ren and K. Chang, "5.8-GHz circularly polarized dual-diode rectenna and rectenna array for microwave power transmission," *EEE Trans. Microw. Theory Tech*., vol. 54, no. 4, pp. 1495–1502, 2006.

[3] Y. B. Strassner and K. Chang, "5.8-GHz circularly polarized dual rhombic-loop travelling-wave rectifying antenna for low power-density wireless power transmission applications," *IEEE Trans. Microw. Theory Tech*., vol. 51, no. 5, May 2003.

[4] J. O. Mc. Spadden, F. Lu, and K. Chang, "Design and experiments of a high conversion efficiency 5.8-GHz rectenna," *IEEE Trans. Microw. Theory Tech*., vol. 46, no. 12, pp. 2053–2060, Dec. 1998.

Electrochemical Impedance Spectra Analysis for PAN/PMMA Hybrid Polymer Electrolytes

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Abstract - Electrochemical impedance spectra (EIS) analysis is crucial in determining the ionic conductivity of polymer electrolytes. Ionic conductivity is a measurement of the movement of Li^+ ion from cathode to anode which occur ins polymer electrolytes. PAN/PMMA hybrid polymer electrolytes are prepared through solution cast method at different weight ratio with equal amount of lithium salt ($LiCF_3SO_3$), plasticizer (EC) and filler (Al_2O_3) are added to form complexion with host polymer backbone. The mixture is dissolved in DMF and stir at room temperature for 24 hours until a clear and slurry solution is obtained. Lastly, the solution is cast onto petri dish to allow slow evaporation in fume hood. The resultant polymer electrolyte films are examined for their dryness and standability. Subsequently the film is trimmed into round shape with equal area size for EIS analysis. By incorporating 2% of PMMA into PAN/PMMA hybrid polymer electrolyte, ionic conductivity is increased to 2.69×10^{-3} S/cm.

Keywords— impedance spectra, ionic conductivity, polymer electrolytes

I. INTRODUCTION

Polymer electrolytes have been a promising candidate in replacing the conventional liquid electrolytes in battery fabrication. The absence of liquid content in the system has definitely eliminates the leakage problem which is severe in liquid electrolytes. Moreover, polymer electrolytes exhibit high energy density which is crucial in realizing rechargeable battery for various applications. Apart from this, the other properties including the flexibility of fabricating into thin film polymer, good contact and adherence with electrodes without physical degradation during cycling have brought polymer electrolyte to the front stage. There are three categories of polymer electrolytes, which are the solid polymer electrolytes (SPE), gel polymer electrolytes (GPE) and composite polymer electrolytes (CPE). SPE consists of a polymer host and lithium salt. Due to the absence of linking agent in the system, the ionic conductivity is too low to possible application. With the inclusion of plasticizer in the system, GPE offer a much higher ionic conductivity, however it suffers low mechanical stability [1-5]. As such, filler is added into GPE to form CPE. Inclusion of filler into the polymer electrolyte system strengthen the polymer backbone system which then aid in the movement of lithium ion between electrodes[2,6]. There have been various types of host polymers been investigated for realising polymer electrolytes, such as poly(methyl methacrylate) (PMMA), poly(acrylo nitrile) (PAN), poly(vinyl chloride) (PVC), poly(vinylidene fluoride) (PVdF), poly(vinylidene fluoride-hexafluoropropylene) (PVdF-HFP), and poly(propylene oxide) (PPO). PMMA electrolytes have good compatibility with lithium – electrolyte interface conductivity is offset by poor mechanical strength[7-9]. Hence, PAN host polymer which is proven to provide high ionic conductivity is added into PMMA based polymer electrolytes to form hybrid PAN/PMMA composite polymer electrolytes. The rise in ionic conductivity reading is predictable in this hybrid polymer electrolyte system since amorphosity is improved with the addition of PMMA into PAN polymer backbone. The scope of this work is to focus on the ionic conductivity measurement in this hybrid CPE system.

II. METHODOLOGY

PAN/PMMA hybrid electrolyte films are prepared by using solution cast method. All the materials, namely PAN, PMMA, EC, $LiCF_3SO_3$ and Al_2O_3 used in this experiment are used as obtained from Sigma Aldrich. PMMA (Mw ~ 996 000) and PAN (Mw ~150 000)is chosen as the host polymer. Plasticizer (EC), lithium salt ($LiCF_3SO_3$) and inorganic fillers (Al_2O_3) were added accordingly together with PAN/PMMA to yield a 2g mixture. The mixture is then dissolved in anhydrous N,N-Dimethylformamide (DMF) and stirred continuously for 24 hours in room temperature until homogenous slurry solution is obtained. The solution is then poured into petri dishes and left to allow excess solvent evaporate off slowly at room temperature until thin films are formed. The produced film is then trimmed into three samples with equal sizes for characterization by AC impedance spectroscopy.

III RESULTS AND DISCUSSIONS

Ionic conductivity arises in the polymer electrolyte system upon the movement of Li^+ cation between electrodes with the presence of applied voltage. From the complex impedance plot, ionic conductivity is then calculated by using the equation $\sigma = \frac{t}{R_B A}$, where t (cm) is the averaging thickness of each sample measured at five different points, R_B (Ω) is the resistance obtained from the Nyquist plot and A (cm^2) is the contact area of

the composite polymer electrolyte film with electrode. Specifically, R_B is determined from the intercept of semicircle tail with residual tail in the Nyquist plot of AC impedance spectroscopy.

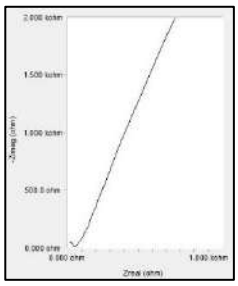

Fig.1 Complex EIS for hybrid PMMA CPE

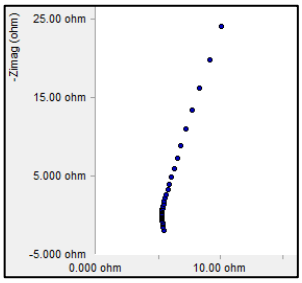

Fig.2 Complex EIS for PAN CPE

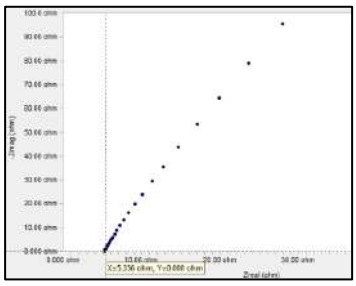

Fig.3 Complex EIS for PAN/PMMA CPE

The complex EIS characterization Nyquist plot for PMMA CPE is shown in Fig. 1. There exist a small portion of semicircle arc at high frequency range, indicates existence of bulk ionic conduction in the electrolyte. At lower frequency range, there exists a linear line adjacent to the semicircle arc, which indicates electrode polarization effect resultant from diffusion process. This PMMA based CPE with the addition of nano-size filler Al_2O_3 gives ionic conductivity up to 1.52×10^{-4} S/cm. In PAN CPE, the semicircle arc is greatly suppressed, indicates that resistance is predominant than bulk capacitance in the ionic transport process. This gives higher ionic conductivity up 6.98×10^{-4} S/cm, approximately 5 times than that of PMMA CPE. However, the polymer films is brittle and is unable to sustain a good mechanical stability. Fig. 3 shows the complex EIS plot for PAN/PMMA hybrid CPE. The absence of semicircular portion at high frequency indicates ionic conductivity is mainly due to ion conduction. Based on the Nyquist plot, the bulk resistance is retrieved with 5.36 **Ω** at room temperature. By using the equation in above, the ionic conductivity is calculated as 2.69×10^{-3} S/cm which is significantly improved by an order higher than both PMMA- and PAN- CPE. The polymer backbone in hybrid system has eventually gone through a severe polymer chain reorganization. Table 1 summarizes the ionic conductivity readings obtained from each polymer electrolyte system.

Table 1. Ionic conductivity of PMMA CPE, PAN CPE and PAN/PMMA CPE.

Polymer Electrolytes	Bulk Resistance (Ω)	Ionic Conductivity (S/cm)
PMMA CPE	42.61	1.52×10^{-4}
PAN CPE	8.58	6.98×10^{-4}
PAN/PMMA CPE	5.36	2.69×10^{-3}

IV. Conclusion

PMMA based CPE, PAN based CPE and PAN/PMMA hybrid CPE are developed in this work to study the resultant ionic conductivity. Hybrid polymer electrolyte system is able to significant improve the ionic conductivity of polymer electrolyte with single host polymer. Based on EIS characterization, the highest ionic conductivity obtained from hybrid CPE system is 2.69×10^{-3} S/cm at room temperature.

Acknowledgement

This research work is supported by 2019/2020 Mini Fund Project (MMU/RMC/MiniFund/2019/02).

References

[1] J. Y. Song, Y. Y. Wang and C. C. Wan, *J. Power Sources* **77**, 183–197 (1999).
[2] A. M. Stephan andK. S. Nahm, *Polymer* **47**, 5952 – 5964 (2006).
[3] S. S. Zhang and D. T. Tran, *Electrochimica Acta* **114**, 296 – 302 (2013).
[4] F. B. Dias, L. Plomp and J. B. J. Veldhuis, *J. Power Sources* **88**, 169 – 191 (2000).
[5] B. Scrosati and J. Garche, *J. Power Sources* **195**, 2419 – 2430 (2010)..
[6] S. Rajendran, O. Mahendran and T. Mahalingam, *European Polymer J.* **38**, 49 – 55 (2002).
[7] G. B. Appetecchi, F. Croce and B. Scrosati, *Electrochimica Acta* **40**, 991– 997 (1995).
[8] O. Bohnke, G. Frand, M. Rezrazi, C. Rousselot and C. Truche, *Solid State Ionics* **105**, 66– 97 (1993).
[9] J. Vondrak, M. Sedlarikova, J. Velicka, B. Klapste, V. Novak and J. Reiter , *Electrochimica Acta* **46**, 2047–2048 (2001)

PRACTICAL ENERGY HARVESTING FOR WIRELESS POWER COMMUNICATION SYSTEMS

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***Abstract* -Radio frequency energy harvesting (RFEH) is a microwave technology that involves direct power or battery charging and recharging from abundant electromagnetic (EM) energy radiating in the environment. The transfer of energy is achieved by a rectifying antenna (rectenna). The rectenna comprises a receiving antenna, an impedance matching network (IMN), a rectifying diode, a dc-pass filter, and a terminal load, often called an RFEH system. However, the amount of energy recorded from the surrounding remains an open challenge. This work presents an efficient dual-band and multi-band rectenna design with the ability to extract energy from GSM/900, GSM/1800, UMTS/2100, Wi-Fi/2.45, and LTE/2600 frequency bands. The proposed two RF harvesters drive a BQ25504-674 evaluation module (EVM) to achieve a maximum dc output voltage of 0.75 V and 1.21V respectively in an ambient environment. Hence, it is a potential candidate for various applications in a low-powered RFEH system through careful circuit management.**

Keywords—Radio frequency energy harvesting (RFEH), impedance matching network (IMN), power conversion efficiency (PCE), rectenna.

I. INTRODUCTION

RFEH is a microwave technology that involves direct power or battery charging and recharging from abundant electromagnetic (EM) energy radiating in the environment [1]-[3]. The concept of energy harvesting started to evolve in the 1990s along with Tesla finding's on electrical energy conversion from an EM wave [3]-[5]. The transfer of energy is achieved by a rectifying antenna (rectenna) consisting two segments, namely an antenna and a rectifying circuit as shown in Fig.1 [1]-[3]. The RF spectral survey in this work shows available RF power density for extraction in the GSM/900, GSM/1800, UMTS/2100, Wi-Fi/2.45, and LTE/2600 frequency bands [4]-[6]. The RFEH technology serves as an additional source of energy through wireless power transfer and can be integrated into low-powered devices for security surveillance, smart farming, and much more [3]-[4].

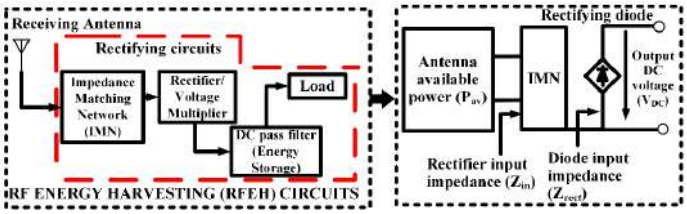


Fig. 1: Block diagram of the RFEH circuits.

In this paper two sets of RFEH (dual-band and a dual-port multiband) rectenna have been proposed. The dual-band operates at (0.9 GHz and 1.8 GHz) matched through a 4.5 kΩ terminal load. The dual-port multiband rectenna composed of a wideband (0.74 GHz - 5.85 GHz) antenna connected to a multiband (0.93 GHz, 1.80 GHz, 2.10 GHz, 2.41 GHz, and 2.60 GHz) rectifier at Port-1 and Port-2 matched with a 2 kΩ terminal load.

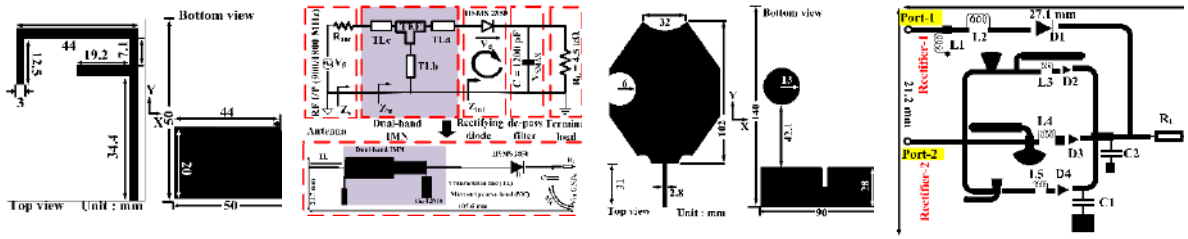
II. METHODOLOGY

Fig. 2 presents the geometry and layout of the proposed dual-band and dual-port multiband rectenna. The two proposed rectenna are designed on a 1.6 mm thick double layer FR-4 substrate, with a dielectric constant of 5.4, and a loss tangent of 0.02. The proposed rectifier components from each rectenna are modelled on a single series HSMS 2850 Schottky barrier diode with a physical configuration number of SOT-23 from Avago.

The resonant lengths of the proposed dual-band monopole antenna is computed using a transmission line model theory [2]-[3]. The resonant length is tuned and optimized at λ/2, and λ/4 of the guided wavelength at the two operating frequencies (0.9 and 1.8 GHz), respectively. For antenna excitation, a 50 Ω microstrip line of 3 mm width is used. A dual-band IMN is then designed to match rectifier input impedance based on single series diode (SSr) topology with a 50 Ω transmission line using a unique Π-section IMN.

The proposed wideband antenna is derived from a rectangular patch of size 102 mm × 80 mm. Four triangular slots, three semi-circular slots, and an arc are added to the radiator to achieve the desired resonance modes. A defected ground and a circular parasitic patch are used to enhance antenna bandwidth and gain. The proposed dual-port rectifier is designed using two separate IMN approach at Port-1 and Port-2. The first section of the rectifier (Rectifier-1) is realized using L-section matching network (MN) at 0.93 GHz. The second section (Rectifier-2) is designed using an impedance transformer cell match to a single series diode. The three cell braches are connected in parallel to achieve a multiband operation at (1.80 GHz, 2.10GHz, 2.41 GHz, and 2.60 GHz).

The proposed antennas and RF-rectifiers are design using high frequency structure simulator (HFSS) and advance design system (ADS), respectively.

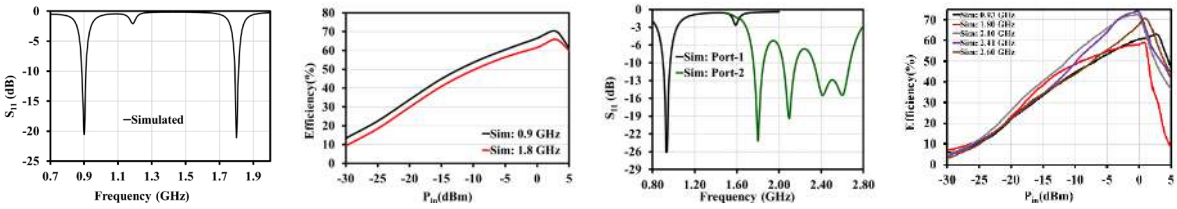


(a) (b) (c) (d)

Fig. 2: Geometry and layout of the proposed: (a) Dual-band antenna (b) Dual-band RF-rectifier (c) Wideband antenna (d) Dual-port RF-rectifier

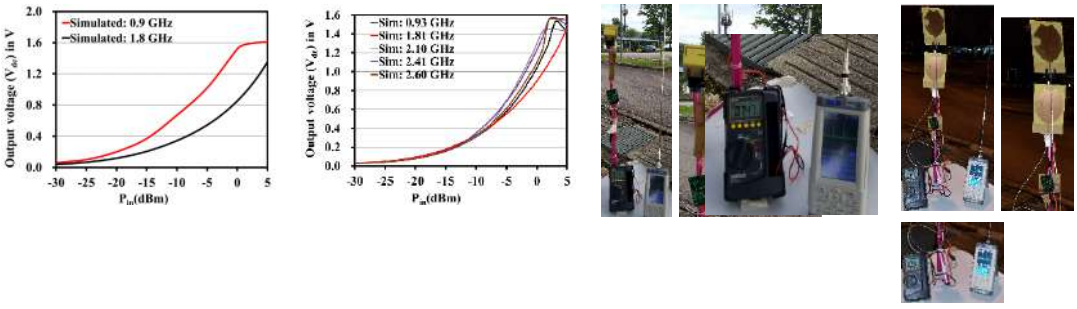
III. RESULT

Fig. 3, and Fig. 4 presents the results of the two rectenna and their performance in an ambiance environment.



(a) (b) (c) (d)

Fig. 3: Simulated (a) S_{11} of the proposed dual-band RF-rectifier (b) RF-to-dc PCE of the dual-band rectenna (c) S_{11} of the dual-port multiband rectifier (b) RF-to-dc PCE of the dual-port multiband RF-rectifier.



(a) (b) (c) (d)

Fig. 4: Simulated output DC voltage of the proposed: (a) Dual-band rectenna (b) Dual-port rectenna. Ambiance measurement of the: (c) Dual-band rectenna (d) Dual-port multiband rectenna.

IV. CONCLUSION

A dual-band and multi-band rectenna for RF energy is proposed. The proposed dual-band and dual-port multi-band rectenna achieved a maximum power conversion efficiency (PCE) of 68.6% and 72.3% for an input power of 3 dBm and 0 dBm, respectively. The two proposed RF harvesters drive a bq25504-674 evaluation module (EVM) to achieve a maximum dc output voltage of 0.75 V and 0.95 V in an ambient environment, respectively. The design shows a better RF-to-dc PCE with the ability to extract practical RF signals across the operational frequencies than most of the reported work in the literature.

ACKNOWLEDGEMENT

This work was supported by TM R&D Malaysia under project number MMUE/190001.

REFERENCES

[1] M. M. Mansour and H. Kanaya, "High-Efficient Broadband CPW RF Rectifier for Wireless Energy Harvesting," *IEEE Microwave and Wireless Components Letters,* vol. 29, no. 4, pp. 288–290, 2019.

[2] Muhammad, S., Tiang, J. J., Wong, S. K., Smida, A., Ghayoula, R., and Iqbal, A. (2021e). A dualband ambient energy harvesting rectenna design for wireless power communications. IEEE Access, 9:99944–99953.

[3] F. Khalid, W. Saeed, N. Shoaib, M. U. Khan, and H. M. Cheema, "Quadband 3d Rectenna Array for Ambient RF Energy Harvesting," *International Journal of Antennas and Propagation,* vol. 2020, 2020.

[4] S. Muhammad, J. Jiat, Tiang, W. S. Kin, A. Iqbal, M. Alibakhshikenari, and E. Limiti, "Compact Rectifier Circuit Design for Harvesting GSM/900 Ambient Energy," *Electronics,* vol. 9, no. 10, p. 1614, 2020.

[5] S. Shen, Y. Zhang, C.-Y. Chiu, and R. D. Murch, "A Triple-Band High Gain Multibeam Ambient RF Energy Harvesting System Utilizing Hybrid Combining," *IEEE Transactions on Industrial Electronics,* 2019.

[6] Muhammad, S., Tiang, J. J., Wong, S. K., Smida, A., Waly, M. I., and Iqbal, A. (2021f). Efficient quadband rf energy harvesting rectifier for wireless power communications. AEU-International Journal of Electronics and Communications, 139:153927.

REAL-TIME DOSIMETRY MEASUREMENT SYSTEM

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Abstract

Optical fibers offer a unique capability for remote monitoring of radiation in difficult-to-access or hazardous locations. Optical fiber sensors can be located in hazardous radiation areas and optically interrogated from a safe distance. A variety of remote optical fiber radiation dosimetry methods has been developed. The LS-1000 is a state-of-the-art real-time remote dosimetry system based on fiber optic sensor technology. With primary utility in operations such as radiation detection, monitoring, evaluation, and dosimetry, the LS-1000 can be used in versatile environmental conditions, field size (including small field), and energy ranges (kV through MV). The device is interfaced with a computerized control console through a high-speed USB connection allowing real-time signal acquisition, processing, measurement, and display. Optimizing the absorbed dose during cancer patients' treatment is one of the goals that fostered the development of real-time dosimetric systems. Indeed, introducing proper procedure optimization, like such a device, measures the dose rate from outside the operating room, the absorbed dose could be reduced. Real-time dose measurements would greatly facilitate this task through real-time monitoring and automatic data recording. Besides, real-time dose monitoring could allow automatic data recording. This work will describe the calibration and validation of the LS-1000 real-time prototype dosimeter based on a new sensor, Germanium doped silica. The validation measurement in clinical conditions has demonstrated the prototype capability of measuring dose rates. The fiber dosimeter can be connected to a long transmission fiber (up to 15m), allowing remote monitoring.

Keywords— Radiation dosimetry; optical-fiber dosimeter; dose-rate

I. Introduction

Various monitoring techniques have been developed to measurement of ionizing radiation via scintillation detectors. One of the most important in seeking effective measurement of ionizing radiation such as X-rays, gamma rays and electron beams to measure the dose delivery, and sense the instantaneous dose-rate produced by a particular source of radiation. Therefore, real-time radiation dosimetry requires a sensor that is both highly sensitive as well as providing an accurate assessment of dose[1][2].

LS-1000 make real-time monitoring and measurement of ionizing radiation via solid-state or scintillating detectors possible. The real-time luminescence method applied in a dosimeter system has stimulated demand for novel materials with fast and precise dosimetric response, which can support sophisticated radiotherapy treatment modalities, in particular, stereotactic radiation therapy (SRT) and intensity-modulated radiation therapy (IMRT) among others [3][4]. Commonly used linear accelerators used in radiotherapy treatments operate on pulsed modes delivering radiation pulses at a rate of ~50 Hz up until ~ 400 Hz, corresponding to a duration of 20 ms to 2.5 ms between each of the pulses. For each cycle, the pulse generally lasts for about 2 μs – 5 μs depending on the manufacturer[5][6]. The LS-1000 is interfaced with a computerized control console through a high-speed USB connection allowing real-time signal acquisition, processing, measurement and display. The LS-1000 use the doped silica optical fiber as a dosimeter[2]. Therefore, is impervious to water, allowing in-vivo measurements to be made, also free from Electromagnetic interference because the fiber dosimeter operates in the optical domain, hence no electromagnetic interference[7][1][8].

II. methodology

The understanding of Radioluminescence (RL) and Optically Stimulated Luminescence (OSL) led to the prototype development of an optical fibre-based radiation dosimetry system, called LS-1000. The real-time dose measurement system (LS-1000) comprised of both a hardware and a software section. Figure 1, shows the depiction of the LS-1000 prototype dosimetry system.

The hardware system of the LS-1000 consists of, the scintillator (doped silica fiber), the propagating optical fiber,the photodetector and appropriate data acquisition electronics. The working principle of this section is based on the scintillator reacting to ionizing radiation and inducing a luminescence (photon particles); these particles propagate through the optical fiber (PMMA) to the photodetector. At the same time, the software connects the dosimetric system computer, which displays the real-time response. The software has another purpose outside showing the dose-response, which is controlling the gating time of the photodetector as well as controlling the external triggers. This software interface also contains the save and load function, this grants it the capability to review pass data if and when necessary.

Hence, these two-section of the dosimetry system work in tandem to maximize the efficiency of the system. Figure 2 showing the data captured and the software model. In this study, phosphorous doped silica fiber would be used at the scintillating fiber; the fiber would be of three concentrations 1.40 wt%, 3.10wt% and 5.37wt%. Each of theis concentration would be refered to in this paper henceforth as low, medium and high respectively.

Fig. 1: LS-1000 Real-time Dosimetry System

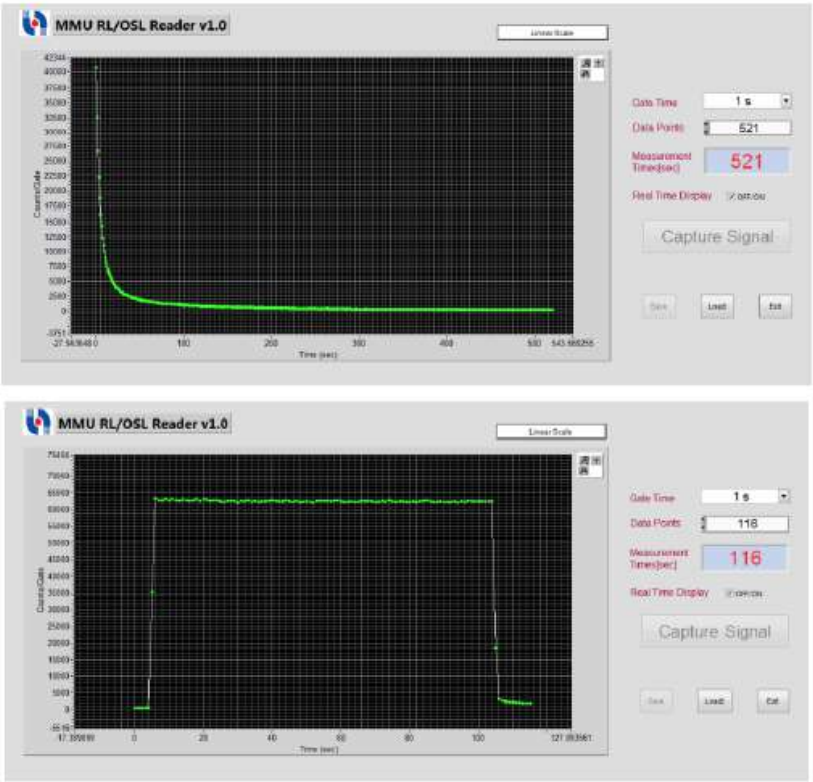


Fig. 2: Labview based software interface for data acquisition.

