

Chapter 14

NetmAR: Mobile-Augmented Reality for Teaching and Learning

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Abstract

In the current digital era, there are various way of learning using digital devices that includes laptop, smartphone and projector. With the emergence of technology such as Augmented Reality, mobile-Augmented Reality(mAR) application development was possible to be used for education purpose. NetmAR or Network Fundamental mobile-Augmented Reality application was developed to help student visualize and understand the concept, then view 3D models of networking device using their smartphone. AR helps merged the virtual content with real physical environment to help student feel as if the device is in front of them, students are also able to interact with the 3D object through touch, zoom, voice and information to make the learning process interactive between students and the device rather than just reading text.

Introduction

The use of mobile learning in higher education has contributed to the effectiveness of its implementation at various universities in Malaysia. Mobile learning is defined as the use of mobile or wireless devices for the purpose of learning while on the move. The concept of mobile learning starts from e-learning and distance learning revolution of the 18th and 19th century. Mobile devices allow students to extend their academic knowledge through emails, portals, e-library, internet-based information and group projects, thus, aiding them during the time they are studying. Mobile devices vary from laptop, smartphones and tablets which majority of student have access with affordable price while having an acceptable computing power for learning. However, the use of mobile device for educational purposes is still low if compared to entertainment activities on smartphone such as consuming videos, music or playing games. Which is why Augmented Reality is part of this research, to gain more interest from students towards learning through their mobile devices. Augmented reality is a combination of technologies that enable real-time mixing of computer-generated content with live video display. Augmented reality helps in better visualizing 3D objects through the screen of mobile device and enable user to interact with touch screen capabilities. Mobile learning or M-learning will have strongly impact on Malaysian higher education as more student nowadays have access to smartphone and rely on it to communicate with their lecturers and other students. It is evidenced with the increase in research activities and initiatives in the area of mobile learning, particularly in the public and private universities. Thus, the need for a proper framework to guide developers in creating an application that will help students. This study will focus on three problems of mobile learning: visualization, user interface and framework. This framework includes the learning theory and also interactivity and evaluation of constructivism theory. In this study, students from various universities in Malaysia will be participating in this study. The expected outcome of this research is to build a proven framework to develop a mobile learning application with augmented reality that can be used by multiple Universities in Malaysia.

Research Method

This research consist of developing a mobile-Augmented Reality (mAR) application for learning Network Fundamental aiming towards student in higher learning institutions in Malaysia. The objective of this research are to develop a mobile-Augmented Reality application for Computer Science course.

Network Fundamental mobile-Augmented Reality Application

Network Fundamental mobile-Augmented Reality (NetmAR) is an application aims to help student in higher learning institutions that are taking computer science course in learning better through the use of their smartphone. By using their smartphone as a device to help them *visualize* better about the learning material through Augmented Reality (AR). AR is a technology that helps merge virtual object such as 3D Models, videos, picture and text into the real physical environment through the smartphone. NetmAR is an application that was developed to enable student to view 3D Model of networking devices such as Router and Switch in a real environment through AR. AR can help gain student interest towards learning through *multimodal interface* where student would be able to interact with the learning material through *touch, sizing, manipulate and voice narration* rather than reading a text from a book or a PowerPoint slide. The strength of AR lies in the content that are presented to the students for them to be able to study in their own time. NetmAR was developed as a self-centred learning application for student to learn better and effectively in their own time. The application was developed using three main softwares, Unity 3D SDK, Blender/Sketchup and Vuforia.



Fig 1. Image Being Converted into a Marker

Figure 1 shows the NetmAR logo designed and being converted into an marker for the smartphone to detect it as a marker as seen in the bottom image. A marker can be any image and be converted into a marker. The marker will then be used for a smartphone to retrieve content when it detects the marker. Virtual object such as 3D models, text, picture and videos will then overlay on top of the marker, making it seems as if the object appears in the real world.



Fig 2. Main interface of NetmAR

Figure 2 shows the three main material that the students can learn through AR, which are 7 Open System Interconnect (OSI) Layer, Router and Switch. The 7 OSI layer shows the 7 layers in the OSI from Physical to Application where students can learn more about each layer with voice narration. Router and Switch are virtual devices that the student can view in its 3D form and interact with by manipulating, magnifying and rotate to see more detail of the device.



Fig 3. 7 OSI Layer

Figure 3 shows the 7 OSI Layer appearing on top of the marker, students can see and select one of the layers from the 7 OSI Layer to know more in detail about what each layer functions and does. Voice narration is part of the interaction with student in the 7 OSI layer, where rather than reading about each layer, students can also listen for further understanding.



Fig 4. Router 3D Model

Figure 4 shows the 3D model of the Router appearing on top of the marker. Students are able to view the 3D model in 360° and resize the Router as well as know more about the router by tapping on “Router Configuration Commands” and “Show Ports Label”.

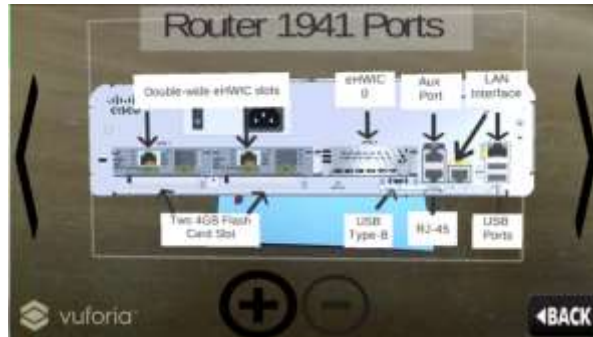


Fig 5. Router Port Label Shown

When the student tap on the “Show Ports Label”, all the ports behind the router will be shown as seen in Figure 5, each of the ports are label in the white boxes with a black arrow indicating the position of the port. Each of the label can be tap to hear how it is pronounce. Next, the application will be used at five universities to be compared with Traditional Method using PowerPoint slides and Mobile Learning using mobile application.

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