DEVELOPMENT OF AUGMENTED REALITY SYSTEM FOR ELECTRICAL ENGINEERING COURSE

RESEARCH MANAGEMENT INSTITUTE (RMI)
UNIVERSITI TEKNOLOGI MARA
23000 DUNGUN, TERENGGANU
MALAYSIA

BY :

NUR IDAWATI MD ENZAI
NORHAYATI AHMAD
SYAZILAWATI MOHAMED
SITI SARA RAIS
MOHD AMIR HAMZAH AB GHANI
NURAIZA ISMAIL

SEPTEMBER 2020

3. Acknowledgements

Special acknowledgment goes to Universiti Teknologi MARA (UiTM) Cawangan Terengganu Kampus Dungun for the Special Interest Group Grant, (SIG) - 600-UITMCTKD (PJI/RMU/ST/DANA SIG 5/2/1) Jld.4 Dst (05/2019) for funding the research activities.

5. Report

a. Proposed Executive Summary

The Fourth Industrial Revolution (Industry 4.0) has shaped the direction of education sector in Malaysia towards digital transformation to stay ahead of the game. This in particular affects higher education system as it is directly related to supply of industrial workforce. However, there has been serious concern regarding decrease of enrolment in science, technology, engineering and mathematics (STEM) courses. One of identified main factors is lack of students' interest in STEM due to uninteresting approach of teaching and learning. According to Education Development Plan (Higher Education) 2015-2025, one way of addressing the challenges of Industry 4.0 is through incorporation of integrated learning model as key pedagogy method. This research selects Augmented Reality (AR) Method for learning and teaching model development. AR is known for its ability to overlay rich media into the real world by viewing through web-enabled devices such as phones and tablets, making it accessible anywhere anytime. In addition to improving interest and motivation of students during learning process, AR could also address the financial and space constraints pertaining to STEM laboratory equipment and apparatus. This research will start by conducting literature on the requirements for an AR system with respect to electrical engineering education framework. The AR system will be developed according to system development method by using Assemblr software. The developed AR system will be tested and evaluated through selected course assessment. Surveys will be conducted on lecturers and students of the course to determine usability. Effectiveness will be measured based on the comparison of results before and after using AR. New Augmented Reality teaching tool that can be applied to multiple knowledge is expected to be produced for the benefit of both educators and students. The outcome of this research will support government's inspiration in encouraging and expanding educational exports that drive innovation and invention culture in developing a first world talent base to feed the Education National Key Economic Area (NKEA).

b. Enhanced Executive Summary

Engineering education in particular requires substantial equipment and apparatus and this poses safety risks as well as financial constraints. Recent pandemic has also affected engineering education teaching and learning process as all the classes as well as laboratory sessions need to be conducted via online distance learning (ODL) method. Therefore, this research selects Augmented Reality (AR) Method for innovative teaching and learning process. AR is known for its ability to overlay rich media into the real world by viewing through web-enabled devices such as phones and tablets, making it accessible anywhere anytime. In addition to improving interest and motivation of students during learning process, AR could also address the financial and space constraints pertaining to science and technology laboratory equipment and apparatus. In this research, an AR has been developed according to system development method by using Assemblr application. The developed AR system is then given to selected educators for them to evaluate in terms of their awareness and the system's usability. The educators' responses are obtained through a questionnaire survey and the findings are

then analysed and presented in this paper. The responses are taken into account for improving the AR system and the development process will be continued in parallel with more testings. The final prototype will then be implemented in real classes in the future.

c. Introduction

The integration of technology in our daily routine has immensely increased over the last decade as our society finds its new way of living especially during the global pandemic time. The repercussion of it served as a catalyst to technologists and innovators to devise a fresh approach in easing our way of life. The move seems to mitigate the dependency of human in general. Several fields of study would require less face to face interaction but on the up side, this is a situation where technology would excel by introducing fun and interactive ways of problem solving. The constant change of learning methodology or pedagogy in education field is something to look forward to as Education 5.0 is looming. The widely available Augmented Reality (AR) used to be regarded as complex and hard to manoeuvre type of tools but technology did improve and accessibility of it through various platforms help ease people into it. Augmented Reality provides an environment where virtual and physical objects can be intertwined. It allows rich educational experience for teaching and learning process without requiring existence of physical object by making use of AR application or software on mobile devices (Billinghurst, 2002). The application of AR in education specifically has substantial improvement in terms of promoting students to engage, stimulate and motivate in learning.

d. Brief Literature Review

Many researchers had implemented the AR in education either directly or not for example in medical applications and training simulations (Yuen, Yaoyuneyong, & Johnson, 2011). The features that make AR suitable for learning experience are: interaction with 3D synthetic objects, good utilization of mobile devices and location-tracking, sense of involvement for the learners, as well as virtual realization of invisible concepts or scenarios (Wu, Lee, Chang, & Liang, 2013). AR also worked well in higher education setting, in particular when it comes to courses which involve mechanisms of machinery and systems as well as complicated theories (Bower, Howe, McCredie, Robinson, & Grover, 2014). Contextual enriched interaction with AR technology helps clarifying the complex concepts for the students. Among the subjects that utilize AR as one of its education tools are astronomy, chemistry, physics, biology, mathematics and geometry (Lee, 2012). Review studies which concentrate on possible factors of AR in education was conducted in (Bacca, Baldiris, Fabregat, & Graf, 2014). Based on their studies, Science tops the usage of AR in education with 40.6%, followed by 21.9% of humanities and arts and 15.6% of engineering, manufacturing and construction. AR was also incorporated into a sewing workshop to implement better learning method compared to conventional. The students' results have shown improvement in their learning experience and understanding, subsequently proving that AR works well in portraying complex concepts (Yip, Wong, Yick, Chan, & Wong, 2019). On the other hand, (Akçayır & Akçayır, 2017) highlighted the challenges

Contents