III. RESULTS/ FINDINGS

The reading acquired is therefore composed of raw data from the scintillating doped silica fiber under the induced effect of a radiation source of the radioluminescence. As shown in Figure 3, the RL counts are indicated at the Y-axis with respect to the time at the X-axis from a pristine P-doped silica optical fibre (~2 cm length, medium P-content). Owing to similar origins and spectral characteristics (only different in terms of luminescence lifetime), both the fluorescence and radioluminescence component will be treated as the same in this study and will be referred to as radioluminescence

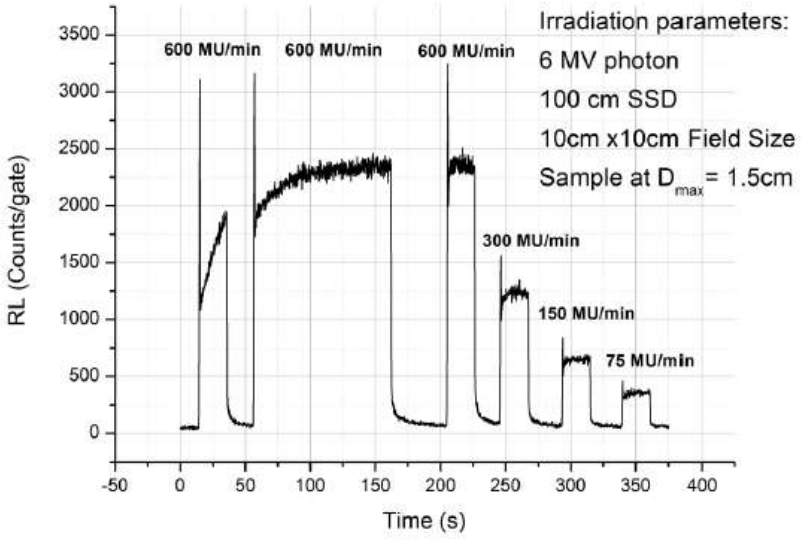
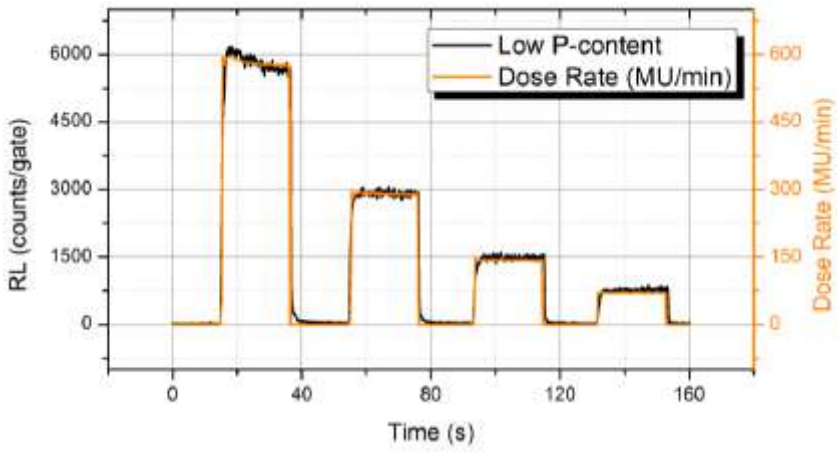


Fig. 3: RL Response of a Pristine P-Doped Silica Optical Fibre Subjected to 6 MV Photon Radiations Delivered at Various Dose-Rates

A logarithmic growth curve is observed for the first accumulated dose of ~12.8 Gy (between 0 and 175 s). This corresponds to the RL sensitization process whereby trap centres are saturated over time filling deep and shallow traps, and enabling a stable radioluminescence response. Irradiation following the sensitization process produced a stable RL signal whose magnitude varied in proportion to the dose rate. The dose-rate measurement was extracted after the experiment from an internal data logger of detectors inside the LINAC machine. The RL response of low, medium and high P-content fibre scintillators is presented in Figure 4



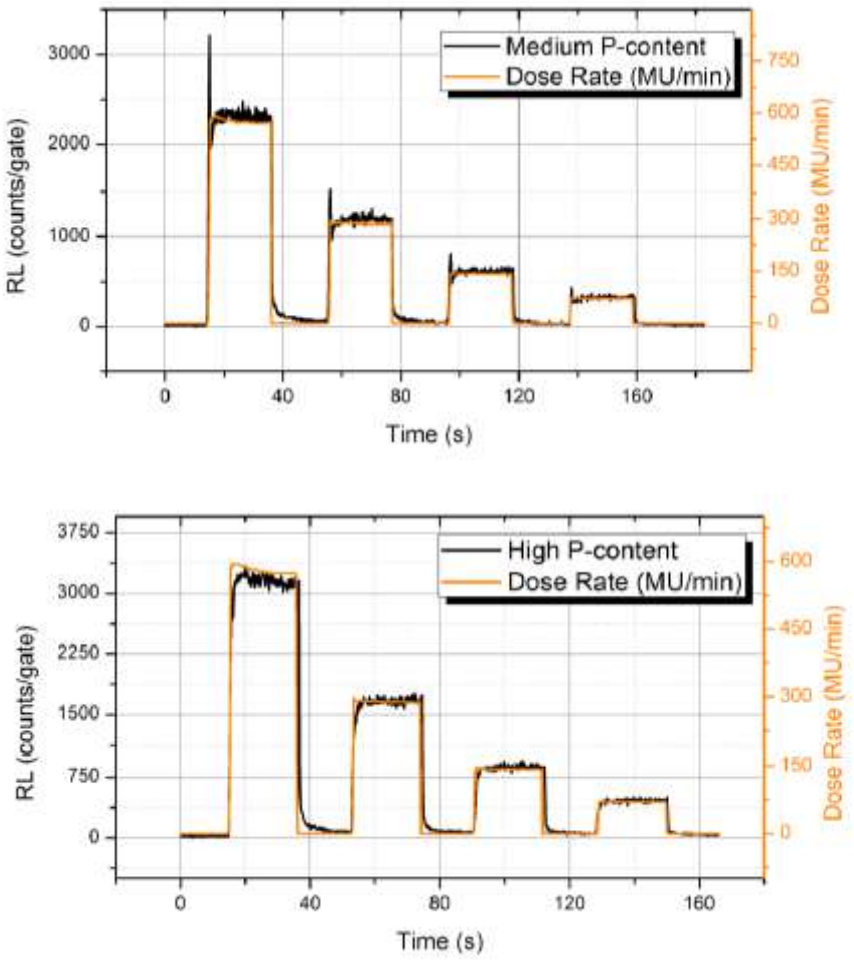


Fig. 4: RL Responses of the P-Doped Optical Fibres Aligning With LINAC Dose Delivery Rate

The linearity graphs of total RL responses produced by each type of P-doped fibre when they were subjected to different dose rate as shown in figure 5.

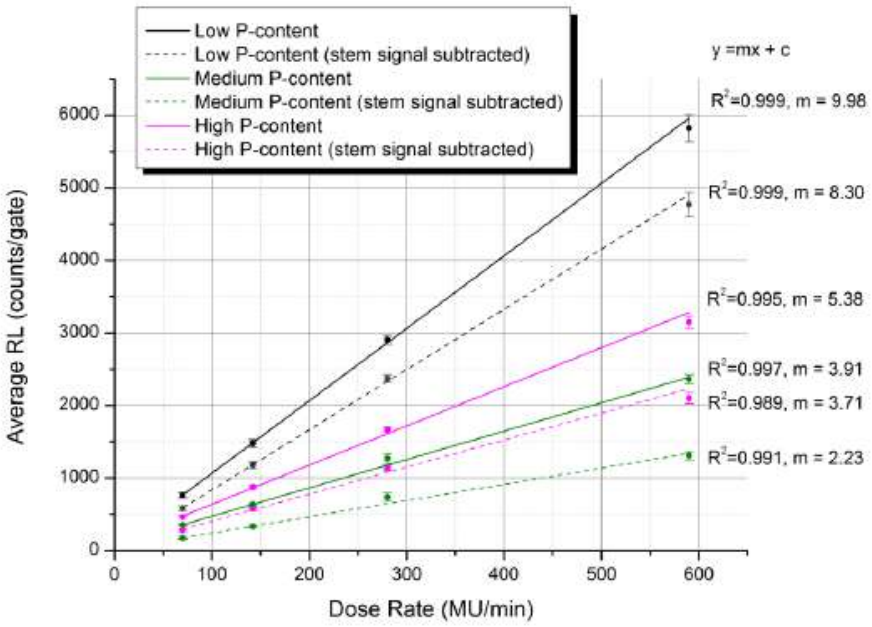


Fig. 5: Linearity of Instantaneous RL Response Subjected to Different Dose-Rates

IV. CONCLUSION

The RL response recorded was consistent over prolonged periods, thus, making LS-1000 suitable for real-time dose measurements. Other properties such as high melting point, smaller dimension for the scintillator used (allowing for higher spatial resolution), large core size (ensuring maximum light propagation) and insolubility in water make this system a promising candidate for radiation dosimeter in radiotherapy.

ACKNOWLEDGEMENT

I would like to express my sincere gratefulness to my honourable supervisors, Prof. Hairul Azhar Abdul Rashid and Dr. Siti Azlida Binti Ibrahim for their guidance, outstanding advice, encouragement, informative ideas and support through the various challenges of this project. [Number MMUE/190082].

I would like to confer my appreciation to Prof. D. A. Bradley, University of Surrey, UK, who supported me and pushed my boundaries of science towards more research with quality and quantity. Most importantly, he has given me the pleasant association and guidance of my work.

My deepest acknowledgement to the researchers of FORC, FOE, MMU, Mr. H.T. Zubair and Mr Adebiyi Oresegun for there invaluable assistance, cooperation and support.

REFERENCES

[1] H. T. Zubair *et al.*, "Real-time radiation dosimetry using P-doped silica optical fiber," *Meas. J. Int. Meas. Confed.*, vol. 146, pp. 119–124, 2019.

[2] H. T. Zubair *et al.*, "Radioluminescence of Phosphorus- Doped Optical Fibre for Radiation," no. May, 2019.

[3] M. Li, F. Xie, D. Gu, Q. Guo*, C. Mou, and T. Wang, "An optimized optical fiber radiation dosimeter for radiotherapy," *Opt. InfoBase Conf. Pap.*, vol. Part F138-, pp. 5–7, 2019.

[4] M. E. Rutherford, D. J. Chapman, T. G. White, M. Drakopoulos, A. R. D. E. Eakinsa*, and AInstitute, “Evaluating scintillator performance in time-resolved hard X-ray studies at synchrotron light sources,” *J. Synchrotron Radiat.*, vol. 23, no. 3, pp. 685–693, 2016.

[5] A. K. M. M. RAHMAN, “Characterization of Germanium / Aluminium Doped Silica Optical Fibres in Radioluminescence and Optically Stimulated Luminescence Dosimetry Doctor of Philosophy Multimedia University Characterisation of Germanium / Aluminium Doped Silica Optical Fibres in,” no. January, 2017.

[6] Q. Guo *et al.*, “Luminescence characterizations of YAG:Ce crystal via sol-gel method for radiotherapy,” *Opt. Mater. (Amst).*, vol. 109, no. April, p. 110297, 2020.

[7] Lingxia Chen *et al.*, “YAG:Ce-Phosphor Scintillators for Optical Fiber Radiation Sensors With High Temporal Resolution,” *IEEE Photonics Technol. Lett.*, vol. 30, no. 18, pp. 1653–1656, 2018.

[8] S. Gundacker, R. M. Turtos, E. Auffray, and P. Lecoq, “Precise rise and decay time measurements of inorganic scintillators by means of X-ray and 511 keV excitation,” *Nucl. Instruments Methods Phys. Res. Sect. A Accel. Spectrometers, Detect. Assoc. Equip.*, vol. 891, no. January, pp. 42–52, 2018.

Universal Minimized Sensors Industrial Motor Fault Detection Using Hilbert Transform Current Signatures Only

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Abstract - Major player of industry is the induction motor. The motors are in motion and mechanical in nature causing many wear and tear creating need for frequent maintenance example brush contact change. Un-mannered and un-frequent monitoring of motors which is common in the industry would easily overexert it self causing major fault. If the motor fault was detected earlier with automated fault monitoring it would have been just a minor fault, reducing the cost and down time of production due the motor repairs. There are few types of method to detect 3 phase motor faults fault available. One by analyzing average vibration signals values of V, I, pf, P, Q, S, THD and Frequency. Two by analyzing signatures of V and I frequency in Hilbert Transform (HT) domain. Three by analyzing instantaneous signals of V and I trajectory lissajous curve. All all the three method needs at least 6 sensors for a 3-phase motor detection three sensors for current and three for voltage. We have proposed a new method of monitoring fault in 3-phase industrial motors using HT instantaneous current signature curve only, reducing the number of sensor to only three units of current transformers. Our system detect fault signature accurately at any voltage or current levels whether it is delta or star connected motors. This is due to our system design incorporated with normalized curves of HT in the fault analysis database. We have conducted the experiment in campus laboratory for two different 3-phase motors with four different fault experiments. The results shown in this paper are comparison of two methods, the V and I lissajous trajectory curve and our HT instantaneous current signature curve. We have chosen them as our benchmark as their fault results resemble close with our system results but our system has the upper hand universality and cost reduction of sensor to 50%.

Keywords—Hilbert Transform, AI, 3-phase, Induction Motor

I. Introduction

There were many common causes of a motor failure that happened in industry. This project was conducted to detect and monitor the faults for three-phase machine. This would help the technician and engineers especially who were working in industry in detecting the fault. This would help in improving the maintenance and productivity of an industry. We had designed this project by applying artificial intelligence to distinguish between a healthy and faulty electrical machine in industry that would help a lot in easier of use and cost effective design. HT application in this project had been really helpful in detecting faults with clear visualization by using minimum number of sensors.

II. methodology

There are two types of load monitoring of load [1] which is classified into non-intrusive load monitoring (NILM) [2] and intrusive load monitoring (ILM) [3]. We gathering data requires a combination of software and hardware. In this case, the most significant microcontroller used is Arduino Mega which is suitable to use as a high speed logger for 50Hz [4]. The Arduino was constructed with ethernet shield and micro SD card, potential sensor ZMPT101B and current sensor YHDC SCT 013-030 [NILM]. This hardware setup was perfected by implementing the software especially using Arduino for coding and programming. The potential sensor was controlled by potentiometer that was connected with Arduino. The high sampling rate of 8500 samples/second per input were taken. This hardward system used in Figure 1 are for bechmarking two methods V and I lissajous trajectory curve and our HT instantaneous current signature curve. Our system alone would result of deleting the VT sensors.

III. results/ Findings

This project involves hardware, programming and data analysis software. We have successfully conducted and completed the experiment for two 3-phase induction motors with four fault simulation in laboratory environment. There are many types of faults that can be monitored and identified but we have only chosen this four types due this type of fault could be simulated without damaging the experiment hardware sets in the campus laboratory.

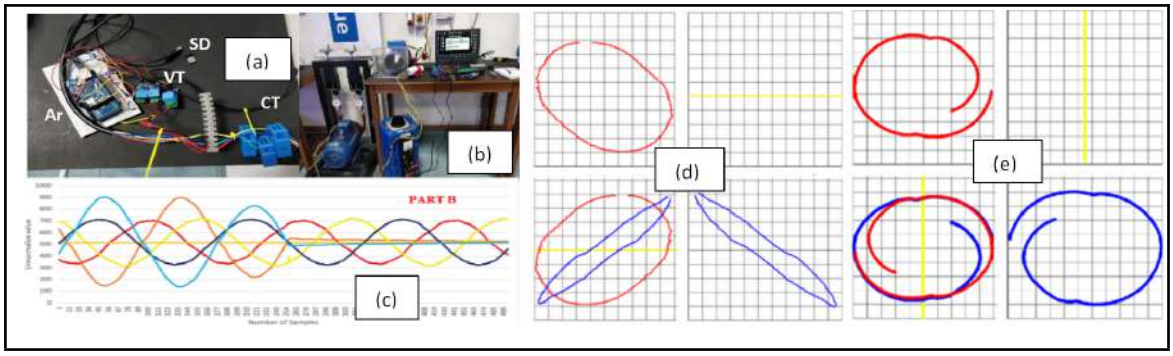

FIGURE1. (A) PROTOTYPE (B) THREE PHASE MOTOR SETUP (C) RAW DATA OF MOTOR WHEN PROTECTION TRIPS DUE TO HIGH CURRENT (D) VI TRAJECTORY (E) HILBERT TRANSFORM.

Figure 1 shows one of the fault data collected represented both methods. Where Figure 1(d) and (e) uses two different method with one minimized sensor 50% but outcome are the same or better for our method.

IV. CONCLUSION

In this project, it was found that our HT instantaneous current signature fault detection method is a better choice in disaggregation approach where it was able to show obvious difference in healthy and faulty curve from its competitor. The better diversified visualization of fault curve helps in increase the accuracy of interpretation of AI software and the maintenance crew to pinpoint or identifying the fault in real time via LCD monitors installed. As each fault will give a specified fault curve signature. From the experiment we conclude that our system also able to identify per-fault. This per-fault can be detected when a slight defection start to occur towards a per-determine known fault curve in our database. Pre-fault would help the maintenance period by per-stocking parts needed with scheduled downtime; if-else un-schedule downtime will incur lost in production profit for industries that relies on this main horse powers.

Another big advantage in our system is the hardware cost for the sensor reduced 50% as only three current transformer needed to be used where else for all the other system in the market need another 3 potential transformer sensors. For future work we would recommend testing our system design in actual production factory environment for 3-phase induction motors, synchronous motors and other types of motors also.

ACKNOWLEDGEMENT

The authors would like to express appreciation for the support of the sponsors [Project Number MMUI/190018] Mini Fund Grant provided by Multimedia University Cyberjaya Malaysia.

REFERENCES

[1] A. Zoha, "Non-intrusive Load Monitoring approaches for disaggregated energy sensing: A survey," *Sensors (Switzerland),* vol. 12, no. 12, pp. 16838-16866, 2012.

[2] D. Burbano, "Intrusive and Non-Intrusive Load Monitoring (A Survey)," *Latin American Journal of Computing Lajc,* vol. 2, no. 1, pp. 45-53, 2015.

[3] A. Ridi, "A survey on intrusive load monitoring for appliance recognition," in *Proceedings - International Conference on Pattern Recognition*, Switzerland, 2014.

[4] S. M. Cruz, "Rotor cage fault diagnosis in three-phase induction motors by extended Park's Vector approach," *Electric Power Components and Systems,* vol. 28, no. 4, pp. 289-299, 2000.

Digital Creative & Cinematic Arts

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A DESIGN OF VIRTUAL REALITY MIRROR THERAPY FOR STROKE REHABILITATION

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***Abstract* - Mirror therapy requires the patient to perform physical movement with the non-affected limb and the movement is reflected in a mirror. This study aims to develop a mirror therapy that couples with virtual reality technology to provide a new approach for stroke recovery. In this study, a leap motion controller is introduced as a human machine interface to track movement of the upper limbs. A motion sensor is used to translate the physical gestures into instructions for the device. The Unity game engine is used to create a virtual 3D environment with objects to interact with, and a head mounted display is set up to provide a fully interactive virtual reality experience. Theoretically, a virtual mirror is placed within the virtual world and simulates a mirroring hand. This mirror hand will mimic the opposite hand in the same fashion as a mirror. The developed virtual environment provides the same function as a physical mirror while allowing a more interactive experience when undergoing therapy. 32 volunteers were invited to test play the program to measure its effectiveness. 90.6% of the volunteers rated it 3 and above when asked to rate the level of engagement on a scale of 1 to 5, with 5 being the most engaging. The volunteers were also asked to rate the helpfulness they think the program will have towards mirror therapy from a scale of 1 to 5, with 5 being the most helpful. 87.5% of the volunteers rated it highly from 4 and above. The results are promising based on the overall positive reviews from the participant evaluation.**

Keywords—mirror therapy, virtual reality, Unity software development

I. Introduction

Stroke is the third-largest cause of death in Malaysia, with an estimated 40,000 Malaysians suffering from stroke each year [1]. Stroke effects are highly dependent on the location it occurs and the volume of damaged brain tissue [2]. Most of the stroke patients suffer from motor dysfunction [4] and they are dependent on others for transportation to the medical facilities and usually limited by the schedule of the staff for rehabilitation therapy. Owing to the reasons provided, many patients who undergo therapy give up before results are even yielded. Hence this study proposed a home-based virtual reality mirror therapy to enable patients to carry out their own training. Mirror therapy is a type of stroke rehabilitation approach where the reflection of a moving non-affected limb gives the illusion of movement in the affected limb. The incorporation of virtual reality therapy into the field of mirror therapy rehabilitation displays the potential to improve the quality of life of patients. In the time of pandemic, a home-based mirror therapy also enables the patients who are confined at home to continue their own training without disruption.

II. methodology

The processes involved in the methodology aim to facilitate the translation of physical movement into digital data. Fig. 1 illustrates the path that data from hand movement translates across the system. Physical hand movement captured in the real world is converted into data by a leap motion sensor and the converted data is fed into the unity game engine where a virtual 3D environment is developed. A head mounted display (HMD) is set up to provide a fully interactive virtual reality experience for the user. In this program, a virtual mirror is placed within the virtual world to simulate a mirroring hand. The virtual mirror script works to reflect the movements of the hand and insert them into the opposite pair of hands. The Leap Motion Standard Developer Kit (SDK) for Unity provides the assets needed to build the game. There is a game object called 'Leap Rig' that includes the setup for a virtual arm pair in front of the camera. The location of the camera is set to be about eye level to render this game object best used with HMD for virtual reality. Next, a pair of hand model was bound to the game object. The 'LoPoly Rigged Hand' is chosen to build this project. The model for left and right hand needed to be bound individually for the game object to work. With this setup, when the scene is played, the user will be able to create a pair of virtual limbs with the leap motion controller. In this project, the configuration of the software consists of three components in which the Trinus VR is used to develop telephone-computer communication for the HMD, the Unity Game Engine is responsible for creating the interior of the virtual world and objects and the Microsoft Visual Studio is used to provide the game engine with C sharp scripting.

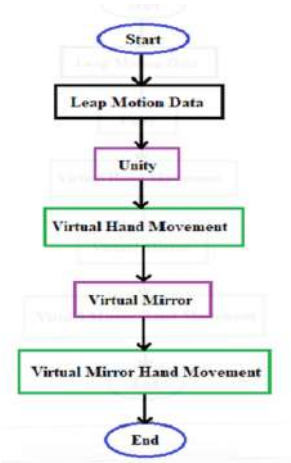

Fig. 1: Hand movement process flowchart

III. RESULTS/ FINDINGS

Fig. 2 shows the mirror hands when both hands of the user are active after the completion of the program. A survey was conducted with a total of 32 volunteers to measure the effectiveness of the program. 93.5% of the participants had some prior knowledge regarding virtual reality but had never experienced any in their life. While using the software, besides allowing them to explore the virtual environment, the participants were also required to perform upper limb exercises commonly conducted in traditional mirror therapy session. The implementation of leap motion controller in virtual reality training is observed to be an interesting experience for 84.4% of the participants as the game captures their attention for 5 to 10 minutes. 90.6% of participants rated the engagement level highly with a 3 and above on a scale of 1 to 5 with 5 being the most engaging. 87.5% of respondents rated it highly from 4 and above when asked to rate helpfulness level with 5 being the most helpful. All the participants were able to adapt to the virtual reality experience within 10 minutes when continuous attempts were given. A common request from the participants was the addition of more games in the program such as the use of swiping motion and pinching motion.

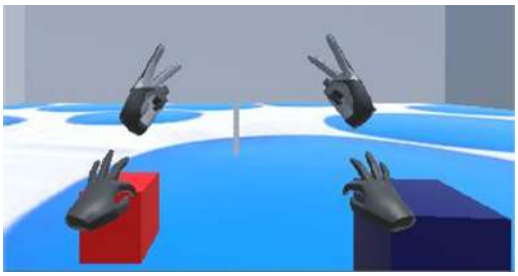

Fig. 2. Screenshot of the training program

IV. CONCLUSION

With new understanding in the field of virtual reality, a 3D virtual world is created for the purpose of developing mirror therapy to aid upper limb recovery training. Modern tools such as leap motion controller were used to implement a solution. From the overall positive feedback from the public testing, the result is considered to be promising. Further exploration can be conducted so that the end product is ready to be used in a telemedicine setting. A long term longitudinal study on stroke patients must be performed to obtain a definitive answer to whether mirror therapy in virtual reality is comparable or even superior to the traditional mirror box.

REFERENCES

[1] Effects of Stroke: American Stroke Association; 2017 [08.11.2020]. Available from: http://www.strokeassociation.org/STROKEORG/AboutStroke/EffectsofStroke/Effects-of-Stroke_UCM_308534_SubHomePage.jsp.

[2] N. National Stroke Association Malaysia, “How Stroke Is Diagnosed? | Stroke Prevention | National Stroke Association of Malaysia | NASAM.” [08.11.2020] Available from: http://www.nasam.org/english/prevention-what_is_a_stroke.php.

[3] American Speech-Language Hearing Association, “Stroke,” 2017. [08.11.2020]. Available from: http://www.asha.org/public/speech/disorders/Stroke/.

[4] Stroke Association, “What problems do people have after a stroke? | Stroke Association,” 2015. [08.11.2020]. Available from: https://www.stroke.org.uk/what-stroke/what-problems-do-people-have-after-stroke.

AN APPROACH FOR MEASUREMENT OF TIMBRE TOWARDS QUANTIFYING AURAL AESTHETICS

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The study of aesthetics of timbre started in the era of Pythagoras with the classification of intervals into consonances and dissonances. This became the basis for the construction of musical scales as we know it today. Musical timbres are described using qualitative semantic descriptors such as mellow, harsh, dark and bright – all of which are descriptors that lacks granularity. A tone that is described as harsh does not include information on the degree of harshness of said tone. We hypothesize that a quantifiable measure of timbre in relation to aesthetics allows for a more accurate description of timbre compared to semantic descriptors. Applications of a granular descriptor include automatic parameter recommendation for synthesizers and ranking mechanisms for evaluation of tone quality of synthesizers. In this paper, we classified historically significant studies into five categories of theories for tonal consonance where each category represents a significant approach towards understanding and defining tonal consonance. We seek to propose an approach to derive a quantifiable measure of timbre based on the five classification of theories for tonal consonance.

Keywords — timbre, tonal consonance, music technology, computational aesthetics, music information retrieval

I. Introduction

Timbre are oftentimes explained using qualitative semantic descriptors such as bright, warm, dark, and smooth. These semantic descriptors are void of granularity such that if a timbre is said to be bright, there is no information on the degree of brightness. Spectral analysis of an instrument's timbre reveals spectrum and envelope information that makes up for the perception of timbre for said instrument. Spectral information includes the number of partials present and the fundamental frequency of the timbre. Musical tuning systems are a definition of a set of tones, or pitches constructed from relationship between different frequencies which acts as a basis for musical compositions. The distance between each pitch to the root or first pitch in a set of pitches are musical intervals. An interval is said to be consonant if it sound pleasant, with little to no tension or dissonant if it sound unpleasant, with high tension [1]. Similarly for musical timbres, where distances of each partial to the fundamental frequency can be viewed as intervals as well.

The degree of pleasantness (consonance) and unpleasantness (dissonance) are described in Helmholtz's explanation on the phenomenon of beats. High frequency beating occurs if the interval between two pitches are sounded close together due to the interference between the two frequencies. As the interval moves closer, beating frequency lowers and disappears as the two frequencies becomes identical [2]. Plomp and Levelt experimented with consonance by asking participants in their study to rate the degree of pleasantness for different intervals using pairs of pure tones. The result from this experiment is the consonance curve, which shows how consonance levels change as an interval gets larger. High consonance was observed at unison and tapers down to dissonance as the interval gets larger [3]. A computational model for consonance and dissonance by Trulla, Stefano and Guiliani observed that consonances occurs at just intonation frequency ratios such as octaves, fifths and fourths [4]. W.A. Sethares created a dissonance curve model for timbres by comparing the timbre sounded at various intervals and summing the dissonances between all pairs of partials in a timbre at every interval. This model creates a contour plot with peaks and valleys where the peaks represent interval dissonances and the valleys represent interval consonances [5].

II. methodology

In this study, we employed a quantitative approach utilizing a descriptive research design with observational and analytical methods. An aggregate for what causes the degrees of consonance and dissonance are defined based on five identified categories of theories of tonal consonance. Timbral key features are identified based on the defined aggregate. Identified timbral key features are extracted from samples of timbres which matches the semantic descriptors used to describe the timbre. Key music information retrieval features are also extracted alongside our identified timbral features. Timbral key features are extracted from two different sources for two different purposes. Firstly as a reference feature model, created using feature data from SAFE-DB and secondly as the observed feature model, created using features extracted from samples obtained from Freesound.org

sound library. SAFE-DB (Semantic Audio Feature Extraction Database) is a database of semantically annotated music production metadata taken from an international user group of sound engineers initiated by Semantic Audio Labs. Freesound.org is an open to public collaborative database of audio samples catalogued by semantic descriptors initiated by the Music Technology Group of Universitat Pompeu Fabra, Barcelona, Spain. Reference feature model and observed feature model are analysed using dynamic time warping (DTW) algorithm. Analysis results are observed to formulate a quantifiable measure of timbre.

III. RESULTS/ FINDINGS

We have classified five categories of theoretical approach for tonal consonance. From these classified categories, we have identified four shared observations. The identified shared observations are:

1. Perception of pleasantness and tonal consonance are closely identical for the average individual.
2. Consonance is related to simple frequency ratios.
3. Degree of consonance are dependent on the interval distances.
4. There are a set of intervals in which a given timbre will sound most consonant.

From these shared observations, we have identified key timbral features for extraction from SAFE-DB and Freesound.org. This identified key features are used alongside key music information retrieval audio features such as Mel-Frequency Cepstral Coefficient (MFCC) and Spectral Centroid. Figure 1 and 2 illustrates two plots for two different samples that are semantically described as ‘warm’. Blue lines in the plots are the reference feature model while orange lines are the observed feature model. The reference feature model is created using our key timbral features on a sample generated by applying equalisation to a square wave as source signal. The equalisation parameters are set to feature data from SAFE-DB labelled ‘warm’. The source signal frequency is set to the fundamental frequency of an arbitrarily chosen sample labelled ‘warm’ in Freesound.org. The observation feature model is created using our key timbral feature on the same arbitrarily chosen sample labelled ‘warm’ in Freesound.org.

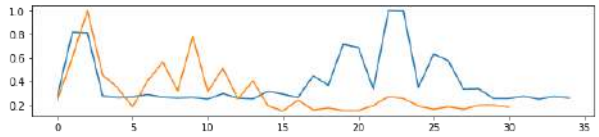

Figure 1. Analysis of sample ‘Warm01’

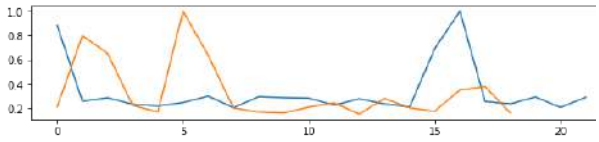

Figure 2. Analysis of sample ‘Warm02’

DTW analysis for ‘Warm01’ returns a value of 17.14 while for ‘Warm02’ returns a value of 10.61. The DTW analysis returns a value of 0 for analysis of two identical temporal sequences, which means a lower number suggests closer similarity. These values describes close similarity between the reference feature model and observed feature model. At the same time, these values also showcased that while both ‘Warm01’ and ‘Warm02’ are ‘warm’ samples, both samples produced different models, highlighting the varying degree of ‘warmth’ in samples that are both semantically described as ‘warm’.

IV. CONCLUSION

Our study demonstrated an approach for a quantified measurement of timbre to introduce granularity in timbral description. Timbral key features were identified based on a set of classified theories of tonal consonance and we have demonstrated the use of the identified timbral features to create reference and observational models for analysis. Reference models are created from semantic audio feature extraction database (SAFE-DB) and observational models are created from samples obtained from Freesound.org sound library. Finally, we demonstrated the use of dynamic time warping (DTW) algorithm and highlighted examples showcasing numerical figures that are meaningful towards granular timbral description.

ACKNOWLEDGEMENT

The authors would like to express appreciation for the support of the sponsors, Research Management Centre, MMU Graduate Research Assistant Scheme [MMUI/180023.02] and MoHE Fundamental Research Grant Scheme [FRGS/1/2019/SSI07/MMU/02/1] without which this research would not have been possible.

REFERENCES

[1] E. Terhardt, “The concept of musical consonance: A link between music and psychoacoustics,” Music Perception: An Interdisciplinary Journal, Journal, vol. 1, p. 276, April 1984.

[2] H. Helmholtz, On the sensations of tone. Courier Corporation, 2013.

[3] W.J.M.L. Reinier Plomp, “Tonal consonance and critical bandwidth,” The Journal of Acoustical Society of America, vol. 38, p. 548, October 1965.

[4] A. G. Lluis, L. Trulla, Nicola Di Stefano, “Computational approach to musical consonance and dissonance,” Frontiers in Psychology, vol. 9, April 2018.

[5] W.A. Sethares, Tuning, timbre, spectrum, scale. Springer Science and Business Media, December 2005.

ASSESSING THE RELATIONSHIP BETWEEN SPATIAL LAYOUT COMPONENTS AND AFFECTIVE VISITORS' PERCEPTIONS OF GALLERY AFFORDANCE

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***Abstract* - Multimedia gallery space design takes into consideration content and context, tools and technology, visitors' experience and perception. The components are interrelated where the introduction of interactive digital platforms and multimedia content require considerable attention in the area of contextual physical spatial planning. Negligence to adhere will result in unsatisfying visitor experience which is the occurring issue. Changes are taking place from static exhibition modes to interactive multimedia platforms in accordance with the advancement of technological means. Due to this, visitors' behaviour and acceptance towards multimedia gallery spaces are seeing changes too. By assessing the relationship between spatial planning components and their influence towards affective visitors' experience, gallery affordance will be better designed. Therefore the objective is to propose a conceptual model for multimedia gallery experience. A survey was carried out during the Faculty of Creative Multimedia Showcase (FCM) 2020 at the e-Gallery to find out more on visitors' experience and perception. Findings show that with emphasis given on the concept of sense of place, visitors relate better to the spatial surrounding. This is useful for curators, designers and creative artists of the built environment.**

Keywords—multimedia gallery, spatial planning, visitor experience, gallery affordance, sense of place

I. Introduction

When accessing components in a multimedia gallery, it is inevitable to be discussing about the relationship between content and context with visitors' perception and experience. Any transition of changes in the digital platform, namely the tools, devices and technology used in the gallery space will affect the planning of the spatial layout. Based on the six layouts in gallery design and components in exhibition design [1], negligence to treat spatial layout components accordingly will result in an unsatisfying visitors' experience. Reference [2] has put forward the importance of visitor satisfaction in their research adding that visiting galleries is a prescribed experience. Exhibition spaces are becoming more audience-centred where the needs of audiences must be considered during planning of activities [3]. Assessing visitors' experience using the concept sense of place stresses on their place reference as sense of place is often known as affective link to physical space that involves meanings [4]. By achieving the understanding of sense of place, gallery affordance design can be enhanced when spatial layout components are clearly defined.

II. methodology

Based on the Museum Experience Model, theory of Sense of Place and Affordance in Design, a conceptual model is designed to assess affective visitors' experience towards physical spatial layout. A survey questionnaire is then designed with questions involving components such as:

i. Spatial Layout: Pubic, private and semi-public, Gallery Furniture and Circulation Pathway

ii. Types of Content and Activities: Analogue, Digital, Interactive

iii. Tools and Technology in Galleries

iv. Visitors' Experience: Active, Passive and Interactive

v. Sense of Place

The survey is conducted during the Faculty of Creative Multimedia (FCM) Showcase 2020 at the e-Gallery of Faculty of Creative Multimedia. Around eighty visitors participated in the survey consisting of students, staff and industry experts with design education and experience background.

III. RESULTS/ FINDINGS

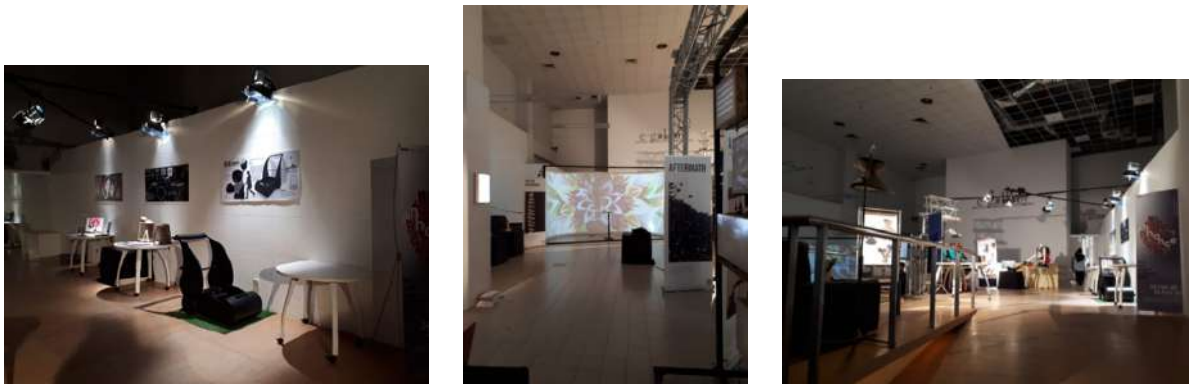

Fig. 1 FCM Showcase 2020 at the e-Gallery

Overall, from the survey, 72.5% agreed that their overall experience have been enhanced with having clear sense of place (SOP), 62.5% agreed that their relationship with other visitors were enhanced with SOP and 68.8% agreed that their visit were more meaningful when they were able to relate to their SOP.

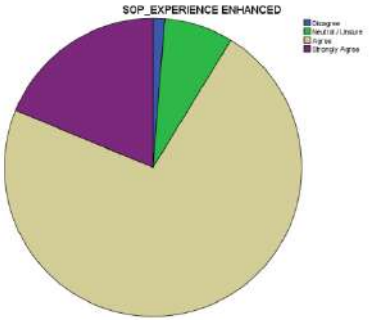

Fig. 2 Overall Experience

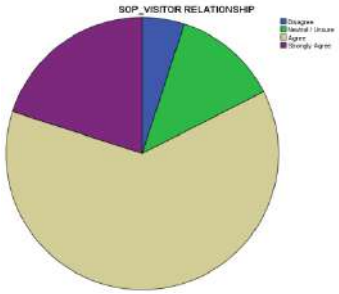

Fig. 3 Relationship with other visitors

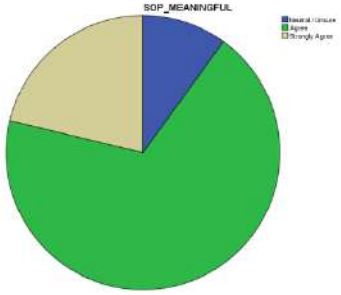

Fig. 4 Meaningful Visit

IV. CONCLUSION

From the findings it is found out that a good sense of place leads to better gallery design affordance as visitors are able to relate better to their contextual surroundings, content and activities, understand better the usage of tools and technology, and the relationship with other visitors. Their gallery experience becomes a more meaningful one and this will lead to the framework of good multimedia gallery design in the future.

ACKNOWLEDGEMENT

The authors would like to express appreciation to the faculty, curators and participants of FCM Showcase 2020.

REFERENCES

[1] Matthews, G. Museums and Art Galleries, Butterworth Architecture, 1991.

[2] Naomi, K. and Ken, W. (2007). *Estimating Visitor Preferences for Different Art Gallery Layouts Using a Choice Experiment. Museum Management and Curatorship, 22(1), 43–58.*

[3] Recupero, A., Talamo, A., Triberti, S., & Modesti, C. (2019). Bridging museum mission to visitors' experience: Activity, meanings, interactions, technology. Frontiers in Psychology.

[4] McCunn, L. J., and Gifford, R. (2018). Spatial navigation and place imageability in sense of place. *Cities*.

Design and Development of Immersive Nanotechnology Laboratory with Virtual Reality

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***Abstract* - This paper presents the development of Virtual Reality (VR) simulation based on actual nanotechnology laboratory. Users can fully immerse themselves in the virtual environment and conduct nanotechnology procedural practice process virtually. The creation of VR based simulation environments holds the potential to enhance student's learning experience and improve the safety of the experiment activity. Safety risk is a critical issue for nanotechnology, such as nanoparticles, raise a number of safety and regulatory rules. Literature highlighted that human factor consideration such as operator process and equipment interface aspects contribute to the issue. The design of confusing equipment increases potential of human error. Therefore, the development of VR simulation with computer-controlled technology enable learner to practice and repeat procedures as often as necessary in order to correct mistakes and optimize the process outcomes. Learning with immersive VR provides pre-training experience to the learner. They can fine-tune their skills and conduct experiment without compromising the safety risks and dangers.**

Keywords—virtual reality, simulation, nanotechnology, student learning experience, vr environment

I. Introduction

According to [1], with the increasing number of technological platforms, virtual reality (VR) is introduced in more accessible applications therefore leading education into a new phase that links current teaching and learning with future world. Reference [2] from their study conclude that pedagogical aspects should be given ample attention as the importance of understanding simulated learning environments as suitable educational approach expands knowledge in effective styles of teaching and learning. VR simulation with computer-controlled technology enables learners to practise and repeat procedures as often as necessary to correct mistakes in order to optimize the process outcomes. This is in accordance with the notion that virtual reality can be used to enhance student learning where it allows students to be immersed, motivated and engages the mind in a remarkable way [3]. He further stressed that the properties of good virtual reality learning experiences are immersive, easy to use, meaningful, adaptable and measurable. Learning with immersive VR provides ample training experience before the actual handling of equipment as they can fine tune their skill. The knowledge gathered from the VR simulation enables them to conduct future experiments with confidence. Virt-Lab is a simulation project developed based on actual activities in a nanotechnology laboratory. The immersive, instructional design of a virtual reality laboratory is designed with the objectives of creating a virtual representation without the need of being present and to understand and learn better the procedures in a physical laboratory. The simulation is intended for undergraduate students with the intention of instilling education element of virtual reality in the instructional practice process while educating on the importance of students' safety. The usage of education element in virtual reality is aimed to enhance students' learning experience in real time and acquiring knowledge of tools and equipment involved. According to [4], the needs for safety during training procedures can be obtained by completing virtual training before working with hazardous material.

II. Design of Virt-Lab

This study adopts phases of methodology proposed by [5] which consist of awareness of problems, suggestion and development as shown in Figure 1. In the coming phase, a user evaluation will be conducted to determine the effectiveness of the system. The need for a safer environment for conducting laboratory experiment and a more engaging learning environment for the younger generation have motivated the exploration of using virtual reality technology to design Nanotechnology laboratory, in short, Virt-Lab. The objective of the Virt-Lab is to enhance students' learning of basic laboratory skills in which they can interact with the laboratory equipment in a safe and immersive laboratory environment. Students can carry out the simulated experiment repeatedly before conducting the real experiment in an actual laboratory. Step-by-step guidance and explanation from the technical experts are included to help students in mastering the skills of handling the equipment. The Virt-Lab provides an alternative solution to the issue of nanotechnology education.

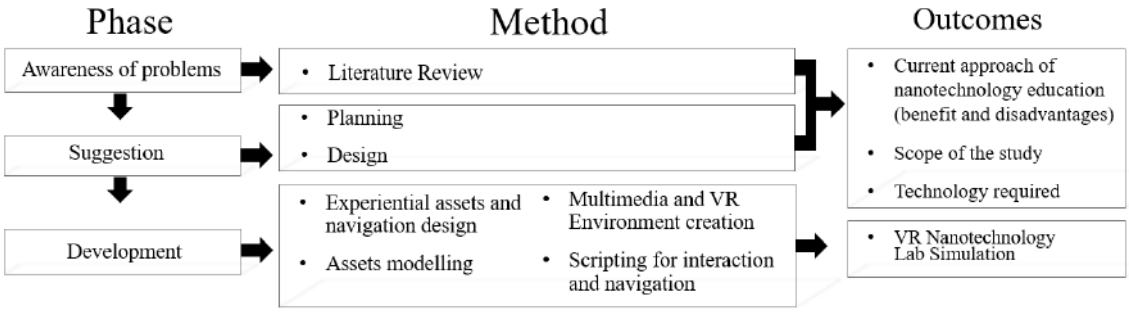

Fig. 1 Research Process of the Study

III. RESULTS/ FINDINGS

The Virt-Lab was developed using Unreal Engine 4 to replicate the Nanotechnology laboratory at Faculty of Engineering, Multimedia University. The app was deployed on HTC VIVE to help undergraduate students familiarize themselves with an actual laboratory setting, safety precaution steps, handling lab equipment, etc. in an immersive laboratory environment. Prior entering the virtual Nanotechnology lab, students are brief on the safety precaution steps such as wearing a facemask, glove, goggle and protective suit. Students will have to complete all the precaution tasks in the preparation room as shown in Figure 2(a). Students are able to explore the simulated laboratory environment, learning to use the equipment and conduct experiment through the Virt-lab as illustrated in Figure 2(b).

Fig. 2(a) Safety Precaution Steps in the Preparation Room

Fig. 2(b) Virtual Learning Environment of the Virt-Lab

IV. CONCLUSION

By researching and implementing procedural process in a nanotechnology laboratory in a simulated VR environment, Virt-lab is produced with the objective to enhance students' learning experience. Understanding target audience capability, operating process and equipment involved the user journey of sequence and interaction is obtained after a series of design implementation and inputs from experts. By also taking into consideration the issue of confusing equipment in the laboratory increases the potential of human error, this immersive nanotechnology laboratory is designed to overcome problems faced by providing pre-training exercises. Knowledge gathered from the VR simulation will enable them to conduct future experiments with confidence as they are able to repeat the process of handling equipment in the Virt-lab.

REFERENCES

[1] Kencevski, K., & Zhang, Y. (2019). VR and AR for Future Education. In Handbook of Mobile Teaching and Learning (pp. 1–16). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-41981-2_136-1

[2] Jamil, M. G., & Isiaq, S. O. (2019). Teaching technology with technology: approaches to bridging learning and teaching gaps in simulation-based programming education. International Journal of Educational Technology in Higher Education. https://doi.org/10.1186/s41239-019-0159-9

[3] Babich, N. (2019). How VR in Education Will Change How We Learn and Teach. Retrieved from https://xd.adobe.com/ideas/principles/emerging-technology/virtual-reality-will-change-learn-teach/

[4] Fazarro, D., Lawrence, H., & McWhorter, R. R. (2011). Going virtual: Delivering nanotechnology safety education on the web. Journal of sTEM Education, 48(2), 38-51.

[5] Vaishnavi, V. K. and Kuechler, W. (2008). Design Science Research Methods and Patterns: Innovating Information and Communication Technology. Auerbach Publications. Boca Raton, FL.: Auerbach Publications.

eHEALTH FRAMEWORK IN PROMOTING WELLNESS FOR WORKING ADULTS

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Abstract
There is an increasing number of working adults in Malaysia who are facing general health and mental health issues in this uncertain time. Pandemic situation has made public health issues utmost critical now. The regulation of health information control should be more open, transparent and credible from the sources to the recipients. eHealth applications such as MySejahtera, and various health related social media applications, etc are playing crucial roles in dealing with public health information and communication to citizens and to avoid emotional distress and panic in this uncertain time. The main purpose of this research is to review some eHealth frameworks that promote health and wellness for the general public and specifically for working adults who play an important role in the family. It will then review eHealth solutions within the selected framework mainly through the guided usage of various digital technologies and methods such as digital devices, tablet and dashboard, smart wearables, mobile or web applications, digital contents and creative communications. It is hoped that the outcome of the paper will be able to propose a more viable eHealth Framework that suits working adults to safeguard their wellness. The scope of this review is mainly to address the wider concept of health and wellness promotion through eHealth for working adults.

Keywords— eHealth framework, digital health, working adults, health, wellness

I. Introduction

There is an increasing number of working adults in Malaysia who are facing general health and mental health issues in this pandemic time [1]. The widespread of misinformation and fake news (i.e. the phenomenon of infodemic) is also "flourish" alongside with credible information from sources such as the World Health Organization (WHO) [2]. eHealth applications such as MySejahtera and various health related social media applications, etc are playing a crucial role to deal with public health information communicated to citizens and to avoid their emotional distress and panic during this pandemic time. The purpose of this research is to review eHealth frameworks that promote health and wellness in a wider scope for working adults who play an important role (breadwinner) in the family. Some eHealth solutions within the selected framework mainly through the guided usage of various digital technologies and methods will be elaborated. The outcome of the paper will be able to propose a more viable eHealth Framework that suits working adults for promoting their wellness.

II. DISRUPTIONS AT WORK

Working adults who constantly work from home (WFH) during the new normal have difficulties to differentiate and delegate their time for work and personal affairs. Lockdown at home has caused some working people unable to take their break from work and therefore they continue to work at home. This situation is a global issue where [3] from the Organization for Economic Co-operation and Development (OECD) has reported the loss of jobs and the transformation of jobs have resulted from the discussions on the policies for a better system for "future of work. [4] reported that the Department of Statistics (DOS) recently published findings from a study on the effects of Covid-19; the samples are non-representative but its findings are still of use, mainly to depict a high percentage (i.e. 44%) of workers were found to work from home; they are mostly high-skill workers who work from home [4]. Tumin [4] suggested that "new working rules and standards related to health and safety at the workplace would also need to ensure workers to remain healthy". A survey has also shown that Kuala Lumpur City in 2019 and 2020 has been ranked as among the top overworked cities in the world [5]. The new work styles at home are prevalent such as to constantly joining a meeting (or a few meetings at once), long sitting hours and screen time for meetings, and at times, they face communication challenges and distress due to virtual environments. All these have resulted in some forms of health challenges for the workers.

Promoting Health and Wellness at Work

This paper focuses more on the wider concept of health and also expanding it to wellness. Wellness is multidimensional and holistic, encompassing lifestyle, mental and spiritual well-being, and the environment that promoting it [6]. "Health is a state of being, whereas wellness is the state of living a healthy lifestyle" [6, para.

3]. According to WHO (1948) [12], "Health refers to physical, mental, and social well-being and not merely the absence of disease or infirmity". Meanwhile, "wellness aims to enhance well-being" [6].

This paper is interested in the discussions of promoting health and wellness for working adults through the facilitation of eHealth solutions. Promoting wellness at home should be an utmost important agenda now but it is often overshadowed by pandemic preventive measures such as practising social distancing, hygiene and wearing masks. Will eHealth / digital health be effective facilitation for promoting wellness for working adults?

III. REVIEW OF EHEALTH MODELS

Telehealth or another closer term is eHealth has been a promising approach to deal with health especially during the pandemic time. According to [8] that "telemental health refers to the use of information and communications technologies, including videoconferencing, to deliver mental health care remotely, including evaluations, medication management, and psychotherapy". The proposal by [8] is that "Telemental health has been quite successful when implemented to different population groups on different conditions of mental health and also multiple clinical settings". In Malaysia, the spending on eHealth applications such as contact tracing software and digital health applications are among the priority and also on other public health initiatives in dealing with the pandemic. MySejahtera application offers various services, mainly "it is to assist the government in managing and mitigating the outbreak of Covid-19" [9]; It is also to remind users to monitor their health; it provides users reliable information and locations of the health providers.

eHealth Model by Shaw et al. (2017) and Others

According to Shaw [10], "eHealth mainly consists of three domains: i) health in our hands, ii) interacting for health, and iii) data enabling health. Health in our hands is the use of eHealth technologies to monitor, track, and inform health status". Interacting for health is the use of technologies to communicate between stakeholders in health. Data enabling health is the use of technology to do the collection, management, and use of health data for more precise or better diagnostic and decision making. There are many examples and use of eHealth solutions related to these domains that will be elaborated in the full paper. A distinctive feature of this eHealth framework is its fluid boundaries, which is the overlapping of the domains, and these three domains are interrelated to each other in defining eHealth ([10], p. 9, refer to Figure 1).

Fig. 1 eHealth framework by Shaws et al. (2017) [10] highlights the three domains of eHealth, namely "D1) health in our hand, D2) interacting with health and D3) data enabling health" (Adapted from [10])

Key Elements	Sub-Elements
Layout and instructional design	Text element; colours; illustrations; sound of audio recordings; look and feel of video recordings; navigation; instructions; print out
Social context and support (simulations of or real person-to-person interaction)	Chat; social community - discussion forum; personal stories; reminders
Contacts with the intervention	Feedback and motivational messages
Tailoring	Goal-setting; customizable character; game elements; choices
Self-management	Activity planning; activity scheduling; activity tracking; self-monitoring; diary; journal

Fig. 2 Elements of the design framework for eHealth by Morrison et al. (2012) [12]. *The figure is adapted from [12]

For example, a social networking system or application provides social support for healthcare professionals to share a diagnosis. This can be categorized under "Domain 1- health in our hands, and Domain 2 - interacting for health". Healthcare services can be provided and supported via a distance to benefit more people. With the advancement of data science, "Domain 3 - data enabling health" - is another dimension that can tackle health through data analytics and intelligence for making better decisions (or provide better services) in the healthcare sector. Figure 1 also shows the overlapping nature of this framework acknowledges the complexity of eHealth. The middle part of the overlap of three domains; indicates the optimum point of eHealth that "integrates health data for enhancing interactions and communications, so as to empower users" for their own health. This

framework also discovers the complex yet flexible approach when implementing digital technologies to deliver health services. It is suggested that any eHealth initiatives that are most impactful to promote wellness for working adults need to include elements from all 3 domains. [10] acknowledges *data privacy and safety* as the key criteria or environment for the eHealth model to work effectively. Data enabled health involves health data that is private and must be handled with discretion. Usually, people are the custodian of their own data. However, in common eHealth models, digital health data from "personal data management systems are shared securely with the nominated people, including medical professionals" ([10], p.8). This exposes the issue of data protection and security which is unavoidable.

On e-mental health solutions, Torous et al. [11] represent leaders in mHealth research, industry and health care system have proposed a set of consensus principles (or standard) of evaluating e-mental health apps. "At a minimum, the standards should consider: a) data safety and privacy, b) effectiveness, c) user experience/adherence, d) data integration" [11]. These principles will be further reviewed for their challenges and recommendations in the full paper. On the other hand, [13] presented the Design Framework as in Figure 2. Morrison and his colleagues [13] explained the importance of the key elements [refer to Figure 2], and those numbers in bracket indicate the occurrence of sub-elements identified in their review study. This framework highlighted the importance of these elements in designing and offering eHealth solutions: i) Layout and instructional design, ii) Social context and support, iii) Contacts with the intervention, iv) Tailoring and lastly, v) Self-management. These elements will be reviewed and discussed further in this paper. [13] stressed that this framework is to facilitate a more user centric design aligned with HCI and design theories.

IV. DISCUSSION & CONCLUSION

It is imperative to safeguard the health and wellness of working adults with high skills. Their home setting and environment for promoting health and wellness are crucial. Apart from Covid-19 preventive measures, other measures on non-communicable diseases (such as obesity, high blood pressure, etc) prevention are equally important. eHealth models are reviewed briefly in this paper and will be reviewed further in the full paper. [8] urges the rethinking of how health and wellness services can be delivered to a larger population. It is also predicted by [8] that the current situation of the pandemic will lead to a significant shift in attitudes and behaviour towards eHealth, and resulting in a larger-scale adoption of eHealth in the long term. The actual research on the adoption of eHealth is going to be addressed by the research group in the near future.

ACKNOWLEDGEMENT

The authors would like to express appreciation for the grant support by "the Ministry of Higher Education's Fundamental Research Grant Scheme (FRGS) 2019-2020", Malaysia [Project Number MMUE190073].

REFERENCES

[1] A. Azuddin, "MCO and mental well-being : Home Sweet Home? Part 1 : Housing and crowding during the MCO." The Centre, 2020.

[2] P. Jandrić, "Postdigital Research in the Time of Covid-19," *Postdigital Sci. Educ.*, pp. 233–238, 2020.

[3] H. T. de Lara, "The future of work and Covid-19: Policies to promote more resilient and inclusive labor markets," in *APEC webinar on the impact of Covid-19 pandemic on future of work: Increasing APEC Community Resillience; Presentation #3 by Hector Tajonar de Lara from OECD*, 2020.

[4] S. A. Tumin, "How common is working from home ?," no. April, pp. 1–13, 2020.

[5] A. Nortajuddin, "Most overworked cities In ASEAN," *The ASEAN Post*, 16-Nov-2020.

[6] D. L. Stoewen, "Health and Wellness," *Can Vet J.*, vol. 56, no. 9, pp. 983–984, 2015.

[7] "Difference between health and wellness," *differencebetween.com*, 2011. [Online]. Available: https://www.differencebetween.com/difference-between-health-and-vs-wellness/. [Accessed: 27-Nov-2020].

[8] E. Whaibeh, H. Mahmoud, and H. Naal, "Telemental Health in the Context of a Pandemic: the COVID-19 Experience," *Curr. Treat. Options Psychiatry*, pp. 1–5, 2020.

[9] "FAQ MySejahtera App," 2020. [Online]. Available: https://mysejahtera.malaysia.gov.my/FAQ_en/. [Accessed: 27-Nov-2020].

[10] T. Shaw *et al.*, "What is eHealth (6)? Development of a Conceptual Model for eHealth : Qualitative Study with Key Informants Corresponding Author :," vol. 19, no. 6, pp. 1–12.

[11] J. Torous *et al.*, "Towards a consensus around standards for smartphone apps and digital mental health," *World Psychiatry*, vol. 18, no. 1. Blackwell Publishing Ltd, pp. 97–98, 01-Feb-2019.

[12] World Health Organization, "Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948," *http//www. who. int/governance/eb/who_constitution_en. pdf*, 1948.

[13] L. G. Morrison, L. Yardley, J. Powell, and S. Michie, "What design features are used in effective e-health interventions? A review using techniques from critical interpretive synthesis," *Telemed. e-Health*, vol. 18, no. 2, pp. 137–144, 2012.

RECOLOR IMAGES BASED ON COLOR HARMONIZATION FOR HUMAN VISUAL PERCEPTION

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Abstract **–** Visual arts that are aesthetically pleasing tend to attract people's attention easier and increase the interest of the person studying on it. One of the most intuitive factors that affects the aesthetic quality of visual arts is the color. The combination of colors that are harmony can increase the aesthetic value of graphics. In this paper, we present a method that will increase the color harmony of static visual arts (image or photograph) by changing their existing colors. This method looks for the harmonic scheme that can preserve the most colors of the original image, and moves the colors that are out of the hue areas of the selected scheme into the accepted range. It also provides the ability to shift the hue values of the selected harmonic scheme to get the final colors based on user preference. We have done some improvements based on the existing methods. The range of color coverage of the harmonic scheme is based on human visual perception. Besides, the difference between colors will be visually consistent when user shift the hue values of the harmonized image. This can retain the discriminability between colors of a recolored image when colors are shifted.

Keywords—color harmonization, human visual perception, aesthetic.

I. INTRODUCTION

Image recoloring has been a popular topic for decades in the visual arts and image editing research. The main purpose of recoloring is to increase the aesthetic values of the image, and one of the important steps is to prepare the target colors. Although those colors can be prepared manually by user from a continuous color space [1], it is difficult to preserve and increase the aesthetic value of the final output as this requires experience and art sense. Existing works has been done to retrieve dominant colors from a set of images to generate color palette [2] but this process requires sample collections and will be challenging without adequate related samples.

In this paper, we use an algorithmic approach to switch the colors that are considered not harmony in an image. This process can be done without require decision making from user or collection of reference data.

II. METHODOLOGY

The color harmonization approach that we used is based on different pattern and degree of sectors on a hue wheel, proposed by Matsuda [3]. This approach consists of eight types of templates (i, V, L, I, T, Y, X, N). The pattern can be rotated freely in an arbitrary angle to match the hue distribution. We found out that the hue circle used in existing researches [4, 5] is based on RGB color space. Due to that, the perceptual range of colors in the sectors will change in different rotations or even potentially lost in certain angle. In this paper, we will apply the color harmonization approach based on human visual perception.

We use the CIELAB color space to generate our hue circle because it is defined by the International Commission on Illumination (CIE) as a perceptually uniform color space [6]. First, we collect the data of all hues from an image and map the distribution of hues on the hue circle in radial histogram form. Then, we select the best color harmonic scheme based on these rules:

i. The greatest number of hues of the image is covered in the acceptable ranges of the selected scheme.
ii. If more than one schemes are chosen based on rule (i), we select the one that have the least unused hues in the acceptable ranges.

Next, we will move all the colors that are out from the acceptable ranges into the nearest harmonic regions, and recolor the image based on the change of hues on the hue circle. The hues that are covered in the harmonic regions will be remained to maintain the original colors of the image as much as possible.

Using the harmonized hue distribution circle, the hues of the entire image can be shifted by rotating along the hue circle. The color difference between pixels will not be affected if the hue circle is generated using a visual perception based color space. The harmonization value will also be preserved regardless of rotation angle because it is still adhering to one of the eight types of color harmonization scheme.

III. RESULTS/ FINDINGS

Fig. 2 and 3 show the color mapping of the sample image (Fig. 1) on RGB and CIELAB hue circle on all eight type of templates with rotation that consists of the most color covered in the shaded region. We realized that the

final chosen template will be different on the two color spaces. In the RGB hue circle (Fig 2.) used by Cohen-Or et al. [4] and Li et al [5], *X-type* will be the best color scheme. However, in the CIELAB hue circle (Fig. 3), *T-type*, *X-type*, and *Y-type* have the similar greatest amount of colors in the shaded region. In this case, based on rule (ii), *Y-type* is chosen because it has the least unfilled space in the shaded region.

Fig. 1 Sample image for harmonization.

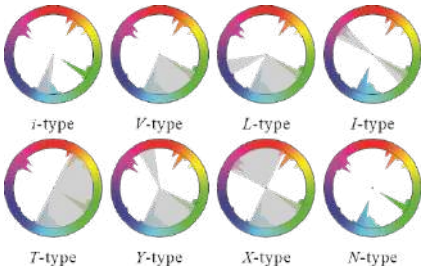

Fig. 2 Color mapping of image on eight color harmony schemes using RGB hue circle.

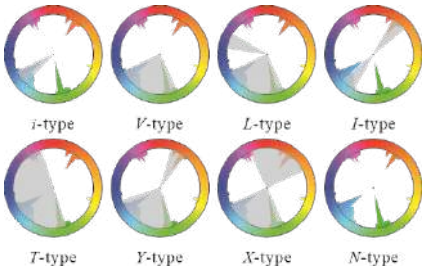

Fig. 3 Color mapping of image on eight color harmony schemes using CIELAB hue circle.

Fig. 4 shows the color harmonization result based on the selected schemes for both hue circles using hue shifting method on specific colors. The out of bound colors in the RGB *X-type* template are moved anti-clockwise into the shaded region, whereas the colors in CIELAB *Y-type* template move clockwise following the same rule.

Fig. 4 Color harmonization result based on RGB hue circle (left) and CIELAB hue circle (right)

Fig. 5 Histograms of shifted hue and the output results on RGB hue circle (left) and CIELAB hue circle (right)

We shifted the hues of the entire harmonized result by rotating the shaded area and all the mapped colors 90 degree anti-clockwise on the hue circles (Fig 5). As comparison, the perceptual hue difference in the sector of the blue to pink region in RGB hue circle drops compared to Figure 4, while the same sector in CIELAB performs better to preserve the difference in colors.

IV. CONCLUSION

We introduced the use of perceptually uniform color space for harmonization, which provides a more comfortable view for human vision. We also discovered that by using different color space, the best harmonization scheme may not be the same due to the difference in distance between same colors. Using the CIELAB hue circle, hue shifting tends to preserve the color discriminability better. This is important while applying harmonization on creative data visualization, where color is usually one of the key dimensions to represent different groups of data, or displaying the changes in continuous values.

Based on the current algorithm, harmonic schemes with larger shaded area usually have a higher potential to be chosen as the best template. In the future research, we plan to implement image processing technique to retrieve the dominant colors for hue mapping to reduce interference. We will also consider to add manual interactions to retain some of the colors such as human skin to prevent unusual and unreasonable harmonization outputs.

ACKNOWLEDGEMENT

The authors would like to express appreciation for the support of the Research Management Centre, MMU Graduate Research Assistant [MMUI/180023.02 AND MMUE/190041.02], and the Fundamental Research Grant Scheme [FRGS/1/2019/SSI07/MMU/02/1] in providing adequate resource and guidance to complete this research.

REFERENCES

[1] Levin, A., Lischinski, D., & Weiss, Y. (2004). Colorization using optimization. In ACM SIGGRAPH 2004 Papers (pp. 689-694).

[2] Zhang, Q., Xiao, C., Sun, H., & Tang, F. (2017). Palette-based image recoloring using color decomposition optimization. IEEE Transactions on Image Processing, 26(4), 1952-1964.

[3] Matsuda, Y. (1995). Color design. Asakura Shoten, 2(4), 10.

[4] Cohen-Or, D., Sorkine, O., Gal, R., Leyvand, T., & Xu, Y. Q. (2006). Color harmonization. In ACM SIGGRAPH 2006 Papers (pp. 624-630).

[5] Li, X., Zhao, H., Nie, G., & Huang, H. (2015). Image recoloring using geodesic distance based color harmonization. Computational Visual Media, 1(2), 143-155.

[6] Schanda, J. (2007). CIE colorimetry. Colorimetry: Understanding the CIE system, 25-78.

THE FUNDAMENTAL CONCEPTUAL OF TRANSTHEORETICAL MODEL FOR BEHAVIOUR CHANGE USING PIBKS#PBL@Sekolah DESIGN CANVAS

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***Abstract* - This project will look into the usage of PIBKS#PBL@Sekolah Design Canvas for the development of the fundamental Conceptual of Transtheoretical Model for Behaviour Change. This project has been one of the catalysts in co-shaping for social impact for experience creation in the fundamental approach of transtheoretical model. The PIBKS#PBL@Sekolah Design Canvas has been used as a tool to integrate various functional roles in co-shaping for social impact. Thus, it has been derived the knowledge readiness as the fundamental approach in designing the conceptual of Transtheoretical Model. The experience of getting ready in the co-shaping for social impact within the environmental of current schooling in Malaysia. Based on this project, it has empathetically designing the conceptual of transtheoretical model for behaviour change towards the co-shaping for social impact.**

Keywords— Transtheoretical Model, Behaviour Change, PIBKS#PBL@Sekolah Design Canvas

I. Introduction

This study has been using the transtheoretical model which has been started and developed by James O. Prochaska of the University of Rhode Island, and Carlo Di Clemente and colleagues since with the various set of theories and analysis of psychotherapy since 1977.[1],[5]. As we know that the changes are "process involving progress through a series of stages" which is the transtheoretical model has been evolved. [2][3]

The basic elements are the series of stages as has been described below: [1],[2],[3]

Precontemplation ("not ready") – "People are not intending to take action in the foreseeable future, and can be unaware that their behaviour is problematic"

Contemplation ("getting ready") – "People are beginning to recognize that their behaviour is problematic, and start to look at the pros and cons of their continued actions"

Preparation ("ready") – "People are intending to take action in the immediate future, and may begin taking small steps toward behaviour change"

Action – "People have made specific overt modifications in modifying their problem behaviour or in acquiring new healthy behaviours"

Maintenance – "People have been able to sustain action for at least six months and are working to prevent relapse"

Termination – "Individuals have zero temptation and they are sure they will not return to their old unhealthy habit as a way of coping"

II. methodology

The methodology for this study used in this study is deductive method based on the experience in running the PIBKS#PBL@Sekolah design canvas. Using the deductive method for teachers in explaining the project to be executed in the school environment based on the PIBKS#PBL@Sekolan design canvas.

III. results/ Findings

The fundamental conceptual of transtheoretical model for behaviour change using the PIBKS#PBL@Sekolah Design Canvas has shown the significant impact on project that has been showcase through the co-sharing idea between students and the community involved. Based on the six basic stages has been the basic fundamental for the need to further the study on behaviour change [4], [5] in the school environment.

Therefore, at the beginning stage, we provide the PIBKS#PBL@Sekolah Design Canvas as shown in Figure 1 to formalise the teachers and administrative roles (school level), parents, industry partners and communities' roles for students' activities.

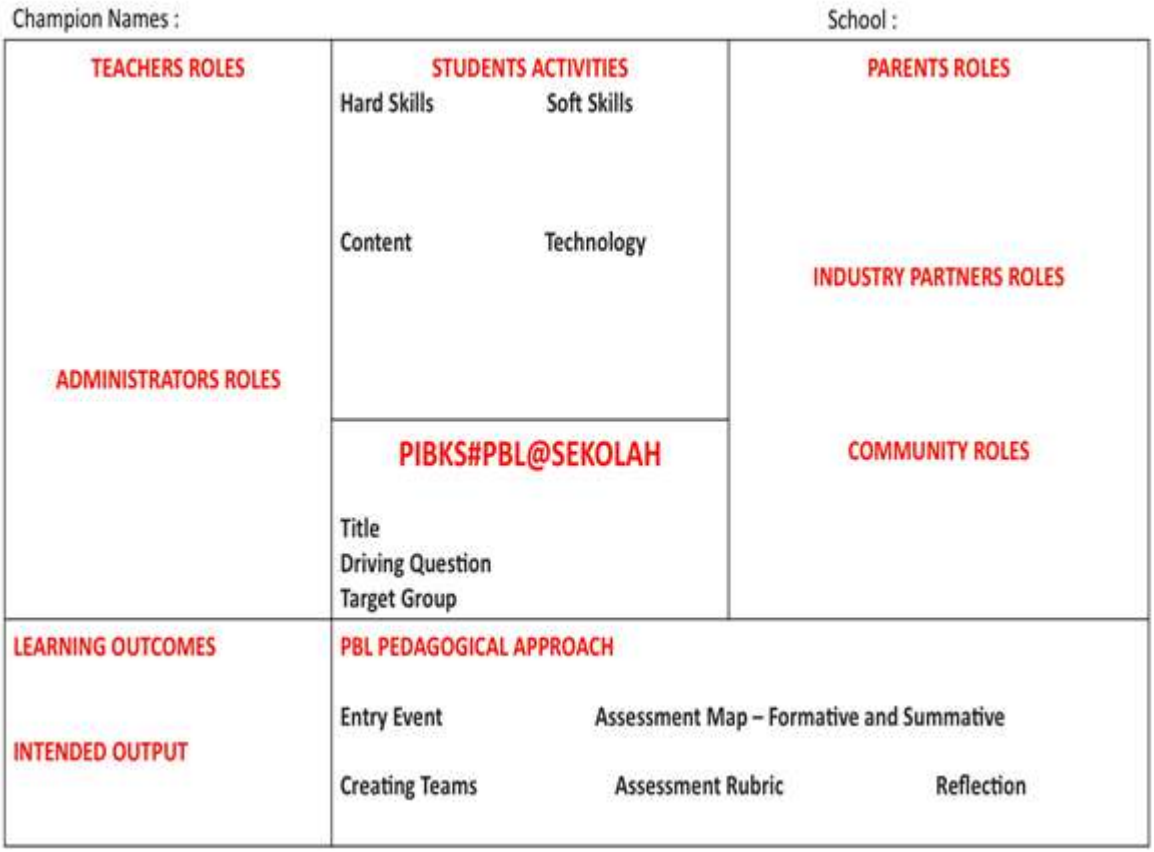

Figure 1: PIBKS#PBL@Sekolah Design Canvas

IV. CONCLUSION

A framework of transtheoretical model has been derived based on the activities that have been delivered by the students from various field of study. This has been a great combination in co-shaping the formal teaching and learning into the project based that required the holistic approach of 21st Century Skills ("*Kemahiran Abad Ke 21"*) toward the 6Cs (Critical Thinking, Creativity, Communication, Collaboration, Connectivity, and Citizenship).

ACKNOWLEDGEMENT

We would like to thank all the parliament under Pejabat Pendidikan Daerah Bangsar Pudu that have been supporting with the various of the activities for year 2019. Special thanks to Puan Maznah, Pengarah, JPWPKL and Encik Rozaidi Ismail SK Seri Saujana and also all schools and communities and industry partners involved in this project. All the project has been recorded in the ebook and can be downloaded at https://www.mmu.edu.my/edc/pibkspblsekolah2019/

REFERENCES

[1] J. O. Prochaska, and W.F. Velicer, "The transtheoretical model of health behavior change". American Journal of Health Promotion. 12 (1): pp 38–48. 1997.

[2] J.O. Prochaska, and C.C. DiClemente, "The transtheoretical approach". In Norcross, John C.; Goldfried, Marvin R. (eds.). Handbook of psychotherapy integration. Oxford series in clinical psychology (2nd ed.). Oxford; New York: Oxford University Press. pp. 147–171. 2005.

[3] C.C. DiClemente, " Addiction and change: how addictions develop and addicted people recover." New York: Guilford Press. 2003

[4] J. M. Prochaska, J. O. Prochaska, and D. A. Levesque, Deborah A. (2001). "A transtheoretical approach to changing organizations". Administration and Policy in Mental Health. 28 (4): pp 247–261 2001

[5] J. O. Prochaska,and J.C. Norcross, "Systems of psychotherapy: a transtheoretical analysis." 9th ed. New York: Oxford University Press, 2018.

THE PORTRAYAL OF CLAUSTROPHOBIC BEHAVIOURS AND EVENTS IN FILM

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Abstract - **The global pandemic has brought a drastic change in lifestyle for many people at all levels. Not many adapt as well as others do. Some of them suffer from mental stress during the lockdown at home. Dealing with mental stress and emotional disturbed situation in a quarantined space is not easy. To effectively relay the extreme message regarding the quarantine situations and environments to the readers, this article aims to depict / portray the claustrophobia through films by studying the events and behaviours during those moments. Films are perfect for portraying claustrophobia situations. This article provides critical review and analysis on how successfully films have relayed this message to their audience with visuals along with relatable stories and characters. Studying films portrayal of claustrophobia will help upcoming film makers to have further information to relay their message effectively to their audience.**

Keywords— claustrophobia, behaviour, quarantine, film review, pandemic

I. Introduction

Claustrophobia is a situational phobia which is defined as an irrational fear or abnormal dread of being in confined places [1]. It is classified as one of the common phobias and is typically developed due to childhood traumas. In the Healthline article, it also states that claustrophobia can be triggered by such common conditions like being stuck in a crowded elevator or even driving on a congested highway [1]. A claustrophobic person may be able to avoid these conditions before, however, due to the global pandemic with governments all around the world implementing lock down as a step to overcome the outbreak, individuals suffering this phobia have no other options than being locked down in their homes for months.

To kill their boredom, films are in great use for entertainment purposes, especially during this pandemic season where people are forced to stay at home for their own safety. Films are also used as a diversion where it gives people comfort and to escape reality, forgetting about their day to day worries. Good films are an effective and useful platform to teach the young and allow the old to relive their experiences through the screen. Film records the reality but sees it differently from an ordinary human's perspective [2]. Therefore, filmmakers go to great lengths researching on current issues and effective ways to deliver beautiful stories for the audience to relate and learn from. It can be agreed that films are the perfect tool to reach out to the claustrophobic community and make them understand that they are not alone.

This research focuses on how films portray claustrophobic behaviours in their story effectively so it can be used to reach out to the claustrophobic community during this time and season. This research helps to raise awareness regarding claustrophobia as well as be a useful guide to amateur filmmakers who want to speak this message in their story.

II. methodology

This research is heavily based on secondary research, content analysis to be more specific, where a researcher would look at media, films or digital content for data. For this research, the content to be analysed are the existing scenes and events from films depicting claustrophobia. These scenes and events are then dissected and broken down to obtain qualitative data. Through this secondary research, a data analysis was performed on how the scene portrayed claustrophobia effectively to the audience. Films offer both cognitive and affective experiences where they can provoke good discussion, assessment of one's values and assessment of self if the scenes have strong emotional content [4]. Four films on claustrophobia were chosen as a medium to find data which simply meant more movie nights. The chosen films were released in the year ranging from 2005-2019. It is also made sure that these films are nominated or won international film awards to justify the choices. This justification increases the credibility of these films to be used as a guide and for analysis purposes. In these films, a scene is chosen from each film and analysed based on the claustrophobic behaviours and symptoms as well as the composition.

III. RESULTS/ FINDINGS

Table 1 is a cross tabulation table based on all the analysis done above. The framework of Claustrophobia Symptoms will be detailed in the full paper. By watching the film and understanding the scene further through technicalities, it gives a clearer vision on how to design a claustrophobic shot through the character's actions as well as shots.

TABLE 1. CROSS TABULATION ANALYSIS OF FILMS BASED ON THE SYMPTOMS OF CLAUSTROPHOBIA

Symptoms of Claustrophobia	Films			
	Buried (2010)	127 Hours (2010)	The Descent (2005)	Escape room (2019)
Sweating	✓		✓	✓
Trembling	✓	✓	✓	✓
Hot Flashes				✓
Feeling intense fear or panic	✓	✓	✓	✓
Becoming anxious	✓	✓	✓	✓
Shortness of breath	✓	✓	✓	✓
hyperventilation			✓	✓
Rapid heartbeat			✓	✓
Chest tightness or pain		✓	✓	✓
Nausea	✓			
Feeling faint or lightheaded	✓		✓	
Feeling confused or disoriented	✓			✓
Composition Techniques				
Rule of Third	✓	✓	✓	✓
Light and Dark	✓	✓	✓	✓
Angles and Perspective	✓	✓	✓	✓

By deducing the above table, it is not a must to include all the symptoms of claustrophobia in order to convey a claustrophobic event. Directors tend to include the symptoms and behaviours that are necessary and logical to the situation. For instance, 127 Hours (2010) ticked less than half of the stated symptoms for it is a mild event of claustrophobia, whereas Escape Room (2019) had almost all the symptoms. By including all the symptoms, it dramatizes and adds more intensity to the situation whereas 127 Hours (2010) had more natural feel.

All four of the movies have been consistent with the symptoms such as trembling, feeling intense fear or panic, becoming anxious and shortness of breath. This gives an outline of core symptoms that needs to be included when designing a claustrophobic event or shot. Other symptoms seem to be very dependent on the story, environment as well as the character's personality. This is because experiencing claustrophobia in a Grand Canyon is different from being buried underground or being stuck in a cave system. Having a strong personality also affects the amount of symptoms, this is proved by the characters in Buried as well as 127 Hours where they remained calm and rational compared to the characters in the other 2 movies.

The above table also gives information on the composition techniques where all the four films shared similarities in creating their scenes. Although they shared similarities, they definitely convey a unique message that is conclusive to the story. There were also different angles and perspectives which gives the audience more

information on what the director wants to relay. Film has an exceptional ability of directing the audience's attention by using lens techniques, camera movements, camera angles, framing shots and film editing that can create a gripping image which is not found in reality [3]. For instance, a low angle in Buried (2010) gives the message of the character looking up in hope to survive whereas a high angle of character looking up in 127 Hours (2010) relays the message of helplessness. Seeing all 4 directors use these composition techniques, it encourages young and amateur filmmakers to include these elements to create an impactful claustrophobic shot or scene.

IV. CONCLUSION

In a nutshell, claustrophobia is a wide field and there is not a checkbox to tick in order to portray a claustrophobic story. However, it is very essential to get as much as information and knowledge regarding claustrophobic before working on this topic. Through this paper, a framework has been developed to help young film and content creators to follow so they do not fall off grid. This paper will educate content creators on how a basic camera work technique helps to deliver an impactful message as well as understand more on the symptoms of claustrophobia and how to use them in their scene in consideration of the environment and character.

As mentioned above, claustrophobia is a wide field, this research paper has only gathered data on developing a basic guideline. This means there are various interesting and creative ways to portray claustrophobia in films. By breaking rules and experimenting, introduces a fresh new perspective in which interesting results can be achieved. Looking at creative ways of portraying claustrophobia will be a mission for the future work.

ACKNOWLEDGEMENT

We are extremely grateful for MMU RICES 2020 for giving us the golden opportunity to showcase our research to the borderless audience despite the current lockdown situation due to pandemic. This is also to acknowledge partially for the contribution of the Ministry of Higher Education's Fundamental Research Grant Scheme (FRGS) 2019-2021 (FRGS/1/2019/SS09/MMU/02/3) in supporting this study by giving some deep thoughts and analyses on the symptoms of claustrophobia through film studies.

REFERENCES

[1] A. Scaccia (2016, November 29). Everything you should know about claustrophobia. *Healthline.* Retrieved from https://www.healthline.com/health/claustrophobia

[2] R. Arnheim, "Film as Art: 50th Anniversary Printing *"*. Univ of California Press, 1957.

[3] N. Carroll, "The power of movies," *Daedalus*, pp. 79–103, 1985.

[4] J. E. Champoux, "Film as a teaching resource," *J. Manag. Inq.*, vol. 8, no. 2, pp. 206–217, 1999.

THIS SCULPTURE DOES NOT EXIST, ANYMORE: A CASE OF VIRTUAL RECONSTRUCTION OF 'PUNCAK PURNAMA'

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Abstract - This paper reports the results of a study of the usage of locative media technologies and augmented reality in cultural practices. The purpose of this study is to establish a development workflow for reinterpreting lost cultural narratives with the aid of locative media technologies specifically Augmented Reality and GPS. The investigation would be carried out in the form of a locative media application development with the aid of a selected cultural artifact as a case study. A demolished public sculpture, Puncak Purnama (Lunar Peaks) created by the late National Art Laureate Datuk Syed Ahmad Jamal in 1986 was selected as the case study of this research. The selected 30 years old artifact was demolished by City Hall in 2016 and it underwent a process of digital reconstruction to generate a digital representation of the original artifact. The digital artefact was then digitally deployed on site with the aid of GPS technologies hence a site-specific digital sculpture. Augmented Reality technologies was integrated into the application to allow users to experience the digital artifact on location. We propose that locative media technologies could serve as an alternative to reinterpret and experience lost cultural artifacts that are no longer present and retrievable.

Keywords—locative media, augmented reality, cultural reinterpretation, 3D reconstruction

I. CASE STUDY

Lunar Peaks was a public sculpture commissioned by the United Malayan Banking Corporation (UMBC) in 1986 as a participatory response to the City Hall's initiative to embellish the city of Kuala Lumpur. (Tan, 1986). The 10 meters tall sculpture was presented as a gift to the city of Kuala Lumpur alongside with the inauguration of the UMBC gardens situated behind the its headquarters. During a quiet afternoon on 1st July 2016, excavators were parked at the UMBC garden with intent of demolishing Lunar Peaks as part of a landscape rejuvenation initiative by the City Hall, DBKL. Sadly, before any action could be taken, the surreptitious demolished has already begun. The demolition lasted for a dreadful three days and Lunar Peaks was reduced to rubble. The incident sprouted criticisms from the various art professionals, cultural institutions, academics, art enthusiast and attracted attention from the news, social media platforms as well as the general public. In the words of Datuk Mahadzir Lokman, Former Chairman of National Visual Arts Gallery expressed in an interview with Astro Awani: "The abrupt destruction of Lunar Peaks is a great loss to the nation's cultural heritage. It came as a complete shock for the art community – to see a bulldozer already demolishing the sculpture on July 1st. It is a regrettable move considering the iconic status of the sculpture."

Fig. 1. Demolition of Lunar Peaks (source: https://www.thestar.com.my)

II. METHODOLOGY

In its attempt to expand the work from other academicians, this research has adopted several reconstruction workflows, methods and principles from other researches as a reference for the proposed workflow. The reference methodologies are mainly adopted from experts specializing in the field of 3D Digital Reconstruction of Cultural Heritage. By adhering to the methodological guidelines proposed by Pfarr-Harfst (2016) and adapting to the models by Hauck O., Kuroczyński P. (2014) and Apollonio (2016), the reconstruction methodology for this research is formulated. The following diagram describes the reconstruction methodology for this research.

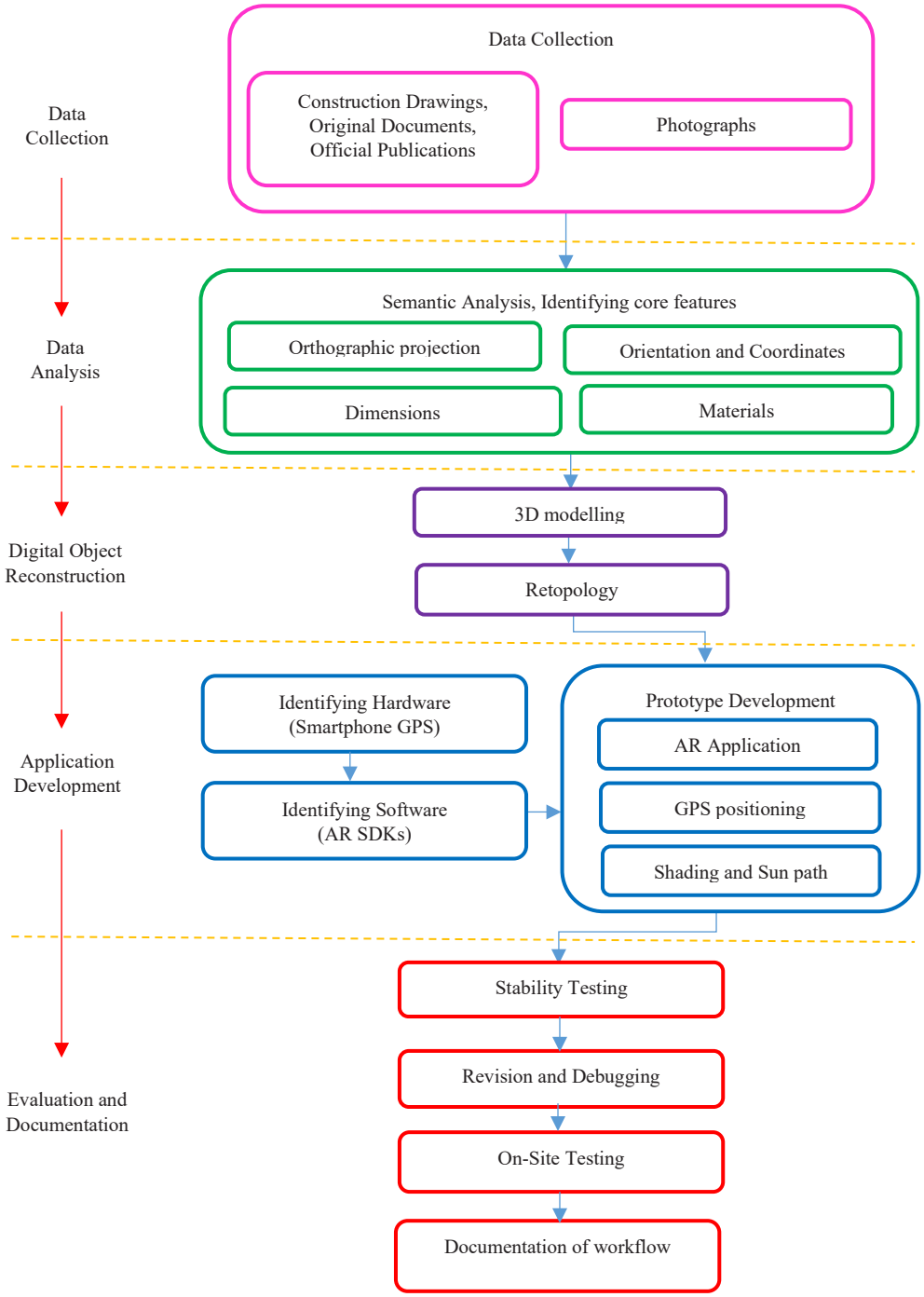

Fig. 2. Reconstruction methodology flowchart

III. DATA COLLECTION

In order to digitally reconstruct the artifact, reliable data and information related to the physical features and specifications of case study were sourced and collected. Since the original artifact has been demolished and no longer accessible during the period of this study, this study is unable to directly access the current physical state of the artifact and hence unable to capture direct physical data by means such as 3D scanning, photogrammetry, or by measuring and plotting. As an alternative, most of the data collected are from secondary sources, comprising original construction drawings, plans, official documents as well as publications, S. Münster et al (2016). The data collected is qualitative in nature which predominantly consist of visual information required for the digital reconstruction process. News articles, photographs and interviews were also sourced to provide additional context to the case study.

IV. CONSTRUCTION DRAWINGS AND DOCUMENTS

Most of the data collected that were more reliable, consisting of official drawings and documents were obtained from 2 main sources. The first source is from the son of Datuk Syed Ahmad Jamal himself, Syed Nabil Ahmad Jamal. The second source was a referral from Nabil himself, which was DRTANLIM architects (DTLM). In 2016, Nabil had worked with DTLM and Pertubuhan Akitek Malaysia (PAM), to organize an exhibition as a tribute to Lunar Peaks as part of the initiation for the new PAM Centre in Bangsar. A meeting was scheduled with the associates of DTLM to gain more information regarding the exhibition and the artifact itself. The data, materials, publications and archives from the exhibition were also collected for the purpose of this study. Other forms of supplementary data which were also scavenged from the web, news articles and social media sites.

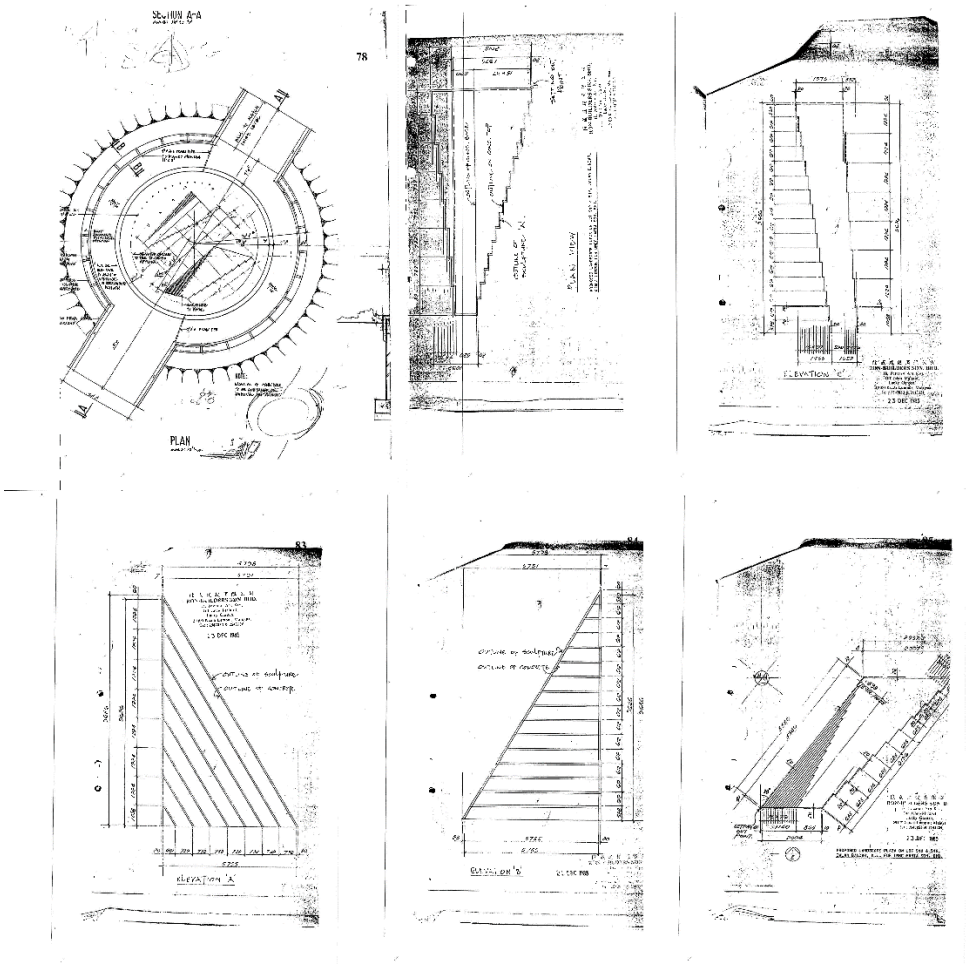

Fig. 3. Compiled construction drawings of Lunar Peaks (Puncak Purnama)

V. SITE SURVEY

A site survey was conducted to function as a preliminary study regarding the current condition of the site. Since the incident, the site itself had undergone several revitalizing attempts which were mostly underwhelming. In 2017, flowers were planted on the site where Lunar Peaks once stood. (Muhammad, 2017). Currently, up to the point where this research was carried out, the site in being renovated under a new rejuvenation scheme called the River of Life project, initiated by the Malaysian government as part of the Economic Transformation Projects. Using a digital compass, the approximate location and orientation of the sculpture was measured and recorded. Photographs of the site were also taken to serve as reference and data to aid the reconstruction process.

Fig.4. On left, photograph of site under renovation,
On right, digital compass to measure the location and orientation

VI. SEMANTIC ANALYSIS

The primary focus of the analysis was to filter and identify the core information and physical features needed for the reconstruction process from the data collected. Information from official construction drawings would be given priority in terms of validity compared to other sources of data. By Adopting the reconstruction workflow of Apollonio (2016) a semantic structure of the artifact was constructed for correlating the relationship between the artifact and the documentation source. During this stage, the physical features of the sculpture were studied and extrapolated, its geometry, dimensions, number of elements, materials, position on site, orientation and projections from the various angles. Relevant information regarding the surrounding of the site were also considered during the evaluation. The data from the site survey was used to calculate a Sun path to analyse the shadows casted at different times of the day.

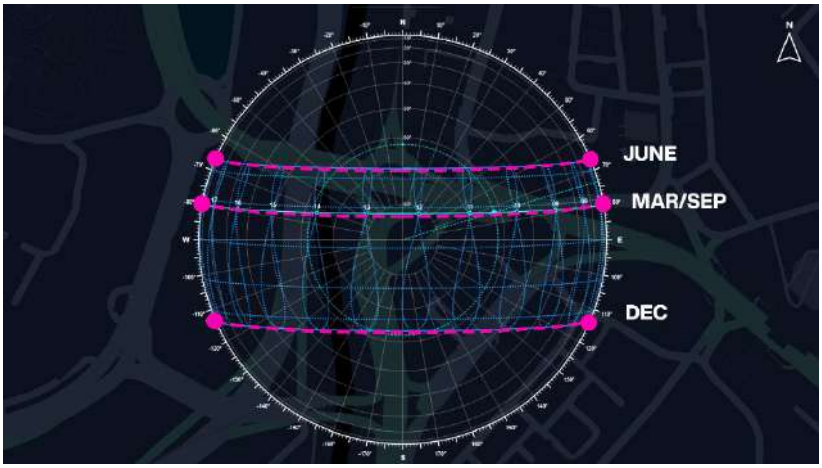

Fig. 5. Sun path diagram of site

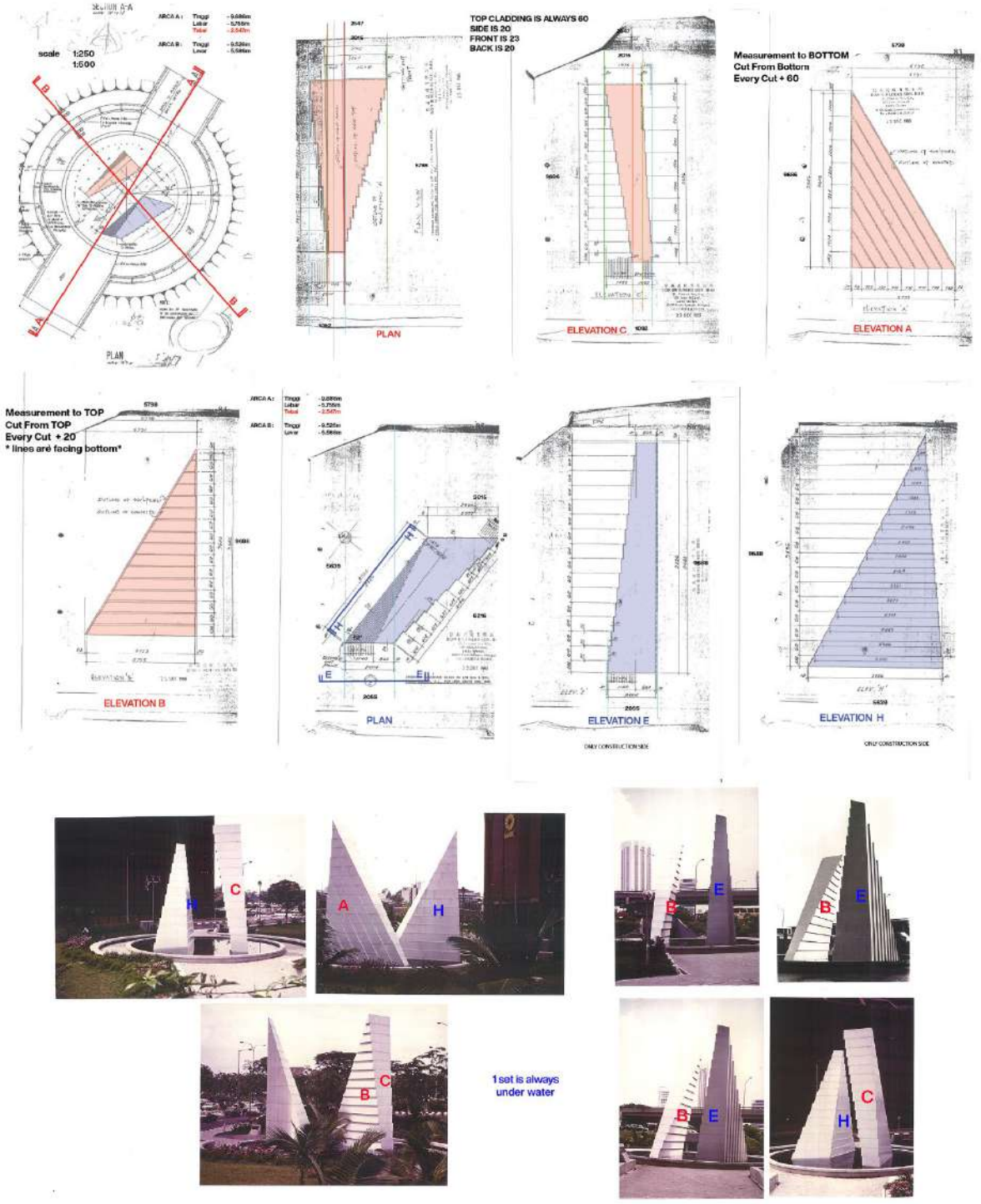

Fig. 6. Semantic analysis of construction drawings and photographs, correlating its elevations

VII. 3D RECONSTRUCTION

Once the comprehensive data is compiled and the core features of the artifact are identified, the artifact was then reconstructed digitally with the aid of a 3D CAD modelling software—Fusion360. A CAD modelling software is selected as the primary modelling tool over a traditional polygon modelling software due to the accuracy of dimensions and abundance of tools and Boolean operations suitable for hard surface modelling. As soon as the digital model was completed in CAD, the asset underwent a process of retopology. The digital asset will be imported to a standalone 3D application—Cinema4d to convert the high-resolution CAD model to a lower resolution development ready asset. This process reduces the number of triangles needed to be calculated during the development of the application and hence conserving more computational resources. The digital model was also textured according to the materials of the original sculpture.

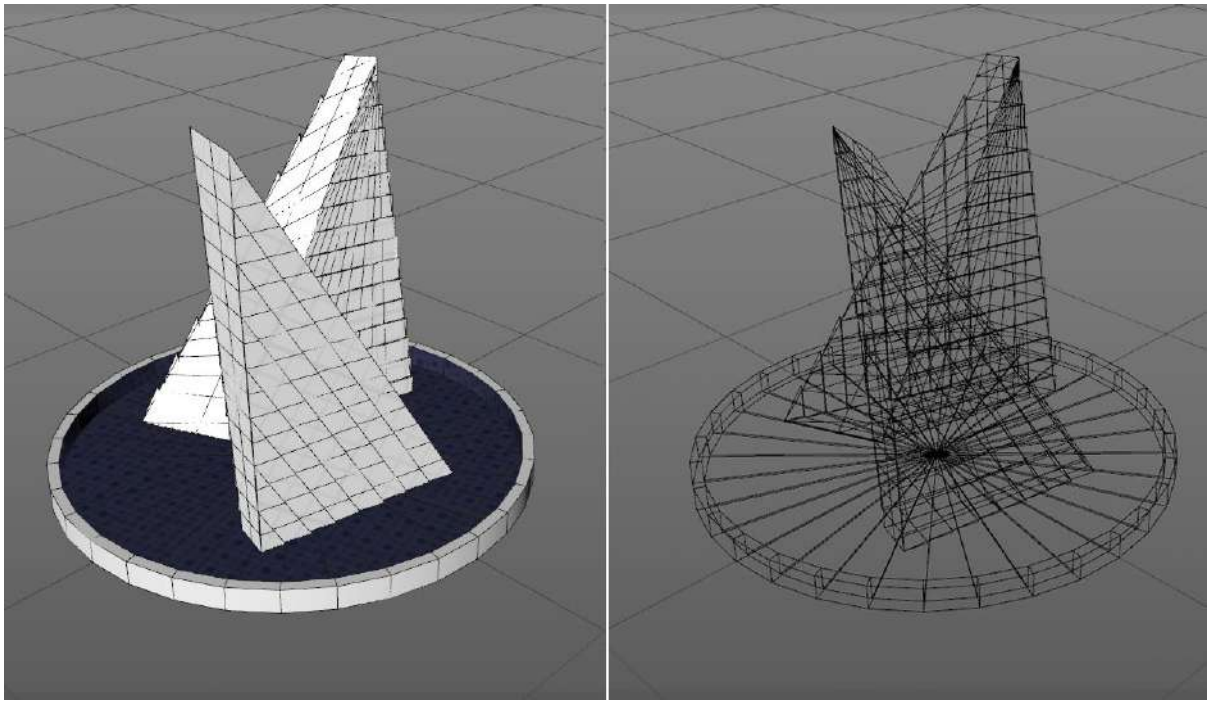

Fig. 7. Reconstruction of digital artifact in Cinema4D

VIII. APPLICATION DEVELOPMENT

Following the completion of the reconstruction process, the completed digital artifact was imported into an application development platform to begin with the application development. The appropriate hardware required and software development packages will be selected prior to the development. The development tool of choice is Unity3D, a cross platform game engine due to its abundance of support packages, documentation, flexibility and ease of use. The targeted development platform is for Android. The main objective is to develop a prototype mobile application to experience the digital asset on site with the aid of Augmented Reality technologies and Global Positioning System (GPS).

IX. EVALUATION AND DOCUMENTATION

The prototype application underwent several usability tests to ensure the stability of the application. Revisions and enhancements were implemented in response to the test results. Once the application is stable, the application was brought to the actual site to conduct an on-site flight test. The site-specific flight test was conducted with a Huawei P30 mobile device running Android OS 10. The GPS accuracy and stability were also measured and recorded using the GPSTest application. Due to the availability of dual-band frequency GPS of the Huawei P30 device, we managed to achieve a GPS accuracy of close to 1 meter.

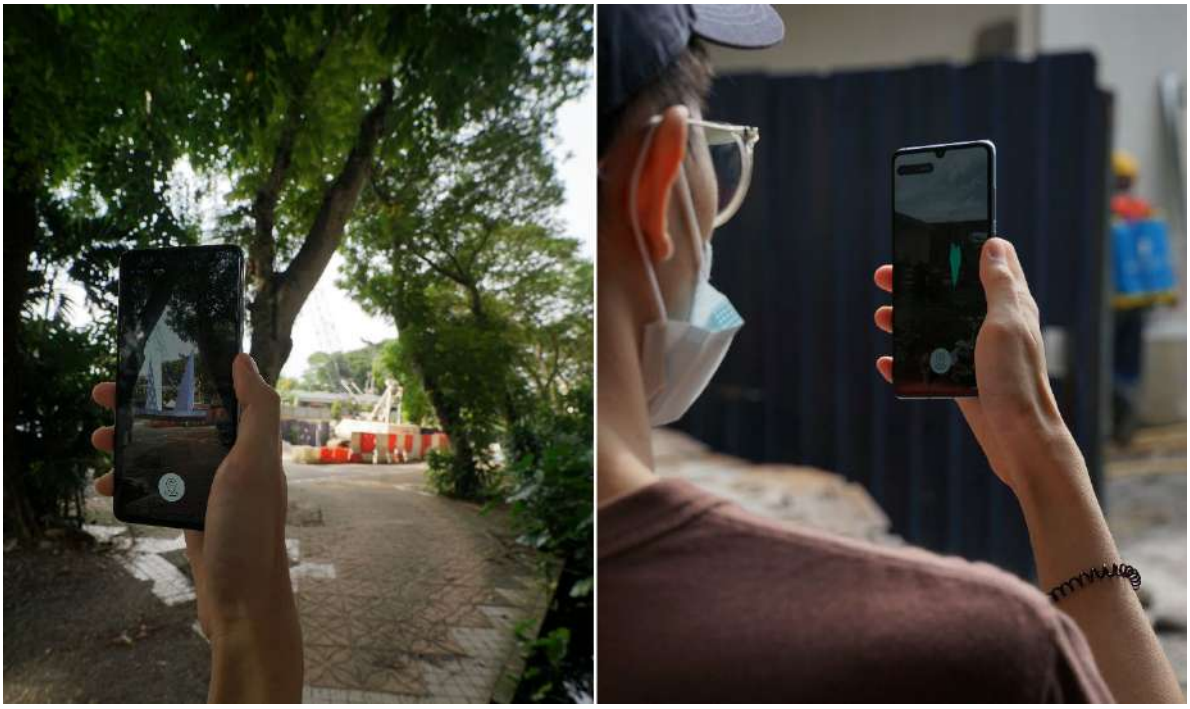

Fig. 8. On site testing of locative media application prototype

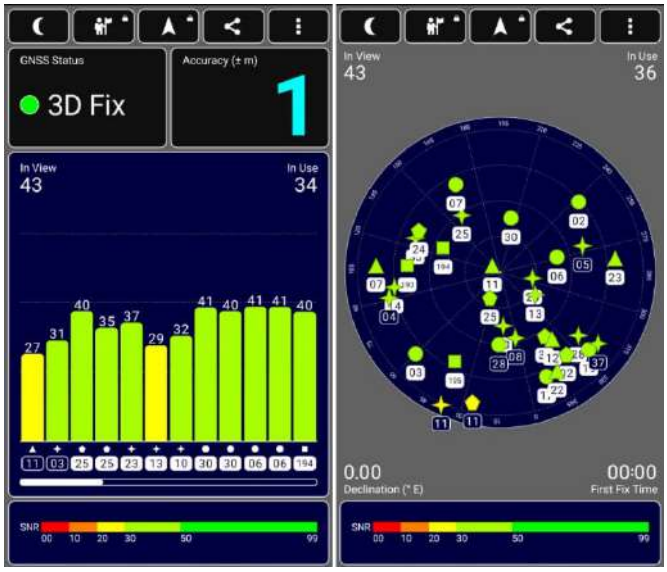

Fig. 9. Screenshot of GPSTest application accuracy test results

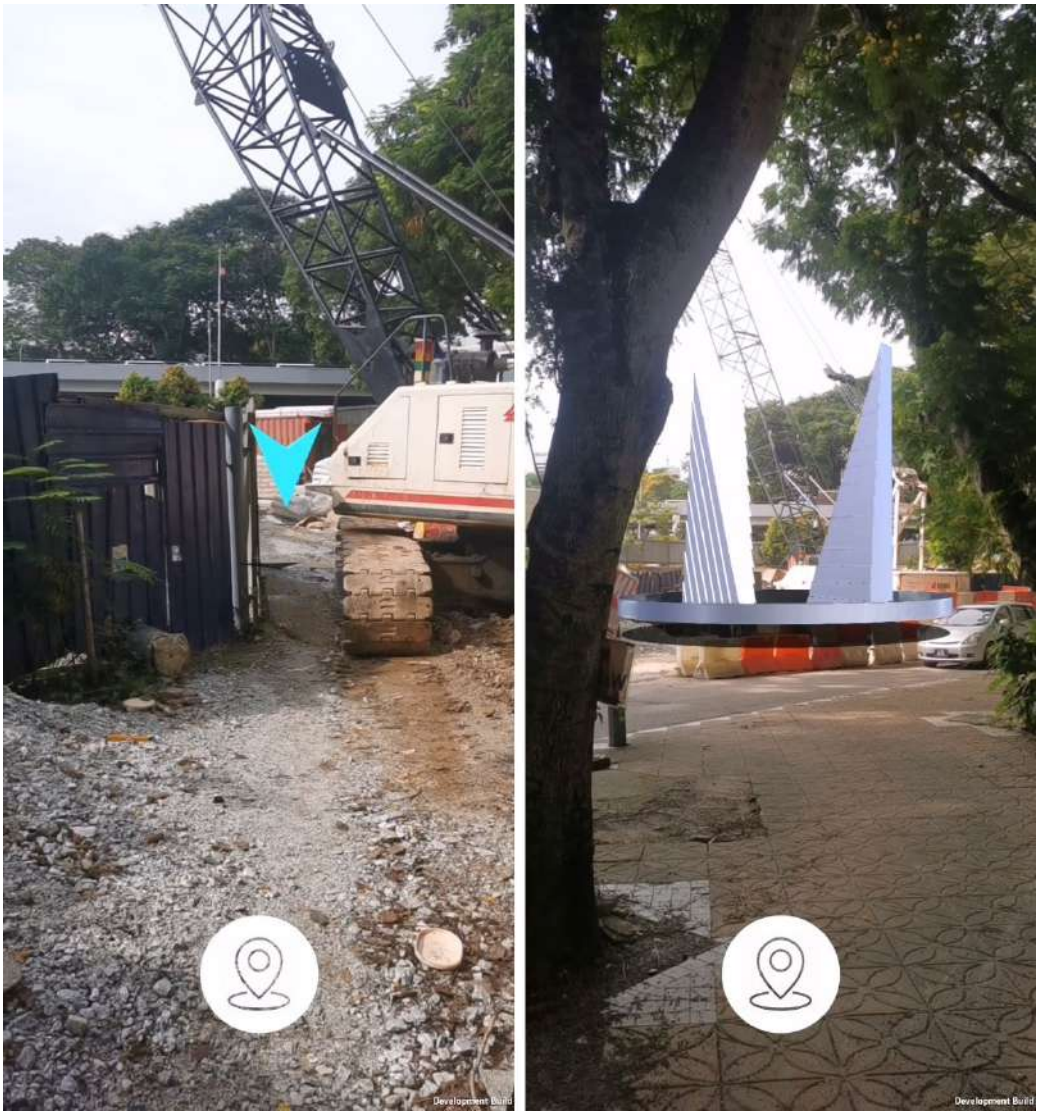

Fig. 10. In app screenshots of application prototype showcasing digital site-specific sculpture

X. CONCLUSION

This study has demonstrated the potential of locative media and Augmented Reality technologies to alleviate our sense of loss towards our cultural identity by providing and alternative reinterpretation. By remediating lost cultural artifacts through the use of locative media and Augmented Reality, the artifact can be reexperienced once again on site, providing a richer sense of spatial presence and embodiment compared to reexperiencing it through a museum or gallery archive. However, this study is limited by the current developments in Augmented Reality and spatial tracking technologies for mobile devices. With the integration of more advanced sensors and spatial tracking algorithms in mobile devices in the future, the tracking and presentation of Augmented Reality with be more accurate and realistic and in turn enhance the overall user experience.

ACKNOWLEDGEMENT

The authors would like to express their appreciation to Syed Nabil Ahmad Jamal and DRTANLIM architects (DTLM) for their generous support and assistance throughout the process of this study. The authors would also like to thank Tai Hui Koon from Balai Seni Visual Negara, Media Arts Living Laboratory (MALL) as well as the Faculty of Creative Multimedia, Multimedia University.

REFERENCES

[1] Apollonio, F. I. (2016). Classification Schemes for Visualization of Uncertainty in Digital Hypothetical Reconstruction. In 3D Research Challenges in Cultural Heritage II (pp. 173-197). Springer, Cham.

[2] Hauck, O., & Kuroczyński, P. (2016). Cultural Heritage Markup Language.

[3] Muhammad. (2017, February 8). *Flowers planted where Puncak Purnama once stood*. Malaysia Kini. https://www.malaysiakini.com/news/371747

[4] Münster, S. (2013). Workflows and the Role of Images for a Virtual 3D Reconstruction of No Longer Extant Historic Objects. ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 5, W1.

[5] Pfarr-Harfst, M. (2016). Typical Workflows, Documentation Approaches and Principles of 3D Digital Reconstruction of Cultural Heritage. In 3D Research Challenges in Cultural Heritage II (pp. 32-46). Springer, Cham.

[6] Tan. (1966, November 21). Bank's Effort to beautify the city. The Star.

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Enhance Mental Health of Millennials through Social Support System: Post Covid-19 Era

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Abstract: The world is likely to face a global crisis in poor mental health due to the coronavirus pandemic. There is an urgent need to tackle the harmful impacts of the COVID-19 pandemic on mental health. Young people seek emotional support and information online however research evidence for their effectiveness in reducing mental health symptoms is currently lacking. The scale of this problem is too serious to ignore, both in terms of every human life that may be affected, and in terms of the wider impact on society. The purpose of the study is to investigate the role of social support system on mental health of millennial in Malaysia. Data were collected using a close-ended questionnaire and a sample of 83 were used for the study. The proposed model was constructed based on the social support theory. The outcome of the research is to recommend Government policy implications on social support system that can be adopted nationwide successfully.

Keywords: *mental health, social support system, Millennials, Malaysia*

I. INTRODUCTION

The COVID-19 pandemic shut down industries, slowed down the economy, and created a sense of loneliness as the world started to remain inside. With anxiety and depression on the rise during the COVID-19 pandemic, many are turning to social media to voice their fears, seek support from health care providers and share experiences and give hope. "Having a strong social network is linked to positive mental health and well-being," said a recent report by the Harvard T.H. Chan School of Public Health (Breede, 2020). Sharing is a way to break down stigmas and feel a connection with others. The post will benefit not only the author but also others in the observation group to reach out. Hence, social media helps to remind that nobody is alone especially when in quarantine or isolation. Past research also revealed that social networks allow individuals to draw on resources such as information and social support from other network members (Viswanath, 2008). This, in turn, is linked to a variety of positive social outcomes such as trust and reciprocity that engender better health (Nieminen et al., 2013). A study by Kim and Kim (2017) also indicated that the use of social media is positively linked to the heterogeneity of the communication network of college students, which in turn, is positively related to social capital and subjective well-being. Although the link between social media use and health has become a growing public health concern, empirical evidence remains inconclusive (Andreassen, 2015). Some studies find no support for the widely held assumption that the use of social media reduces real-life social interactions and reduces mental health and well-being (Berryman et al., 2018).

II. METHODOLOGY

The sample was selected using convenient sampling and quantitative approaches. This research used cross-sectional study and Millennials were invited to participate in an online survey. 83 out of a total of 150 responses were used for this study. First of all, social media exposure was measured by asking how often respondents checked their social media news and information about Covid-19 over the past week. Secondly, respondents were asked whether they contacted random people through social media in order to release their tension during Covid-19. Thirdly, respondents were asked with whom they were most comfortable sharing their feelings during this time. Fourthly, they were asked to identify whether impact of social media led to reduced anxiety, reduced depression and enhancement of mental well-being. Finally, they were asked to express their opinion on whether they were willing to follow and participate in the social media page that provided counselling by Professional consultants.

III. RESULTS/FINDING

Findings showed that almost all millennials used the social media to check the latest information about Covid-19. Out of 83 respondents, only 22 respondents contacted random people through social media in order to release their tension during the Covid-19. Most of the millennials in Malaysia were more comfortable sharing their feeling with their close friends rather than with strangers. 78% of respondents felt that being on social media reduced their anxiety, depression and enhanced mental well-being. Finally, most respondents were willing to follow and participate in social media pages where they could get professional advice and help. The most surprising finding was that millennials were willing to pay in order to get professional online advice and help.

IV. CONCLUSION

The COVID19 pandemic and consequent economic downturn has contributed to fears, anxiety and depression in many people putting them in a survival mode. This is expected to have an adverse effect on people's mental health. However, little is actually understood about how people's mental health and well-being have been affected. This information is crucial to equip mental health providers to correctly help individuals in need. Findings from this study show that millennials in Malaysia are more willing to trust and share their feeling with someone they know rather than strangers. Most of them are ready to engage and interact with professional counsellors to ease their mental stress. The findings in this study complements past findings which suggested that offering online therapy, in addition to face-to-face services, may be a successful way for many universities counselling centres to expand the use of their services and thereby better serve their community (Wong et al., 2018). Hence this study recommends counselling service providers to build a community online counselling portal and provide professional help to the millennials in Malaysia. In addition, this study

also recommends that the Malaysia government expand its counselling service through the social media to enable universal mental health coverage which would be beneficial when the world is struggling with current health emergencies.

REFERENCES

[1] Andreassen, C. S. (2015). Online social network site addiction: A comprehensive review. Current Addiction Reports, 2, 175-184. doi:10.1007/s40429-015-0056-9

[2] Berryman, C., Ferguson, C. J., Negy, C. (2018). Social media use and mental health among young adults. Psychiatric Quarterly, 89, 307-314.

[3] Breeden, E. (2020). Social media helps some cope with 2020. Retrieved from https://www.charlotteobserver.com/charlottefive/c5-wellness/article246424440.html

[4] Kim, B., & Kim, Y. (2017). College students' social media use and communication network heterogeneity: Implications for social capital and subjective well-being. Computers in Human Behavior, 73, 620-628.

[5] Wong, K.P., Bonn, G., Tam, C.L and Wong, C.P. (2018). Preferences for Online and/or Face-to-Face Counselling among University Students in Malaysia. Frontiers in Psychology. Retrieved from https://www.frontiersin.org/articles/10.3389/fpsyg.2018.00064/full

[6] Nieminen, T., Prättälä, R., Martelin, T., Härkänen, T., Hyyppä, M. T., Alanen, E., Koskinen, S. (2013). Social capital, health behaviours and health: A population-based associational study. BMC Public Health, 13, 613.

[7] Viswanath, K. (2008). Social capital and health communications. In Kawachi, I., Subramanian, S., Kim, D. (Eds.), Social capital and health (pp. 259-271). New York, NY: Springer.

EXPERIENCE JOURNEY OF GRANT RECIPIENTS: FINDINGS FROM SABAH YOUNG AGROPRENEURS

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***Abstract* - Agricultural-related entrepreneurship (agropreneurship) provides opportunities for 2.7 million people to be uplifted to middle-class society. To spur the interest in agropreneurship, the Ministry of Agriculture and Food Industry (MAFI) allocates grants to young agropreneurs via its agencies. However, little is known on the grant recipient's experience journey in dealing with the respective agencies. Thus, this study investigates the customer experience journey of young agropreneurs under the Malaysian Agricultural Research and Development Institute (MARDI). The first phase of the study focuses on creating the template of customer journey map by acquiring the details of the agropreneurs' information, service blueprint and standard operating procedure from MARDI. Semi structured interviews were then conducted to understand grant recipient's tasks, feeling, and experience at different touchpoints when dealing with MARDI. The findings of this research indicates that grant recipients were generally satisfied with their experience in dealing with MARDI. The participants also provided suggestions for improvements, such as increasing the visibility of MARDI's programs. This study provides useful insights to policy makers, ministries, agencies, and academia.**

Keywords—Agropreneur. Entrepreneurship, grant, experience journey)

I. Introduction

The agriculture industry contributes to 7.3 per cent of the Gross Domestic Product (GDP) of Malaysia in 2018, amounting to RM99.5 million and offers 1,570.3 thousand jobs, including 492.4 foreign workers [1]. Agricultural-related entrepreneurship (agropreneurship) provides opportunities for the 2.7 million people in the bottom 40 percent of Malaysian households (B40 group) to be uplifted to middle-class society while reducing the unemployment rate at the same time [2]. To spur agropreneurship among the younger generation, the Ministry of Agriculture and Food Industry (MAFI) allocates grants under the Young Agropreneur Program. Ever since the program's inception in 2016, a total of RM104.56 million in grants were allocated, benefitting a total of 6,005 participants across the country [3]. The grants are disbursed via the different agencies under the ministry, including the Malaysian Agricultural Research and Development Institute (MARDI). However, little is known on the grant recipient's experience journey in dealing with the respective agencies. Hence, the aim of this study is to investigate the customer experience journey of the grant recipients by focusing on the young agropreneurs under MARDI.

II. methodology

The research employs a qualitative approach to data collection. The data collection process is divided into two main phases, summarised from the five phases suggested by Halvarsrud, Kyale, and Folstad [4]. The first phase involves tabulating the important customer touchpoints, details of the agropreneurs' information, service blueprint and standard operating procedure from MARDI by interviewing the officers in charge and reviewing the relevant documents. Based on these information, a general journey map for the grant recipients was developed. The second phase utilises semi structured interviews with three grant recipients to understand their tasks, feelings, and experience at different touchpoints when dealing with MARDI.

III. results/ Findings

Fig. 1 illustrates the general journey of the grant recipients. In general, they are expected to undergo five general stages, starting from the exposure or awareness stage of the grant or funding program. This is followed by the registration process, which would lead them to attending the relevant training and consultation session

organised by MARDI. They will then get to apply for the grant after getting the necessary funding and technical assistance and successful grant recipients will be continuously monitored by MARDI.

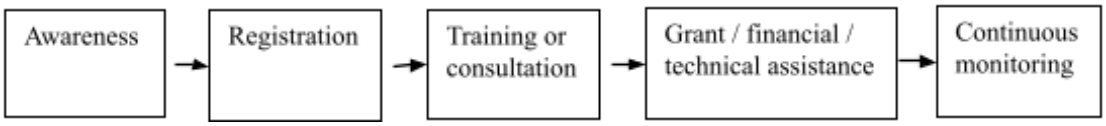

Fig.1: General journey map of grant recipients

Based on the interview with the grant recipients, they concurred with the five stages in the journey map. They were generally satisfied with the execution of all the touchpoints and with the experience dealing with MARDI. Interestingly, some of the respondents shared that they get to know about the grants not from MARDI directly, but from their entrepreneur networks. Nevertheless, they commented that MARDI tend to have more programs in Peninsular Malaysia. They hoped that MARDI would conduct more programs for agropreneurs in Sabah. They also suggested that MARDI should increase the visibility of their programs and funding opportunities by using various online and offline channels.

IV. CONCLUSION

The development of the customer journey map is important for government agencies such as MARDI to understand the experience journey of their customers (agropreneurs). The comprehensiveness of the journey map would enable the agency (MARDI) to closely monitor the execution of the different touchpoints, and also to make continuous improvements. This would foster more pleasant experiences when dealing with government agencies, encourage collaborations, and ultimately improve the standard of living of agropreneurs.

ACKNOWLEDGEMENT

The authors would like to express appreciation for the support of the sponsors: Fisabilillah R&D Grant Scheme (FRDGS) [Project Number FRDGS2018/30].

REFERENCES

[1] Department of Statistics Malaysia, “Selected Agricultural Indicators, Malaysia”. Retrieved from: https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=72&bul_id=SEUxMEE3VFdBcDJhdUhPZVUxa2pKdz09&menu_id=Z0VTZGU1UHBUT1VJMFlpaXRRR0xpdz09, 2019.

[2] Economics Planning Unit, Malaysia, “The Eleventh Malaysia Plan”. Retrieved from http://rmk11.epu.gov.my/index.php/en/, 2017.

[3] Ministry of Agriculture and Food Industry, Malaysia. Retrieved from https://www.mafi.gov.my/home, 2020.

[4] R. Halvorsrud, K. Kvale, and A. Folstad, “Improving Service Quality through Customer Journey Analysis,” *Journal of Service Theory and Practice*, no.26, vol. 6, pp. 840-867, 2016.

IMPLICATIONS OF MCO TO ECOMMERCE BUSINESSES DUE TO POSITIVE SHIFT IN ONLINE CONSUMER BEHAVIOUR

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***Abstract* - Online purchasing involves with high levels of uncertainty related to consumer's knowledge, the Internet shopping skill and utilitarian motivation as key factors for getting popularity during pandemic Covid19 movement control order (MCO). Driven by positivistic research philosophy, this study focuses on testing the research model driven by one theory: Social Learning Theory.The purpose of this research was to unearth new factors and knowledge that have contributed to upsurge in consumer intentions to purchase from online platforms during MCO. The hypothesized model was tested with data collected from survey of individuals who have knowledge about online portals using non-probability sampling method. Structural equation modelling using SmartPLS software was employed for data analysis. We found that knowledge, self-efficacy, internet skill, and utilitarian motivation significantly contributed to this phenomenon. This study will help researchers and practitioners understand consumer online purchase behaviour pertaining to online portals during pandemic in detail and formulate strategies in future.**

Keywords— ecommerce, COVID-19, MCO, online purchase intention, Social Learning Theory (SLT))

I. Introduction (*Heading 1*)

E-commerce plays a significant role in our daily lives given its state-of-the-art functionality. With the development of IT (Information Technology) alongside logistics transportation, online shopping has become more convenient and popular (Zheng et al., 2020). Advancement of technology is helping to open ecommerce opportunities for everyone, anywhere, anytime and via any device (PayPal Research, 2018). During Movement Control Order (MCO) due to Covid19, most of the people depend on online platform to buy their necessary products. Many companies who have websites are now attracting the consumers to sell their products and services through online during MCO (movement control order). Since, most research focuses on consumer's online purchasing behaviour, the research on consumer's online purchasing behaviour during pandemic is still scant.

Nowadays, most of the people will go virtual shopping via the Internet, appreciating the advancement of technology that provides us mobile computing. By searching a single word, lots of similar items will come out on the screen depending on the consumers' preference (Julka, P. & Arora, I.S., 2019). Throughout the long term, shopping through online has been developing enthusiasm from the web users. It is verifiable that more consumers prefer internet shopping instead of heading off to a traditional shop (Kadir et al., 2017). On the other hand, Customers are thinking about the straightforwardness and safety that web-based shopping gives more than ever (Rao & Moorthy, 2020).

II. methodology

Driven by positivistic research philosophy, this study focuses on testing the research model driven by Social Learning Theory. As the population is immense therefore the convenient sampling was adopted. 145 sets of self-administrated questionnaire were distributed to the targeted respondents by means of convenient sampling through Google Form. The respondents of questionnaire were focusing on general respondents from across Malaysia who is above 18 years old. Malaysia is the context for this study since there is a surge in online purchases at the time of the pandemic (Elizabeth Bennet,2020). The items of the questionnaire for every variable have been retrieved from previous study on the basis of consumer purchase behaviour. The hypothesized model was tested with data collected from survey of individuals who have knowledge about online portals using non-probability sampling method. Structural equation modelling using SmartPLS software was employed for data analysis. Moreover, SmartPLS allows rigorous analysis with a small sample size with less stringent assumptions about distribution and error terms and its Bootstrapping ability does to a certain extent overcome non-normal risk (Henseler, Ringle, & Sinkovics, 2009). With the use of proven statistical methods,

the hypotheses deduced in this research were tested to ascertain the relationship between the determinants of consumer online purchase intention to shop from online portals.

III. RESULTS/ FINDINGS

The findings showed that Knowledge, Self-efficacy, Internet Skill, Utilitarian Motivation factors played a significant role in determining consumer's intention to shop from online portals MCO. A total of 145 sets of questionnaires had been received with the response rate of 95.86% and out of 145 sets, 139 respondents were selected and the balance 6 were rejected because those respondents failed to pass the screening questions. Among 139 of respondents, 57 were male and 82 were female respondents. Table 1 shows descriptive analysis of the factors. This study will help researchers and practitioners understand consumer online purchase behaviour pertaining to online portals during pandemic in detail and formulate strategies in future. To find accurate result or analysis in this research we used HTMT which is a new and more reliable alternative method. From HTMT the results, we perceive that each value obtained is below 0.85 which is good (Kline, 2011).

TABLE 1. DESCRIPTIVE ANALYSIS

Variables	Coding	No of items	N	Range	Minimum	Maximum	Mean	Std. Deviation
Knowledge	MKN	4	139	3.5	1.5	5	4.1403	0.71988
Internet Skill	MIS	5	139	2.4	2.6	5	4.305	0.59822
Self-efficacy	MSE	5	139	2.2	2.8	5	3.7525	0.53002
Utilitarian Motivation	MUTI	4	139	2.25	2.75	5	4.3435	0.61331
Online Purchase Intention	MOPT	5	139	2.2	2.8	5	4.1007	0.50239
	Valid N (Likewise)		139					

IV. CONCLUSION

This study extends the body of extant literature on the determinants of increasing the online business during movement control order from the Malaysian buyer's perspective. Explicitly, we proposed and tested the effects of a wide-ranging set of formal instruments on consumers' online purchase intention during MCO. Consequently, as in the situation of this study that trust and aptitude on online purchase intention of consumers in using the e-commerce website as the media for internet shopping is inspected and also Knowledge of online shopping enables consumers to develop a positive online shopping awareness (Jiang, J. C., Chen, C. A., & Wang, C. C., 2008). We found that Knowledge, Self-efficacy, Internet Skill, Utilitarian Motivation factors are important components affecting buyer's buying perception over an online website during MCO. The research has taken the opinion of an individual consumer's perception, so effective factors are going to change the consumer's buying pattern due to the pandemic situation. At the time of finding and recommendation which is shown on the basis of the research, only limited portion of the population was covered. Most of our data sampling had the experience of visiting or purchasing from an online website at least once during this pandemic. Future researchers can benefit from this gap and conduct research on those who have no experience of an ecommerce platform during a pandemic situation. This study will not only contribute to the existing body of knowledge of Social Learning Theory but will also provide an avenue and future scope for the researchers by acting as a guide to identifying the variables that influence consumer purchasing intention to buy from ecommerce platforms.

REFERENCES

[1] Zheng, Q., Chen, J., Zhang, R., & Wang, H. H. (2020). What factors affect Chinese consumers' online grocery shopping? Product attributes, e-vendor characteristics and consumer perceptions. *China Agricultural Economic Review*.

[2] Julka, P., and Arora, I. S., (2019). Customer Perception Towards Online Shopping. International Journal of Management, Technology and Engineering, XI(V).

[3] Kadir, M. R. A., Nor, F. S. M., and Saaid, F. A. (2017). A study on customer online purchasing behavior: A Malaysian perspective. 2017 8th International Conference on Information Technology (ICIT), IEEE, 507-511.

[4] Rao, M. J., and Moorthy, S. (2020). Analysis on Consumers Online Buying Behavior of Essentials during COVID 19 in Central Suburbs of Mumbai. Purakala with ISSN 0971-2143 is an UGC CARE Journal, 31(37), 440-452.

[5] Jiang, J. C., Chen, C. A., and Wang, C. C. (2008). Knowledge and trust in E-consumers' online shopping behavior. 2008 International Symposium on Electronic Commerce and Security, IEEE, 652-656.

[6] Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing. In New challenges to international marketing. Emerald Group Publishing Limited.

[7] Global Summary Report (2018). PayPal Cross-Border Consumer Research. Website link: https://www.paypalobjects.com/digitalassets/c/website/marketing/global/shared/global/media-resources/documents/PayPal_Insights_2018_Global_Report.pdf

IMPROVED MODE FOR A BACK TEST OF MAGIC FORMULA IN MALAYSIAN STOCK MARKET

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***Abstract* - Greenblatt's Magic Formula(MF) has proven effective in the different stock market over the world. However, there is no academic research to investigate its effectiveness in the Malaysian stock market. To fill in the gap of literature. This study applied programming and quantitative finance method to back-test Malaysian stock data from 2004 to 2019. Besides, this research also tests different financial indicators, market capital and portfolio size for finding the optimal MF for the Malaysian stock market. The KLSE index was selected as the benchmark. CAPM model and a variety of financial ratios were applied to evaluate the performance. Risk-reward of portfolios also considered. The results showed that 15 of 18 portfolios deliver a higher return than the benchmark. However, compare the performance of the MF in the United States and other markets. The Malaysian market has not shown its advantages. For further tests, compared with Earning before interest and tax(EBIT) which used in the original MF. Gross profit (GP) is more suitable in the Malaysian stock market. It is worth mentioning that when GP applied to formulas. The performance of small market capitalization portfolios is better than that of large market capitalization portfolios. It exactly contradicts the original MF**

Keywords—The Magic Formula, value investing, retail investors, back-test

I. Introduction (*Heading 1*)

In 2020, Malaysia retail investors increase by 62% compared to 2019 average. The reason behind this dramatical increase due to the amidst diminishing foreign funds backdrop of uncertainties brought by the COVID-19 pandemic, the violent shocks in the market have allowed investors to see opportunities. (Bernama, 2020) On the other hand, a reduction in interest rate also promoted the popularity of the stock market. (Bank Negara Malaysia, 2020) However, invest in the stock market is easy, but how to select the company, choose the strategy being used is difficult, especially for non-professional retail investors. Compared with institutional investors, psychological biases and emotions affect retail investors more significantly (Jaiyeoba, Adewale, Haron, & Che Ismail, 2018).In additional, Herding behaviour are common among Malaysia retail investors. (WeiWei, 2012)

Comprehensive all the above reason, the retail investor needs a reliable investment strategy. At the same time, the logic of this strategy must be easy to understand. For this reason, we choose Magic formula which proposed by Joel Greenblatt in his book *Little book beats the market* (Greenblatt, 2008). This study will test whether this strategy could be used in Malaysia stock market by historical data and proposed a Malaysia version Magic formula and test its result. Meanwhile, some professional researchers in universities will be interviewed to understand their views on the Magic formula.

II. methodology

Research Data: This research tested the listed company in Malaysia main stock market. The data include fundamental data (Factset Fundamentals) and Historical equity price (Global equity pricing). The portfolio will be formed with data of 1st of April every year from 2004-2018 to avoid look-ahead bias. Malaysia KLCI(KLSE) index was selected as benchmark. The data frame of this research is 2004-2019 include major market event such as bubble 2007-2009 financial crisis which gives us insight on how the strategies work in an unusual market environment.In order to proposed the modified version of MF which more suitable for Malaysian Market.

Portfolio construction: This research combined original rules of Greenblatt and two amended MF. The portfolio form in following rules

- Pre-processing data (exclude financial and utility stock)
- Set minimal market capitalization (small cap: 50 million, big cap: 1 billion)
- Calculate financial indicators (ROC = EBIT ÷ (Net Fixed Assets + Net Working Capital) and (EY =EBIT ÷ Enterprise Value) and ranking the result. (for Amended 1 and 2 MF, the EBIT replaced by GP, and intangible assets include in Amended 2)
- Sum the ranking and select 10(20,30) stocks

- Rebalance the portfolio every year

Return Calculation: The return of the portfolio will calculate monthly, Dividend payout per share is included. The formula for return evaluation as follow:

$$Monthly\ return(MR) = \frac{P_t - P_{t-1} + D_t}{P_{t-1}}$$

Where: P_t: Asset price for time period t. P_{t-1}: Asset price for time period t-1. D_t: $Dividend\ pay\ out\ per share\ in\ time\ period\ t.$

$$Annual\ Accumulate\ return = \left(1 + MR_1\right) * \left(1 + MR_2\right) * \left(1 + MR_3\right) \ldots \left(1 + MR_{12}\right)$$

Where:MR_1: $Monthly\ return\ in\ the\ first\ month\ of\ holding\ period.$

$$Compound\ Annual\ Growth\ Rate = (Annual\ Accumulate\ return)^{\left(\frac{1}{T}\right)} - 1$$

Where: T: Total number of time period (years)

CAPM regression model: For measure the risk of each portfolio, research also involved the Sharp ratio, Treynor ratio and Information ratio.In addition to investigate the "true alpha" and risk of each portfolio. researchers applied CAPM regression model.

$$r_p - r_f = \alpha + \beta_p\left(r_m - r_f\right) + \varepsilon_p$$

Where:α: $Intercept\ of\ regression.$ ε_p: $Error\ of\ regression.$

III. RESULTS/ FINDINGS

	Accumulate Return	Standard Diviation	Beta	Jensen's alpha	Sharpe	Treynor	Information Ratio	R-square
P1.1	1.7300	0.275	0.83	0.013	0.135	0.045	0.035	0.219
P1.2	2.6597	0.112	0.56	0.027	0.388	0.078	0.147	0.587
P1.3	3.5331	0.410	0.87	0.085	0.267	0.126	0.208	0.110
P1.4	1.1881	0.324	1.03	-0.010	0.061	0.019	-0.031	0.246
P1.5	2.6602	0.133	0.80	0.023	0.343	0.057	0.283	0.860
P1.6	2.2536	0.377	0.92	0.046	0.193	0.079	0.126	0.145
P1.7	1.6451	0.286	0.98	0.007	0.124	0.036	0.027	0.284
P1.8	2.3500	0.129	0.75	0.015	0.283	0.049	0.113	0.808
P1.9	2.3852	0.355	1.15	0.041	0.208	0.064	0.146	0.254
P2.1	3.1528	0.269	1.23	0.042	0.287	0.063	0.250	0.503
P2.2	2.3803	0.204	1.02	0.018	0.230	0.046	0.140	0.598
P2.3	9.1055	0.293	0.22	0.154	0.547	0.720	0.416	0.014
P2.4	4.6473	0.248	1.11	0.070	0.409	0.091	0.403	0.482
P2.5	1.9673	0.161	0.93	0.001	0.173	0.030	-0.012	0.800
P2.6	8.2003	0.227	0.66	0.122	0.624	0.213	0.537	0.206
P2.7	3.1799	0.227	0.92	0.044	0.311	0.077	0.235	0.392
P2.8	2.3176	0.154	0.92	0.012	0.248	0.042	0.152	0.845
P2.9	9.3719	0.236	0.90	0.127	0.647	0.171	0.643	0.345
P3.1	2.5056	0.277	1.29	0.025	0.225	0.048	0.170	0.521
P3.2	2.2221	0.188	1.00	0.011	0.213	0.040	0.105	0.679
P3.3	7.0277	0.208	0.28	0.119	0.612	0.454	0.423	0.044
P3.4	4.2436	0.242	1.02	0.064	0.389	0.092	0.356	0.432
P3.5	2.1623	0.166	0.98	0.007	0.211	0.036	0.090	0.827
P3.6	9.1545	0.243	0.81	0.129	0.627	0.188	0.586	0.267
P3.7	3.3369	0.224	0.94	0.047	0.330	0.079	0.263	0.423
P3.8	2.2306	0.157	0.93	0.009	0.229	0.039	0.113	0.842
P3.9	8.7531	0.234	0.81	0.124	0.629	0.182	0.588	0.286
KLSE index	1.9593	0.154835	1	0	0.185595	0.028737		1

Finding 1: Original formula does not achieve better return. The result of hypothesis 1 was proven the expectation of quality interview research result which is not significant as it applied in the US stock market. The reason comes from the difference between the Malaysian market and the US market. The total market capitalization in Malaysia is far less than the US. The number of companies that can be selected is also less than the US market. Also, the financial and utility companies were excluded, which is also weakened the return on the investment portfolio. Besides that, a point worth to noting is, different from Joel Greenblatt testing result in US market. The formula was performance better when applied in big-cap firms in Malaysia compare to small-cap firms. However, when the restrictions of capitalization further relaxing, the return increases. Therefore, the conclusion cannot be made with certainty about the influence of the company's market capitalization on the Magic formula results.

Finding 2:GP achieve better return, better for small firms but much higher. Obviously, the return has dramatically increased when Gross profit used instead of EBIT in amended formulas. As shown by another

study (Douglas W. & Nusret, 2017) gross profits can surpass the original Magic formula to obtain a better return in the global regions. This research proves this conclusion is equally obvious in the Malaysia stock market. Therefore, it can be concluded that the Magic formula driven by Gross profit is more suitable for selecting stocks in the Malaysia stock market. In addition, if the restrictions of capitalization set lower or cancelled could deliver even better performance.

Finding 3: larger capitalization lower risk. Regarding risk analysis, the research results show that the risk of large companies is much smaller than that of investing in small companies. This is the same as an investment attempt. From another aspect, it also explains that the excess returns of small companies come from high risk to a certain extent. Also, there is no obvious linear relationship in the size of the investment portfolio, but there is a certain impact in terms of risk. The more stocks the investment portfolio includes, the lower the risk. This conclusion also conforms to the general law of investment.

IV. CONCLUSION

The result of this research confirms the finding from Joel Greenblatt and other researchers. Most portfolios form by Magic formulas could beat the Malaysia market as it does in other places of the world. At the same time, the Amended 1, and 2 Magic formula which we form by changing EBIT instead of Gross profits and include intangible assets could performance better return than KLSE index and original Joel Greenblatt's Magic formula. However, this result only applicable to small market companies. It is an important point worth noting. Although Amended Magic formula can bring more lucrative returns, it is more suitable for small-capitalization companies, but the original formula performs better in large companies when we test Malaysia data. Another point worth noting is we find there have quite a huge number of companies listed in Malaysia stock market which capitalization smaller than 50 million (The minimal capitalization we set for small-cap companies), thus we also test the result for all companies listed in the market (by cancelling the limitation of market cap). The result was astonishing, it could deliver a strong significant abnormal return. For portfolios size test, it did not have much impact on returns but have a great impact on risk. Finally, we evaluate the performance of all portfolio by risk-return tradeoff graph, CAPM regression analysis and several performance-evaluation ratios. To conclude, the Magic formula could beat the Malaysia market as well and perform even better if use Gross profits instead of EBIT when calculating Return of Capital (ROC) and Earnings Yield (EY).

V.ACKNOWLEDGEMENT

The authors would like to express appreciation for the support of my parents and friend Li Yueqi.

REFERENCES

Bernama. (2020, 5 20). Higher retail investors participation in Bursa will continue, says Rakuten Trade. Retrieved from New Straits Times: https://www.nst.com.my/business/2020/05/594155/higher-retail-investors-participation-bursa-will-continue-says-rakuten-trade

Bank Negara Malaysia. (2020, 5 20). OPR DECISION & STATEMENT. Retrieved from Bank Negara Malaysia: https://www.bnm.gov.my/index.php?ch=mone&pg=mone_opr_stm

Jaiyeoba, H., Adewale, A. A., Haron, R., & Che Ismail, C. H. (2018). Investment decision behaviour of the Malaysian retail investors and fund managers: a qualitative inquiry. Emerald insight, 134-151.

WeiWei, U. (2012). Behavior of Malaysian investors towards stock market and investment activities. Sarawak.

Greenblatt, J. (2010). The Little Book That Beats the Market. Wiley. Greenblatt, J. (2010). The Little Book That Still Beats the Market. NewYork: John Wiley & Sons, 2010.

INDUSTRY 4.0 – A PRECURSOR TOWARDS SUSTAINABLE ORGANIZATIONAL PERFORMANCE

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***Abstract* - The study explores the role of Industry 4.0 to foster sustainable organizational performance in the SMEs in Malaysia. The technology adoption involves many challenges that can affect the organization performance significantly, but the integration of Industry 4.0 can assist in overcoming those technological concerns. Industry 4.0 deals with a higher level of organizational performance and industrial automation. As current literature lacks a proper framework of Industry 4.0, an appropriate implementation procedure is missing. Therefore, this study will focus on the crucial factors of Industry 4.0 that act as the precursors to attain sustainable organization performance for the SMEs in Malaysia. This study introduces a framework for integrating the crucial factors of Industry 4.0 to be tested for further research. The results of the study could enable SMEs to establish strategies for attaining sustainable organizational performance under Industry 4.0.**

Keywords—*Industry 4.0, sustainable organization performance, SMEs in Malaysia*

I. Introduction

Recognizing the crucial factors is very essential for the successful execution of Industry 4.0 and thus the organizations can lead to sustainable performance. Human resources are extremely critical at all levels of management and they require enough expertise, information, ingenuity and imagination to meet the customer demand (Pasban & Nojedeh, 2016).

The convergence of human capital with machinery, procedures and products in Industry 4.0 helps organizations to gain costs and time savings in the manufacturing chain and increase the quality of products, market share, profit, costs, sales revenue and customer satisfaction leading to sustainable organization performance (Ogunyomi & Bruning, 2016). Another crucial factor of Industry 4.0 is change management which takes place over a period of time, and increase the probability of success leading to enhance the organizational performance (Al-Haddad & Kotnour, 2015).

National culture plays a vital but complex role in influencing innovation at the national level (Tian et al., 2018). National culture can either facilitate or create difficulties in adopting new technologies (de Sousa Jabbour et al., 2018). The dimensions of national culture should be investigated as it plays an important but conflicting role in technological acceptance (Mahfuz et al., 2017).

II. methodology

This study proposes a new model including the critical factors of Industry 4.0 and their impact on the successful execution of Industry 4.0 and sustainable organization performance. The framework variables are adopted from the National industry framework of IR 4.0 proposed by Ministry od International Trade and Industry(MITI).A cross-sectional survey will be carried out on Malaysian SMEs, and samples will be chosen from SME Corporation. The survey will be conducted in various regions of Malaysia. The data collection procedure will be conducted through a structured questionnaire, and the measurement items will include questions related to all the variables proposed in the framework. The statistical analysis will be performed through the employment of the Structural Equation Modeling (SEM).

III. results/ Findings

This study introduces a framework for integrating the crucial factors of Industry 4.0 to be tested for further research. The results of the study could enable SMEs to establish strategies for attaining sustainable organization performance under Industry 4.0.

IV. CONCLUSION

This study proposes a new model including the critical success factors of Industry 4.0 influencing its successful implementation leading to attain sustainable organization performance. Therefore, this study will focus on the crucial factors of Industry 4.0 that act as the precursors to attain sustainable organization performance for the SMEs in Malaysia.

ACKNOWLEDGEMENT

The authors would like to express appreciation for the support of Ministry of Higher Education (MOHE), Malaysia, under the FRGS Grant.

REFERENCES

[1] S.Al-Haddad, & T. Kotnour, Integrating the organizational change literature: A model for successful change. *Journal of Organizational Change Management*.2015. https://doi.org/10.1108/JOCM-11-2013-0215

[2] a.b.l.Dee Sousa Jabbour,C.J.C. Jabbour, C.Foropon, & M.G.Filho, When titans meet – Can industry 4.0 revolutionise the environmentally-sustainable manufacturing wave? The role of critical success factors. *Technological Forecasting and Social Change*, *132*(January), 18–25.2018. https://doi.org/10.1016/j.techfore.2018.01.017

[3] M.A.Mahfuz, L.Khanam, & H.Wang, The influence of culture on m-banking technology adoption: An integrative approaches of UTAUT2 and ITM. *PICMET 2016 - Portland International Conference on Management of Engineering and Technology: Technology Management For Social Innovation, Proceedings*. https://doi.org/10.1109/PICMET.2016.7806814

[4] P.Ogunyomi, & N.S.Bruning,Human resource management and organizational performance of small and medium enterprises (SMEs) in Nigeria. *International Journal of Human Resource Management 2016.*. https://doi.org/10.1080/09585192.2015.1033640

[5] M.Pasban, & S.H.Nojedeh, . A Review of the Role of Human Capital in the Organization. *Procedia - Social and Behavioral Sciences*.2016. https://doi.org/10.1016/j.sbspro.2016.09.032

[6] M.Tian,, P.Deng, Y. Zhang, &M.P. Salmador, M. P. How does culture influence innovation? A systematic literature review. In *Management Decision*. 2018.https://doi.org/10.1108/MD-05-2017-0462

INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT) IN ONLINE ALTERNATIVE DISPUTE RESOLUTION (ODR): OPTION FOR ALL IN NEW NORMAL

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Abstract **–** Due to unforeseen complication of litigation and benefit of cost-saving strategy, society has now paid attention to adopt Alternative Dispute Resolution (ADR) to settle their dispute. With the advancement and growth of technology usage and due to restriction of physical meeting of movement control order imposed in various countries currently, online alternative dispute resolution (ODR) has started drawn an attention to the community. To resolve a conflict between the parties, ODR employs innovative tools and approaches, such as information management and communication tools. The automation of information management improves the efficiency of dispute resolution, while communication tools bridge the gap between people. To date, there are non-full-fledged online ADR that is established in Malaysia. Thus, this paper will study the application of ODR with the assistance of ICT to resolve the dispute resolution in Malaysia. This is a qualitative study that uses literature to systematically study philosophical and scholarly views. This is not an observational or empirical study, but rather a library study of different primary data sources such as decided cases and legislations and secondary data sources namely articles and journals from online database. The study found that many countries have started to pay attention to the importance of ODR in resolving the dispute. Malaysia has its own 'Mediation Act 2012', 'Arbitration Act 2015' and other relevant statutes governing the dispute resolution but application of ODR in Malaysia is still not encouraging. Thus, it is submitted that there is still a bridging gap in application of ODR in Malaysia and thus if the ODR can be codified in the written law, it could promote ODR as preferred form of ADR.

Keywords—*Information and Communication Technologies, New Normal, Online Alternative Dispute Resolution*

I. INTRODUCTION

Online alternative dispute resolutions (ODR) refers to dispute resolution with the advantage of the Internet, a resource that extends what we can do, where we can do it, and when we can do it."[1] This paper will explain the use of information and communication technologies (ICT) in Alternative Dispute Resolution. It will outline the numerous types of ODR procedures, as well as the ways developed and refined through the use of ICT, as well as the benefits and drawbacks of going online and employing electronic technology. The purpose of this study is to show how information and communication technology (ICT) can be used to improve alternative conflict resolution methods and make them more effective and efficient. The paper will conclude with examples of ODR online providers and a general view of rules making and norms in the world wide web, stressing on online consumer confidence in the conduct of ODR.

With the use of ICT, ODR began to use technologies that did more than just converse online, and as a result, it began to set itself apart from its offline counterparts. Moreover, currently we are facing pandemic Covid-19 and face to face communication is much restricted. Thus, ODR is getting popular in resolving dispute in various areas. A pilot project in online mediation conducted for eBay by the University of Massachusetts Center for Information Technology and Conflict Resolution was one of the key catalysts for this move.[2] The terms of service of eBay, both then and now, did not require it to provide services in the event of a conflict. eBay had built up a feedback rating system to allow parties to report whether a sale went successfully in order to determine if a seller was trustworthy. Even with this resource, however, as eBay developed, so did the number of disputes. The trial experiment resulted in the filing of 200 complaints over the course of two weeks. Due to its performance, eBay chose SquareTrade.com, an Internet start–up, as its preferred dispute resolution supplier.

II. METHODOLOGY

This is qualitative study that involves a systematic study of philosophical and academic views though literatures. Therefore, this study is not an empirical study but rather a library study from various primary data sources such as cases, statutes and secondary data sources namely articles and journals from online database.

III. RESULTS AND DISCUSSIONS

For dispute resolution, ODR employs modern information management and communication methods and methodologies. The automation of information management improves the efficiency of dispute resolution, while communication tools bridge the gap between people. Consumer confidence is seen as the key issue in increasing the level of online commerce (Treasury 2001). International groups investigating this area have supported online

ADR as a mechanism for resolving e-commerce disputes (for example OECD 1999 and UN Economic Commission for Europe).[3] In the USA, the push for online ADR has been spearheaded by the Bureau of Consumer Protection of the Federal Trade Commission. The Bureau has produced a discussion paper (FTC 2000a) and held a workshop with over 120 online ADR academics and practitioners (FTCb2000b). One of its key recommendations for consumer protection in the global online marketplace was to encourage the development of OADR. In Europe, consumer protection is a strong driver, and the European Commission has funded the creation of an online consumer dispute resolution service, ECODIR, as well as funding other initiatives, including one in Italy (Rule 2002:117). The EC has issued a Green Paper on ADR in civil and commercial law and envisages setting up an accreditation framework for ADR in business to consumer relations (Tilman 2002).

The employment of artificial intelligence (AI) agents, i.e. computer systems that can negotiate and assist in the resolution of disputes, necessitates enhanced ODR negotiating tactics. AI agents can assist in resolving disagreements between two or more humans, as well as negotiate or negotiate on behalf of a human negotiator. For example, the two disputants will meet to discuss their dispute. The AI agent will inquire about each party's interests and preferences before attempting to reach an efficient agreement.

For example, suppose that Party A tells the AI agent privately that it would like to settle a claim with Party B for RM10,000 but would settle for RM5,000. The agent then might ask Party B if they would be willing to pay RM10,000. Party B says it is will pay no more than RM6,000. The agent can then propose a settlement of RM6,000, a figure acceptable to both parties. The process eliminates haggling and should generate efficient outcomes. What if one party is much more powerful, how does the AI agent manage questions of injustice and structural bias, and conduct an ethical negotiation? Technology can be used to reduce injustice and structural bias or to exacerbate them.[4] Trust can be an obstacle to the adoption of ODR. People may fear that the AI agent will use the information they provide against them, especially if the ODR platform is run by their opponent.

A study by Katalien Bollen and Martin Euwema of the University of Leuven, Belgium, found that subordinates who mediated a conflict with a superior were substantially more comfortable with technology-supported mediation than with conventional face-to-face mediation.[5] Workers' perceptions of authority discrepancies between themselves and their bosses appeared to be reduced as a result of the usage of technology. Workers' expectations of a fair and equal system will be raised as a result of online conflict resolution.

Parties can speed the mediation process by using technology early in the mediation process by performing computer-assisted evaluations of themselves and the conflict before meeting remotely. This online intake process assists the mediator in gaining a better grasp of the problem without leading the parties to argue. The common methods used in ODR systems are[6]

1) Online settlement/ Online Negotiation, using an expert system to automatically settle financial claims

2) Online arbitration, using a website to resolve disputes with the aid of qualified arbitrators

3) Online resolution of consumer complaints, using e-mail to handle certain types of consumer complaints

4) Online mediation, using a website to resolve disputes with the aid of qualified mediators

ODR provides more convenient access to justice because they have the ability to transact twenty-four hours a day, seven days a week, regardless of constraints of distance, time zones, local cultures, geographic borders and legal frameworks.[7]

SquareTrade[8] which was founded in 1999 is another popular online ADR service provider that offers a forum to mediate e-commerce consumer disputes.[9] Cybersettle.com[10] focuses on the settlement of monetary disputes, particularly insurance related and workers compensation disputes.[11]

To date, there are non-full fledged online ADR that is established in Malaysia. Nonetheless, there hasn't been much effort in Malaysia to investigate the various approaches to ODR legislation.

However, the Singapore Mediation Centre has also offered e-settlement. It is primarily intended for disputes concerning fundamental monetary assertions between two parties. The parties essentially make a bid and demand utilising an electronic mechanism. If the offer and demand are within a specific range, the system would indicate that a settlement occurs at the midpoint between them.

IV. CONCLUSION

"Computer networking does not replace other forms of human communication; It increases our range of human connectedness and the number of ways in which we are able to contact others. Historically, changes in the means of Communication- from speech to writing to the printing press- have transformed Human development and society." (Harasim 1993). With the correct SKAs (Skills, Knowledge, and Attitude) for human capital development and working in cooperation with technology (the 4th party), there is so much for the future of O

ADR.

The Internet is a unique and evolving medium; therefore, ADR mechanisms used in the real world may not be easily duplicated in the online environment.[12] Nevertheless, owing to the adaptable nature of ADR, traditional forms could be modified to resolve most online disputes.

APPENDIX

Nil

ACKNOWLEDGEMENT

The author would like to express appreciation for the support of the sponsors, namely Multimedia University.

REFERENCES 4

[1] Colin Rule, co-founder of ODR provider Modria.com.
[2] Cybersettle, Claim Resolution Services, at http://www.cybersettle.com/products/claimresolution.asp.
[3] Cybersettle, What is Cybersettle? At http://www.cybersettle.com (last visited Nov. 22, 2003).
[4] Federal Trade Commission (FTC), Global Business Dialogue (GBDe), the Org for Economic co-operation and Development (OECD), The American Bar Assoc Task Force on E-commerce and ADR (ABA Task Force), The European Extra-Judicial Network (EEJ-NET), Electronic Consumer Dispute Resolution (ECODIR), ODR expert colloquium of the University of Geneva. Mireze Phillipe 2002.
[5] Haloush, H.A. & Malkawi, B.H., (n.d.). Internet Characteristic and Online Alternative Dispute Resolution. *Harvard Negotiation Law Review*, 13:327,327- 348.
[6] Heuvel, E., (n.d). Online Dispute Resolution as a Solution to Cross-Border E-Disputes. An Introduction to ODR.
[7] Joseph W. Goodman, The Pros and Cons of Online Dispute Resolution: An Assessment of Cyber-Mediation Websites, 2003 *DUKE L. & TECH. REV*. 4, 31 (2003).
[8] Rifkin, J. (2001). Online Dispute Resolution: Theory and Practice of the Fourth Party. *Conflict Resolution Quarterly,* 19(1) at pp. 117.
[9] SquareTrade, About SquareTrade, at http://www.squaretrade.com/cnt/jsp/abt/aboutus.jsp;jsessionid=m5ysw6xln1?vhostid =daffy&stmp=squaretrade&cntid=m5ysw6xln1 (last visited Dec. 3, 2003)
[10] William Krause, Do You Want to Step Outside?: An Overview of Online Alternative Dispute Resolution, 19 J. *MARSHALL J. COMPUTER & INFO. L*. 457, 462 (2001).

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[1] Rifkin, J. (2001). Online Dispute Resolution: Theory and Practice of the Fourth Party. *Conflict Resolution Quarterly*, 19(1) at pp. 117.
[2] Alberto Elisavetsky, Maria Victoria Marun (2021). Artificial Intelligence, ODR, The Black Swan, and ...Imaginative Cells. https://www.mediate.com/articles/elisavetsky-marun-odr.cfm#. Accessed on 1..7.2021.
[3] Federal Trade Commission (FTC), Global Business Dialogue (GBDe), the Org for Economic co-operation and Development (OECD), The American Bar Assoc Task Force on E-commerce and ADR (ABA Task Force), The European Extra-Judicial Network (EEJ-NET), Electronic Consumer Dispute Resolution (ECODIR), ODR expert colloquium of the University of Geneva. Mireze Phillipe 2002.
[4] Colin Rule, co-founder of ODR provider Modria.com.
[5] Kalter, M., Bollen, K., and Euwema, M. C. (2018). The long−term effectiveness of mediating workplace conflicts. Negot. J. 34, 243–265. doi: 10.1111/nejo.12227.
[6] Heuvel, E., (n.d). Online Dispute Resolution as a Solution to Cross-Border E-Disputes. An Introduction to ODR.
[7] Haloush, H.A. & Malkawi, B.H., (n.d.). Internet Characteristic and Online Alternative Dispute Resolution. Harvard Negotiation Law Review, 13:327,327- 348.
[8] SquareTrade, About SquareTrade, at http://www.squaretrade.com/cnt/jsp/abt/aboutus.jsp;jsessionid=m5ysw6xln1?vhostid =daffy&stmp=squaretrade&cntid=m5ysw6xln1 (last visited Dec. 3, 2003)
[9] William Krause, Do You Want to Step Outside?: An Overview of Online Alternative Dispute Resolution, 19 J. MARSHALL J. COMPUTER & INFO. L. 457, 462 (2001).
[10] Cybersettle, What is Cybersettle? At http://www.cybersettle.com (last visited Nov. 22, 2003)
[11] Cybersettle, Claim Resolution Services, at http://www.cybersettle.com/products/claimresolution.asp
[12] Joseph W. Goodman, The Pros and Cons of Online Dispute Resolution: An Assessment of Cyber-Mediation Websites, 2003 DUKE L. & TECH. REV. 4, 31 (2003).4

RETAINING TALENTED WORKER WITH DISABILITY IN SMALL AND MEDIUM ENTERPRISES

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Abstract – Small and medium enterprises face a lot of difficulties to retain worker with disability in the companies as the worker with disability's turnover rate in Malaysia is 10.1%,4four times higher than worker without disability. The high worker with disability's turnover rate in Malaysia cause small and medium enterprises to lost productivity and valuable knowledge in competitive business environment. Lack of training opportunity, unconducive work environment, and poor work-life balance make the worker with disability incompetent to perform the required job tasks and fail to stay longer in small and medium enterprises. In this research, purposive sampling is used to select and administer survey to 200 respondents in small and medium enterprises. This research is one of the pioneer research in Malaysia that proposes a holistic framework to enhance the retention of talented worker with disability in small and medium enterprises.

Keywords- *Worker with disability, small and medium enterprises, training and development, retention.*4

4

4 I. INTRODUCTION

Worker with disability's retention refers to keeping worker with physical, visual and hearing disability in small and medium enterprises (Khan et al., 2019). According to Kim and Nam (2019), worker with disability is an important asset for small and medium enterprises to sustain businesses. Major consideration on the retention of worker with disability relies on the employer's continuous efforts to place the employee in the most appropriate position in small and medium enterprises.

According to Naraharisetti and Castro (2016), worker with disability's turnover rate in Malaysia is 10.1%, four times higher than worker without disability. The high turnover rate among worker with disability cause small and medium enterprises to lost productivity and valuable knowledge in competitive business environment (Miethlich & Šlahor, 2018). When the worker with disability's turnover rate is high, morale and reputation of the organization will be reduced (Spencer, 2015). Thus, it is crucial for small and medium enterprises to determine key factors affecting worker with disability's retention

This research aims to determine factors that motivate worker with disability to stay in small and medium enterprises. Most small and medium enterprises in Malaysia are lack of experience in retaining worker with disability. They are poor in meeting the needs and requirement of worker with disability. According to Wahab and Ayub (2017) and Talib, et al. (2018), failing to retain worker with disability in small and medium enterprises, particularly the brightest and best worker, have a significant negative impact on an organization, not just in terms of direct costs, but also in terms of intangible company image.

This research is important as employee shortage a crucial challenge for small and medium enterprises (Wahab & Ayub, 2017). According to Talib et al. (2018), 55% of worker with disability who are capable to contribute to the companies are forced to leave their jobs due to poor recognition and compensation. Worker with disability felt not appreciated by the small and medium enterprises and choose to leave the organization after a few years of working (Miethlich & Šlahor, 2018). There is apparently a lack of disability research in Malaysia to look into how work life balance and health benefits motivate worker with disability to continue serving small and medium enterprises. There is also limited disability research in Malaysia to examine the adequacy of working environment in small and medium enterprises in support of worker with disability. This research is conduct to address these research gaps with research objective to assist small and medium enterprises to retain worker with disability in the organization.

Figure 1 shows the research framework of this study. This study intends to examine the effect of training and development, work environment, compensation and work-life balance on worker with disability's intention to stay in small and medium enterprises.

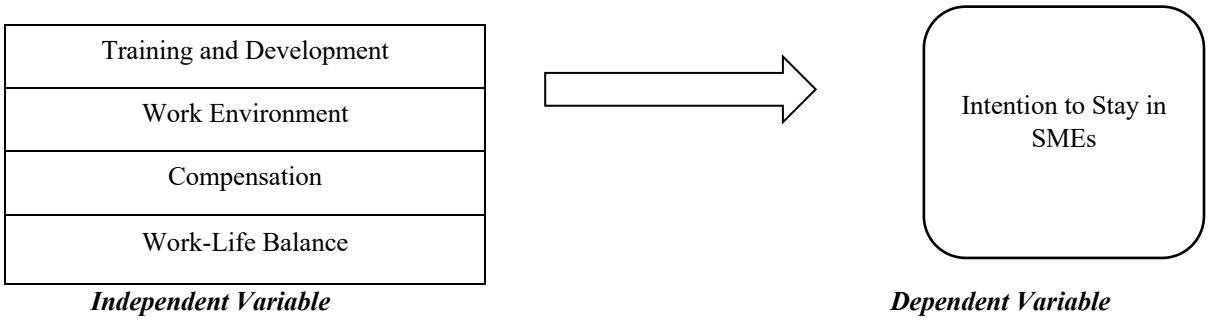

Fig. 1: RESEARCH FRAMEWORK

4

II. METHODOLOGY

This research distributes and collect questionnaire responses from 200 worker with disability respondents from different races and ages in manufacturing and service small and medium enterprises in four key cities in Malaysia (Selangor, Kuala Lumpur, Johor and Penang). The questionnaire is distributed face-to-face to 200 respondents in these cities. These 4 cities were chosen as majority of worker with disability are located in these 4 cities. Purposive sampling is used to select 200 respondents from small and medium enterprises. The respondents are active general worker in small and medium enterprises with at least 1 year working experience.

Questionnaire is an effective and responsive way to collect data and feedback from the worker with disability. It is more convenient and less costly.4

III. RESULTS/ FINDINGS

Items measuring dependent and independent variables in the questionnaire meet the Croabach Alpha threshold values of greater than 0.7, indicating that respondents in this study provide strong, reliable and consistent answers to all questions in the questionnaire.

The result of Multiple Regression Analysis in Table 1 depict an acceptable R-square value of 0.914. This indicates that 91.4% the variance in worker with disability retention is explained by the four independent variables (training and development, compensation, work environment, work-life balance).

There is a significant positive relationship between training and development and the worker with disability's intention to stay in small and medium enterprises. Training and development is the most important factor that affects worker with disability's retention in small and medium enterprises with the highest standardized beta coefficient of.661. There is also a significant relationship between work environment and the worker with disability's intention to stay, significant at p-value 0.028 and standardized beta coefficient 0.207. There is also a significant positive relationship between the work-life balance and worker with disability's intention to stay in small and medium enterprises. The result is significant at p-value of 0.012 and standardized beta coefficient of 0.149. .Nevertheless, the analysis result shows insignificant relationship between compensation and worker with disability's intention to stay in small and medium enterprises.

Respondents claim that they will definitely be working for small and medium enterprises for the next five years if they are given adequate training and development opportunity to explore and advance their job skills and capabilities. Comfortable and disability friendly working aids and working environments are also important in retaining worker with disability as they may require special designed aids, facilities or toolkits to facilitate their jobs and movements at the workplace. Work family balance is also an important determinant for worker with disability to remain in touch with family members while working to seek for assistance. These factors suppress the importance of compensation in retaining worker with disability in small and medium enterprises.

TABLE 1. MULTIPLE LINEAR REGRESSION

	Unstandardized Coefficients		Standardized Coefficients	t	P-value
	B	Std. Error	Beta		
(Constant)	.035	.091		.382	.703
Training and Development	.670	.082	.661	8.130	.000
Compensation	-.047	.101	-.046	-.466	.642
Work Environment	.213	.096	.207	2.217	.028
Work-life Balance	.149	.091	.148	1.641	.012

4

IV. CONCLUSION

Training and development is the most important determinant of worker with disability retention, followed by work environment and work-life balance.

ACKNOWLEDGEMENT

The authors would like to express appreciation for the support of Ministry of Education Malaysia for providing Fundamental Research Grant Scheme to support this research project. [Project Number (FRGS/1/2017/SS03/MMU/03/1)].

REFERENCES 4

[1] Khan, N., Korac-Kakabadse, N., Skouloudis, A., & Dimopoulos, A. (2019). Diversity in the workplace: An overview of disability employment disclosures among UK firms. Corporate Social Responsibility and Environmental Management, 26(1), 170-185.

[2] Kim, W. H., & Nam, J. K. (2019). Corporations May Hire More People with Disability Through Public Employment Support Services: Propensity Score Matching Analysis. Rehabilitation Counseling Bulletin, 62(4), 243-252.

[3] Miethlich, B., & Šlahor, Ľ. (2018). Employment of worker with disability as a corporate social responsibility initiative: Necessity and variants of implementation. In Innovations in Science and Education, CBU International Conference, Prague, 21-23.03. 2019 (pp. 350-355). Prague: CBU Research Institute Sro

[4] Naraharisetti, R., & Castro, M. C. (2016). Factors associated with worker with disability employment in India: a cross-sectional study. BMC public health, 16(1), 1063.

[5] Talib, R. I. A., Sunar, M. S., Nikolic, P. K., & Mohamed, R. (2018, November). Building an Ecosystem to Support Social Mobility for Person with Disability (worker with disabilitys): Malaysia Context. In EAI International Conference on Smart Cities within SmartCity360° Summit (pp. 497-506). Springer, Cham.

[6] Wahab, H. A., & Ayub, Z. A. (2017). Employment right of worker with disability in Malaysia. In Social Interactions and Networking in Cyber Society (pp. 217-232). Springer, Singapore.

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THE EFFECTS OF DIGITAL FINANCIAL LITERACY AND ADOPTION OF FINANCIAL TECHNOLOGY TOWARDS THE RETIREMENT PLANNING BEHAVIOUR AMONG MALAYSIANS

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Abstract - **Improved longevity and declined mortality rate with advanced medical healthcare over the years have burdened personal well-being after retirement in terms of finance. The digital inclusion of the finance sector has provided alternatives for Malaysians to adopt financial technology to plan for retirement. However, it is still doubtful with regards to the benefits and risks of the adoption of financial technology due to the unpreparedness of the society and poor regulation. Lately, the acknowledgment of digital financial literacy is promoted to be one of the predictors which significantly influence one's retirement planning behaviour. This paper proposes to examine the relationships between the adoption of financial technology and digital financial literacy in retirement planning behaviour among Malaysians. Individuals who are willing to adopt financial technology tend to adopt more digital financial products and services in their retirement portfolios. The individual with enhanced digital financial literacy tends to improve their retirement planning behaviour in terms of saving and investing which could dampen their over-spending urge. Younger adults are found to adopt more financial technology while planning for retirement whereas older adults adopt less financial technology due to the declining tech-savviness and social isolation.**

Keywords— Digital Financial Literacy; Adoption of Financial Technology; Retirement Planning; Financial Planning; Robo-Advisor

I. Introduction

The increase in life expectancy due to improved living standard and technological advancement in the healthcare sector have created a risk called "longevity risk" among the individuals. Longevity can be a two-edged sword as it could cause the population in a country to age and thus become a burden to the current pension system designed primarily to cater for shorter human lifespans. It may influence one's well-being after retirement when there are unforeseen occurrences of economic crisis, inflation and increased living cost. According to Nga and Yeoh (2018), Malaysia will transform and become an ageing nation by 2050. Most Asian countries including Malaysia imposed the mandatory retirement age which is 60 years old. Therefore, a rising number of retired populations per each household increases the dependency ratio of the country which creates many negative implications on the social security schemes. Besides this, it also exacerbates many issues including imposing higher burden on the next generation to provide care and support financially to the elderly. Hence, these are the concerns that need to be addressed in one's financial planning in particular related to sustainability of their savings, investment earnings and spending behaviour to live a comfortable life after retirement. Based on Moorthy et al. (2012) and Mahdzan et al. (2017), Malaysians are found to have underprepared for their retirement and the younger generations habitually spend extravagantly without adequate financial planning for retirement. Based on the World Bank Data, there is only 60.8 per cent working adults in Malaysia actively save parts of their salary earnings to the Employee Provident Fund (EPF) (Noorshahrizam, 2020). Low-income workers are found to be not saving enough for their pension.

With digital financial inclusion, the revolution of digital financial technology on the various types of financial applications has reshaped the retirement planning process in Malaysia. Malaysians are given more opportunities to plan for their finance with the emergence of Robo Advisory system. However, these changes reshape the whole financial environment in terms of the regulatory framework, new ethical consideration, data and privacy concern and the challenges of the adoption of financial technology while individuals prepare for their retirement (Fisch et al., 2019). Other than that, by adopting the Robo-advisor, it helps the younger generation with less investment experience to re-allocate their investment profile and develop an unbiased financial decision(Fisch et al., 2019). The older generation is a population which faces the challenges to adopt the financial technology while planning for retirement due to the declined tech-savviness and social isolation (Setiawan et al., 2020). Based on Klapper et al. (2017), people who are lack of basic financial literacy are unlikely to plan for their retirement in terms of saving, spending and investing. Therefore, digital financial literacy is promoted and acknowledged to be one of the key determinants to influence one's retirement planning behaviour in this era of Industry Revolution 4.0. The adoption of financial technology in terms of Robo-advisor and the implication of digital financial literacy towards retirement planning behaviour among Malaysians are still left unexplored. Hence, in this study, the impacts of adoption of financial technology and digital financial literacy on retirement planning behaviour need to be examined to improve Malaysians' future social-economic standard in Malaysia.

II. Methodology

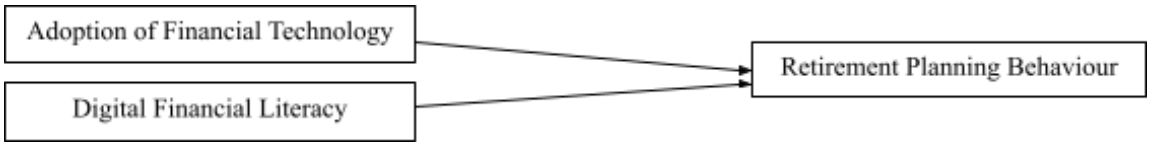

Figure 2. 1 Research Framework

In this research, the quantitative method will be used and the survey method will be selected to collect the data. The targeted population will be Malaysian adults in Malaysia who are aged of 18 years old and above. The non-probability sampling will be used, specifically, quota sampling and purposive sampling will be applied in this study. In quota sampling method, the targeted respondents will be selected based on the races, gender and age to fit for the elements of Malaysian total population to represent the composition. Other than that, purposive sampling method is developed to filter the respondents who hold at least one online banking account to enjoy the features of digital financial technology. Based on the Statista (2019), the population of Malaysian adults who are age of 18 and above are about 21.82 million. Hence, 384 respondents will be selected according to the assumptions of sampling size in the population with 5 per cent of margin error (Saunders et al., 2019). Furthermore, it is difficult to get 100 per cent of response rate from the respondents, therefore, 450 sets of self-administered questionnaire will be distributed to Selangor, Kuala Lumpur and Malacca through online google form. These states are selected due to the population distribution and characteristic of Malaysian basic demographic referred from the Census Report 2010 (Department of Statistics Malaysia, 2010). Then, the data collected will be analysed using the IBM SPSS Statistics version 24 to do the data screening, descriptive analysis and normality test whereas the Structural Equation Model (SEM) using Smart-PLS 3.0 will be utilised to measure the validity and reliability of the model in the study.

III. Findings

Gerlach and Lutz (2019) indicate that people who adopted the e-banking services earlier have higher acceptance rate in adopting other digital financial technologies in the future. Other than that, the adoption of Robo-advisory system positively influences one's intention to prepare for retirement financially online (Fisch et al., 2019). Setiawan et al. (2020) prove that the level of digital financial literacy influences one's spending and saving behaviour in India. Most people in India are lack of digital financial literacy on the e-investment and e-saving products. However, generally, individuals in India are familiar with e-borrowing products. This shows the importance of getting the necessary education especially with regards to the usage of sophisticated financial technologies. This will then create awareness of both potential risks and benefits among the individuals in adopting the digital financial technology while planning for retirement to ensure a comfortable retirement in future (Yoshino et al., 2020).

IV. Conclusion

The goal of this research is to examine the willingness of Malaysians to adopt the financial technology while planning for retirement and to determine the level of digital financial literacy which may influence individual retirement planning behaviour. The adoption of Robo-advisors is more preferable compared with using a human financial advisor due to high transparency, low cost and low required account balance. Robo-advisors might be popular among the low-income workers who are unable to afford the traditional financial advisory services. Besides, individual education background and income level are the key determinants to affect one's level of digital financial literacy which could influence individual financial planning behaviour in future.

ACKNOWLEDGEMENT

We thank to the Ministry of Higher Education (MOHE) for financial support through Fundamental Research Grant Schemes (FRGS) (FRGS/1/2018/SS05/MMU/03/1)

References

[1]Faezah, N., Talib, M., & Manaf, H. A. (2017). Attitude towards Retirement Planning Behaviour among Employee's. *Journal of Business and Management*, *1*(1), 15–21. Retrieved from https://www.ijbmjournal.com/uploads/2/6/8/1/26810285/004-ijbm-12 17.pdf%0Ahttp://www.ijbmjournal.com/uploads/2/6/8/1/26810285/nurul__15-21_.pdf

[2]Fisch, J. E., Labouré, M., & Turner, J. A. (2019). The Emergence of the Robo-Advisor. In *The Disruptive Impact of FinTech on Retirement Systems*. https://doi.org/10.1093/oso/9780198845553.003.0002

[3]Gerlach, J. M., & Lutz, J. K. T. (2019). Evidence on Usage Behavior and Future Adoption Intention of Fintechs and Digital Finance Solutions. *The International Journal of Business and Finance Research*, *13*(2), 83–105.

[4]Hassan, K. H., Rahim, R. A., Ahmad, F., Tengku Zainuddin, T. N. A., Merican, R. R., & Bahari, S. K. (2016). Retirement Planning Behaviour of Working Individuals and Legal Proposition for New Pension System in Malaysia. *Journal of Politics and Law*, *9*(4), 43. https://doi.org/10.5539/jpl.v9n4p43

[5]Klapper, L., Lusardi, A., & van Oudheusden, P. (2017). Financial Literacy Around the World: Insights From the Standard & Poor's Ratings Services Global Financial Literacy Survey. *S&P Global FinLit Survey*, 1–27. Retrieved from http://www.openfininc.org/wp-content/uploads/2016/04/2015-Finlit_paper_17_F3_SINGLES.pdf

[6]Mahdzan, N. S., Mohd-Any, A. A., & Chan, M. K. (2017). The influence of financial literacy, risk aversion and expectations on retirement planning and portfolio allocation in Malaysia. *Gadjah Mada International Journal of Business*, *19*(3), 267–289. https://doi.org/10.22146/gamaijb.24441

[7]Moorthy, K., Chelliah, T., Shu Sien, C., Chin Leong, L., Ze Kai, N., Choy Rhu, W., & Yoke Teng, W. (2012). A Study on the Retirement Planning Behaviour of Working Individuals in Malaysia. *International Journal of Academic Research in Economics and Management Sciences*, *1*(2), 54–72. https://doi.org/10.22038/ijorl.2017.20807.1775

[8]Ng, T.-H., Tay, W.-Y., Tan, N.-L., & Lim, Y.-S. (2011). Influence of Investment Experience and Demographic Factors on Retirement Planning Intention. *International Journal of Business and Management*, *6*(2). https://doi.org/10.5539/ijbm.v6n2p196

[9]Saunders, M., Lewis, P., & Thornhill, A. (2019). Chapter 4: Understanding research philosophy and approaches to theory development. In *Research Methods for Business Students*.

[10]Setiawan, M., Effendi, N., Santoso, T., Dewi, V. I., & Sapulette, M. S. (2020). Digital financial literacy, current behavior of saving and spending and its future foresight. *Economics of Innovation and New Technology*, *0*(0), 1–19. https://doi.org/10.1080/10438599.2020.1799142

[11]Yoshino, N., Morgan, P. J., & Long, T. Q. (2020). Financial Literacy and Fintech Adoption in Japan. In *Asian Development Bank Institute Working Paper 1095*. Retrieved from https://www.adb.org/publications/financial-literacy-fintech-adoption-japan

VALIDATING THE INTENTION – BEHAVIOUR GAP BETWEEN ENVIRONMENT FRIENDLY LIFESTYLYE AND THE PREVALENCE OF NCD AMONG VULNERABLE POPULATION

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Abstract - This study analyzes the current status of NCD prevalence in Malaysia, the intervention strategies devised by the government through its National Strategic Plan for Non Communicable Diseases (NSPNCD) and the current and more stringent measured announced in 2017.The study aims to find the gap in implementation of intended environment friendly lifestyle, promoted as the major decelerating factor for NCD prevalence and the actual condition in reduction achieved in the country, by employing an Intention-Behaviour Gap modelling. The findings are expected to contribute to the existing knowledge and understanding as there is no-known study to measure the intention and behaviour towards environmentally friendly lifestyle and its impact on NCD prevalence in Malaysia..

***Keywords*— Non-Communicable Disease, Intension –Behaviour gap, Malaysia, Environmental- friendly lifestyle, Malaysia**

I. Introduction

Protection of health is a dynamic and lifelong learning process that every society experiences in order to achieve the capable and potential socioeconomic development. In the 21th century world, the prevalence and propagation of non-communicable diseases (NCDs) has become an important cause of death and disability. NCDs have resulted in 36 million deaths in 2008, accounting for 63% of the global death toll of 57 million that year. 80 - 90% of the 9 million NCD deaths that occurred below 60 years of age, have occurred in low and middle-income countries (WHO 2021). Changing levels of physical activity and dietary patterns have been found as major contributing factors to increasing obesity and hence an increasing prevalence of NCDs

II. methodology

This study will be conducted in four Malaysian states namely Perak, Pahang, Johor, Terengganu each representing regions with higher prevalence of NCD (NCD Annual Report) The samples of NCD patients will be randomly selected. A structured questionnaire will be used in collecting the data which include – details of the household, social and economic background, status and well-being etc. Secondary data will be collected from the Ministry of Health, Malaysia, World Health Organisation (WHO), Department of Statistics and Malaysian Health data Warehouse (MyHDW). The study will adopt the stratified random sampling technique to select the samples and will collect complete data from 500 vulnerable groups, which are expected to be sufficient to test the model, based on the recommendation by Wolf et al.(2013).The statistical analyses will be carried out using SPSS and Smart PLS.

III. results/ Findings

This study is expected to contribute to our understanding and the knowledge of how aging NCD-prone population behaves to a unique set of variables. This understanding could lead to creating new marketing campaigns, partnerships and investments to influence their intention, attitude, norms and behaviours. It also incorporates components from diffusion of innovation theory (i.e., the relative advantage) to provide a satisfactory explanation to the intention-behaviour gap. Findings of this study provide opportunities for the policy makers to find ways to educate mass prone populations to adapt environmentally friendly lifestyle and to help them overcome the ill-effects of NCD.

IV. CONCLUSION

This study incorporates components from diffusion of innovation theory (i.e., relative advantage) to provide a satisfactory explanation for the intention-behavior gap. All the findings are expected to contribute to the existing knowledge and understanding as there is no known study so far to measure the intention and behavior towards environmentally friendly life-style among the vulnerable groups in Malaysia.

ACKNOWLEDGEMENT

The authors would like to express appreciation for the support of Ministry of Higher Education (MOHE), Malaysia, under the FRGS Grant.

REFERENCES

[1] Azimi I, Rahmani AM, Liljeberg P et al , Internet of things for remote elderly monitoring: a study from user-centered perspective. J Ambient Intell Humanized Comput 8:273–289, (2017).

[2] Chan, M., Estève, D., Fourniols, J.-Y., Escriba, C., Campo, E., (2012). Smart wearable systems: current status and future challenges. Artif. Intell. Med. 56 (3), 137–156, 2012

[3] Goodkind D, Kowal PR,International population reports. US Census Bureau. https://www.census.gov/content/dam/Census/library/publications/2016/demo/p95-16-1.pdf. Accessed 19 Sep 2019

[4] Li, X., Lu, R., Liang, X., Shen, X., Chen, J., Lin, X., Smart community: an internet of things application. IEEE Commun. Mag. 49 (11), 68–75, 2011

[5] World Health Organization (2019). None-communicable Diseases Country Profile. Retrieved from https://www.who.int/nmh/countries/*mys*_en.pdf (19/11/2019).

What cause adolescents to initiate smoking intention?

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Abstract – The prevalence of smoking rate among Malaysian adolescents is an undeniable critical issue. The smoking rate is still worrying though various intervention programs have been conducted by the government. The detrimental effects of smoking can cause a social and financial burden to the government. Therefore, this study aims to utilize problem behavior theory and positive psychology to examine the potential factors that influence the adolescents' intention to smoke. A structured questionnaire will be developed and distributed to a targeted sample of 400 school-going students. Structural equation modeling will be used for data analysis. The expected results will provide useful information to regulators to design smoking intervention program.

Keywords- tobacco initiation, adolescents, problem behavior theory, positive emotion

I. Introduction

In Malaysia, the prevalence of smoking among adolescents is worrying. One out of ten school-going adolescents were current smokers. The smoking rate among the adolescents was increased to 13.8% in 2017 from 11.5% in 2012 (Institute for Public Health, 2018).

This study focuses on adolescents as 80% of adult smokers initiate smoking at the young age (<20 years old) and start smoking at the young age can trigger higher exposure to smoking-related diseases. There is a greater likelihood that adolescents become permanent smoker (Lim et al., 2019). Smoking behavior is learned and starts from the young age. Besides, smoking at the young age can cause social and economic problem to the country. Therefore, this study reviews the literature that study the factors influencing the adolescents to initiate smoking. The aim is to develop a research framework that meets the research gap.

II. methodology

This study reviews the existing literature with the aim to build a research framework. A total of 124 articles from the existing literature is examined.

III. results/ Findings

From the review of literature in smoking research, most theories employed are theory of planned behaviour (Brown et al., 2010 and McGee et al, 2015), social learning theory (Dahlui et al., 2015; McGee et al., 2015), theory of reasoned action (Brown et al., 2010; Jimba et al., 2012). For the data collection techniques, a number of researches used review paper (Wellman, 2016; Ho, 2019) and survey (Jimba, 2012; Nur Atikah et al., 2019).

In the aspect of constructs used in the literature, most studies examine social demographics factors (Lee et al., 2019; Nur Atikah et al., 2019), attitude (Kaleta et al., 2017; Kim et al., 2020), knowledge (Abidin et al., 2014; Lim et al., 2019), Interpersonal factors (Bobo, 2018; Kim et al., 2019), education & sport factors (Zenic, 2017), family factors (Cambron, 2017), psychological factors (Mohammadpoorasl et al., 2012) and personality system, perceived environment system, and behavior system (Chun et al., 2020; Lee et al., 2019).

Under the methodology, techniques such as frequency analysis (Zarallo et al., 2019), Anova analysis (Stevens et al., 2005; Duncan et al., 2018), multivariate regression analysis (Pentza, 2019), logistic

Under the methodology, techniques such as frequency analysis (Zarallo et al., 2019), Anova analysis (Stevens et al., 2005; Duncan et al., 2018), multivariate regression analysis (Pentza, 2019), logistic regression model (Flay et al., 1989; Mohammadpoorasl et al., 2012) and experiment test (Leatherdale & Cole, 2015) have been employed.

IV. CONCLUSION

A majority of theories used are theory of plan behaviour and social learning theory in which less attention has been given to positive psychology. At the same time, sensation seeking, which is one of the important characteristics exhibited by adolescents, is not given much focus. Therefore, this study develops a framework which incorporates both positive emotion and sensation seeking in smoking intention of adolescents.

ACKNOWLEDGEMENT

The authors would like to express appreciation for the support of the sponsors from Ministry of Higher Education, Fundamental Research Grants Scheme [Project Number 190044].

REFERENCES

[1] A. H. Nur Atikah *et al.*, "Factors associated with different smoking statuses among Malaysian adolescent smokers: A cross-sectional study," *BMC Public Health*, vol. 19, 2019.

[2] A. K. Brown, C. Moodie, G. Hastings, A. M. Mackintosh, L. Hassan, and J. Thrasher, "The association of normative perceptions with adolescent smoking intentions," *J. Adolesc.*, vol. 33, no. 5, pp. 603–614, 2010.

[3] A. Mohammadpoorasl, S. Nedjat, K. Yazdani, A. Fakhari, A. R. Foroushani, and A. Fotouhi, "Intention to start smoking and its related factors in never smoked adolescents in Tabriz, 2010," *Int. J. Prev. Med.*, vol. 3, no. 12, pp. 880–886, 2012.

[4] B. R. Flay, D. Koepke, S. J. Thomson, S. Santi, J. A. Best, and K. S. Brown, "Six-year follow-up of the first Waterloo school smoking prevention trial," *Am. J. Public Health*, vol. 79, no. 10, pp. 1371–1376, 1989.

[5] C. Cambron, R. Kosterman, R. F. Catalano, K. Guttmannova, and J. D. Hawkins, "Neighborhood, Family, and Peer Factors Associated with Early Adolescent Smoking and Alcohol Use," *J. Youth Adolesc.*, vol. 47, no. 2, pp. 369–382, 2017.

[6] C. E. McGee *et al.*, "Influence of family and friend smoking on intentions to smoke and smoking-related attitudes and refusal self-efficacy among 9-10 year old children from deprived neighbourhoods: A cross-sectional study," *BMC Public Health*, vol. 15, no. 1, p. 225, 2015.

[7] D. Kaleta, K. Polanska, P. Wojtysiak, and F. Szatko, "Involuntary smoking in adolescents, their awareness of its harmfulness, and attitudes towards smoking in the presence of non-smokers," *Int. J. Environ. Res. Public Health*, vol. 14, no. 10, 2017.

[8] F. T. Bobo, P. Thanasekaran, A. J. R. Joice, B. Yadecha, and A. Alebel, "Susceptibility to cigarette smoking and associated factors among high school students in western Ethiopia," *BMC Res. Notes*, vol. 11, no. 1, Aug. 2018.

[9] G. R. Zarallo, M. Zoraida, C. Chamorro, A. G. Luque, and R. M. Condón, "Prevalence and Factors Related to Tobacco Use in Adolescent Students," 2019.

[10] Institute for Public Health, "National Health And Morbidity Survey (NHMS) 2017 : Key Findings from the Adolescent Health and Nutrition Surveys," 2018.

[11] J. Chun, M. Yu, J. Kim, and A. Kim, "E-Cigarette, Cigarette, and Dual Use in Korean Adolescents: A Test of Problem Behavior Theory," *J. Psychoactive Drugs*, vol. 52, no. 1, pp. 27–36, 2020.

[12] J. H. Lee, C. W. Striley, C. Custodero, H. A. Rocha, and R. G. Salloum, "Association of pleasant sensations at cigarette smoking initiation with subsequent tobacco product use among U.S. adolescents," *Addict. Behav.*, vol. 89, pp. 151–155, 2019.

[13] J. Kim, G. E. K. Mph, and A. M. Bs, "Transforming Influence To Wellness: Identifying Adolescents' Affect And Preferences During The Preliminary Design Of A Social Board Game For Tobacco Prevention," *J. Adolesc. Heal.*, vol. 66, no. 2, pp. S132–S133, 2020.

[14] K. H. Lim *et al.*, "Smoking susceptibility among non-smoking school-going adolescents in Malaysia: Findings from a national school-based survey," *BMJ Open*, vol. 9, no. 10. 2019.

[15] K. Tolani Jimba and S. Manoj, "Ethnic Differences in Susceptibility to Smoking and Intention to Smoke on Smoking Behavior among Adolescents," *J. Community Med. Health Educ.*, vol. 02, no. 04, 2012.

[16] L. R. Duncan, K. D. Hieftje, T. M. Pendergrass, B. G. Sawyer, and L. E. Fiellin, "Preliminary investigation of a videogame prototype for cigarette and marijuana prevention in adolescents," *Subst. Abus.*, vol. 39, no. 3, pp. 275–279, Jul. 2018.

[17] M. A. Pentz *et al.*, "Addictive Behaviors A videogame intervention for tobacco product use prevention in adolescents," *Addict. Behav.*, vol. 91, pp. 188–192, 2019.

[18] M. Dahlui *et al.*, "Risk and protective factors for cigarette use in young adolescents in a school setting: What could be done better?," *PLoS One*, vol. 10, no. 6, pp. 1–12, 2015.

[19] N. Zainol Abidin *et al.*, "Knowledge, attitude and perception of second-hand smoke and factors promoting smoking in Malaysian adolescents," *Int. J. Tuberc. Lung Dis.*, vol. 18, no. 7, pp. 856–861, 2014.

[20] N. Zenic *et al.*, "Prospective analysis of the influence of sport and educational factors on the prevalence and initiation of smoking in older adolescents from Croatia," *Int. J. Environ. Res. Public Health*, vol. 14, no. 4, 2017.

[21] P. N. Lee, K. J. Coombs, and E. F. Afolalu, "Considerations related to vaping as a possible gateway into cigarette smoking: an analytical review," *F1000Research*, vol. 7, 2019.

[22] R. J. Wellman, E. N. Dugas, H. Dutczak, E. K. O, G. D. Datta, and B. Lauzon, "Predictors of the Onset of Cigarette Smoking A Systematic Review of Longitudinal Population-Based Studies in Youth," *Am. J. Prev. Med.*, vol. 51, pp. 767–778, 2016.

[23] S. L. Stevens *et al.*, "An exploration of self-reported negative affect by adolescents as a reason for smoking : Implications for tobacco prevention and intervention programs," vol. 41, pp. 589–596, 2005.

[24] S. T. Leatherdale and A. Cole, "Examining the impact of changes in school tobacco control policies and programs on current smoking

and susceptibility to future smoking among youth in the first two years of the Compass Study: Looking back to move forward," *Tob. Induc. Dis.*, vol. 13, no. 1, 2015.

[25] S. Y. Ho *et al.*, "Adolescent Smoking in Hong Kong : Prevalence , Psychosocial Correlates , and Prevention," *J. Adolesc. Heal.*, vol. 64, no. 6, pp. S19–S27, 2019.

What determine the support to equity crowdfunding?

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Abstract - Equity crowdfunding is an innovative online fundraising by small and medium enterprises. From the investors' perspective, it provides an investment avenue to them. However, little had been done to understand the factors that encourage retail investors to supply their capital through this platform. This study, hence, investigates how financial return, novelty experience, investment risk, technology risk and age affect the support to the investment in equity crowdfunding for a pool of 140 retail investors. The results indicate that all the proposed factors affect the investors' decision except for technology risk. This tells that the investors are willing to take risk and feeling good to make such investment with the aim to earn a higher return. At the same time, they are also concerned about the information they have and age is not a factor which hinders them from investing in equity crowdfunding.

Keywords— equity crowdfunding, retail investors, risk

I. Introduction

In present, retail investors can access to a variety of investment opportunities leveraging on the advancement of technology. One of that is equity crowdfunding investment. Equity crowdfunding investment (ECF) is defined as an investment avenue that investors can invest their money in small and medium enterprises through an online platform. The investors hold an equity form of capital in the company. In Malaysia, equity crowdfunding platforms were in operation in year 2015. Since then, the market was growing progressively over the years but its performance started to decrease in year 2017. The awareness of this asset class is also not common to most retail investors. Therefore, an understanding on what motivate retails investors to invest in equity crowdfunding investment is needed. Specifically, this study examines how financial return, novelty experience, investment risk, technology risk and age influence retail investors decision in equity crowdfunding investment.

In the literature, financial return has a positive relationship with the support of ECF (Hemer, 2011) and investors look for novelty experience when investing in such asset class investment (Green et al., 2015; Angerer et al., 2017). Investment risk tends to delay projects' implementation (Jun et al., 2011) while technology risk, such as project system risk, causes an uncertainty to the decision-making of investors (Chen et al., 2018).

II. methodology

This study uses a survey data with a total of 140 samples. The data is then analysed using structural equation modelling in which both measurement and structural models are performed. The reflective model is used in which financial return, novelty experience, investment risk and technology risk are the exogenous variables while the support to ECF is the endogenous variable. Age acts as the control variable.

III. RESULTS/ FINDINGS

Tests under the measurement model are conducted and all meet the assessment criteria. Table 1 presents the key results under the structural model.

TABLE 1. STRUCTURAL EQUATION MODELLING

Relationship	Coefficient	Standard Deviation	T Statistics	P Values
Financial return -> Support to ECF	0.13	0.058	2.264	0.012**
Novelty experience -> Support to ECF	0.537	0.08	6.727	0**
Investment risk -> Support to ECF	0.173	0.102	1.689	0.046**
Technology risk -> Support to ECF	0.066	0.079	0.835	0.202
Age -> Support to ECF	0.154	0.063	2.446	0.007**

IV. CONCLUSION

All the independent variables, financial return, novelty experience, investment risk and age positively affect the support of investors toward equity crowdfunding investment. The only exception is technology risk. The technology risk that investors may face does not hinder them from supporting equity crowdfunding investments. Most likely, the Malaysian retail investors are technology savvy and they embrace technology in making their investing decision.

ACKNOWLEDGEMENT

The authors would like to express appreciation for the financial support of Malaysia of Higher Education, Fundamental Research Grant Scheme, FRGS [Project Number 170019].

REFERENCES

[1] Angerer, Martin; Brem, Alexander; Kraus, Sascha; Peter, Andreas, "Start-up funding via equity crowdfunding in Germany: A qualitative analysis of success factors", 2017, The Journal of Entrepreneurial Finance (JEF), ISSN 1551-9570, The Academy of Entrepreneurial Finance (AEF), Montrose, CA, Vol. 19, Iss. 1, pp. 1-34

[2] Chen, J., Chen, L., Qian, C. and Xie, K. (2018), "Decision Making in Crowdfunding Under Risk Analysis", Proceedings of the 51st Hawaii International Conference on System Sciences, pp. 1463–1472.

[3] Green, A, Tunstall, RJ and Peisl, T (2015) The benefits of crowdfunding for early-stage entrepreneurs: Between finance gap and democratic involvement. In: UNSPECIFIED R&D Management Conference, 23-26 Jun 2015, Pisa, Italy. RADMA .

[4]Hemer, J. "A snapshot on crowdfunding", 2011, Arbeitspapiere Unternehmen und Region, No. R2/2011, Fraunhofer ISI, Karlsruhe

[5] Jun, L., Qiuzhen, W. and Qingguo, M. "The effects of project uncertainty and risk management on IS development project performance: A vendor perspective", 2011, International Journal of Project Management, Vol. 29 No. 7, pp. 923–933.

[6] Yuniningsih, Y., Widodo, S., & Wajdi, M. B. N. "Entrepreneurship and Business Development", 2017, Volume 1, Number 2. 2018. ISSN. 2597-4785 (online). ISSN: 2597- 4750 (Printed). Economic: Journal of Economic and Islamic Law, 8(2), 122–128.

ACKNOWLEDGEMENT

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e ISBN 978-967-19560-6-9