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Designing An Interactive Interface for Mobile Jawi Augmented Reality (AR) Application (M-JawiAR)

Roslinda Ramli[1], Siti Zaharah Mohid[2], Fitri Nurul Ain Nordin[3], Hafiza Abas[4]

[1]Fakulti Sains dan Teknologi Maklumat, Kolej Universiti Islam Antarabangsa Selangor;

[2]Fakulti Sains dan Teknologi Maklumat, Kolej Universiti Islam Antarabangsa Selangor;

[3]Pusat Pengajian Teras, Kolej Universiti Islam Antarabangsa Selangor;

[4]Razak Faculty of Technology and Informatics, Universiti Teknologi Malaysia;

Email : [1]roslinda@kuis.edu.my, [2]zaharahm@kuis.edu.my, [3]fitri.ain@kuis.edu.my, [4]hafiza.kl@utm.my

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Abstract

Augmented Reality (AR) is amongst the potential technologies that gives advantages especially in education setting. The AR environment is unique since it combines real and virtual objects, interactive in real time and registered in 3-dimension. Nowadays, Jawi seems to be forgotten by our young generation. Until now, those who love and are interested to learn and use Jawi are difficult to find. Even the traditional ways of learning Jawi in schools cannot help much to solve this problem or to attract students to love Jawi. The design and development of AR application is different from the traditional application. Understanding the design requirements or process helps the developers to produce useful, interactive and usable AR applications. This article discusses the process of designing an interactive interface for mobile Jawi Augmented Reality (AR) application for students in Sekolah Rendah Agama (SRA) JAIS. The study is conducted through the analysis, documentations, previous works and interviews with teachers in SRA JAIS. The study highlights the process of the designing phase, conceptual model of Jawi AR, the structure design of Jawi AR content, and the flowchart for learning Jawi prototype. The output or findings from relevant designing phase will be proposed as a guideline for a development of mobile Jawi AR application.

Keywords : Interactive Interface, Mobile Augmented Reality, Jawi

I. Introduction

Mobile applications have been widely used in many field in our daily life. The education field is no exception in using mobile-based learning as a tool in acquiring

knowledge. This is due to the fact that mobile application are fast, portable, offer individual access and can be reached anywhere and anytime.

The use of augmented reality (AR) is not a new phenomenon as this technology is proven to have a great potential in education. Recent technologies such as AR offer the right tools for developing integrated learning environments that support the manipulation of physical objects and visualization of contents, enriching the learning experience. Essentially, AR is a computer technology that uses cameras to capture and display real world environments, objects, or images, and juxtaposes digital information (e.g., audio or graphics) onto reality in real time. In contrast to the synthetic environment rendered onto a virtual reality (VR) system, an AR system augments the physical environment (as seen through the camera lens) with a synthetic representation. Thus, the environments co-existing together can be viewed as a hybrid environment–one complementing the other, and vice versa.

As computer technology becomes more advanced, including mobile technology and wearable technology, AR can now be experienced by almost anyone who owns a decent mobile phone, which is typically equipped with a camera, thus engendering a new term of technology so called the mobile AR. Integrated in mobile learning systems, AR will provide innovative ways to transfer knowledge in education. The application of AR in the education field is encouraged due to its various advantages. Among the advantages are its ability to help student's cognitive process, especially in the visual spatial process (Khalil et al., 2005; Scheiter et al., 2009), its ability to raise student's motivation level, its positive impacts in learning experience especially for weak students (Freitas & Campos, 2008).

Nowadays, Jawi seems to be forgotten by our young generation. Until now, many people, especially school children or students and the other younger generation are not interested to learn and use Jawi. Even the traditional ways of learning Jawi at school cannot help much to solve this problem or to attract students to love Jawi. Besides that, there are not many Jawi learning in mobile application that uses AR technology in the market even though this technology is interesting and can make the learning process become fun and easier as it combines the real and virtual environment. This can make the learning process dynamic and go beyond the classroom. Learning through mobile-based is not limited in space, the learning can take place anywhere and anytime.

It is found that, many students cannot read Jawi. The failure or inability of some primary school pupils in acquiring basic skills in Jawi especially in reading, is among the challenges in education today. Due to this fact, there is a need for researchers to develop a well-designed mobile application in learning Jawi with interactive, fun and engaging learning environment. The aim of the research is to design a mobile augmented reality application on learning Jawi (M-JawiAR). The methodology used in this mobile AR application on learning Jawi was adopted from ADDIE Instructional Design (ID) model. Overall, five phases are involved in the development life cycle: analysis, design, development, implementation and evaluation.

II. Study Background

Augmented Reality

Augmented Reality (AR) has been widely used in many educational contexts to enable students to learn in a more engaging, fascinating, and effective environments. The adoption of AR in learning, is driven by having easy, affordable access to powerful modern devices (e.g., mobile phones) that can be used as an efficient delivery medium for learning (Wu et al., 2013). An augmented reality system combines real and virtual objects in real environments, run interactively in real time and register objects in two environments simultaneously (Azuma et al, 2001). The continuum of AR is depicted in Fig. 1. It is a new technology that generates three-dimensional (3-D) virtual objects, and provides an interactive interface with which people can work and interact simultaneously both in the real world and 3-D virtual objects. Thus, it makes AR an interesting technology for developing educational applications that allow manipulation and visualization (Ucelli et al., 2005). Additionally, in Di Serio et al. (2012) study, AR technology also has shown a positive impact on the motivation of middle-school students. It is proven that AR environments could boost students‘ motivation and interest, which in turn could help them to develop a better understanding in learning contents. The usage of AR application can be seen in Table 1 below.

Table 1. Research on AR in various field

Number	Author	Field
1	Dunleavy et al. (2009)	Math, language arts and literacy skills
2	Tang and Ou (2012)	Science
3	Martin et al. (2012)	Historical
4	Godwin-Jones, R. (2016)	Language
5	Kamarainen, A. (2018)	Ecology

Mobile AR in Education

Using mobile device as a learning tool is a new way for learners to learn anywhere and anytime they like. A number of studies have found that mobile devices play a major role in education nowadays and sees the impact and advantages of these devices in regards to the potential for pedagogical perspectives (Denk, Weber, & Belfin, 2007). Moreover, an application that contains multimedia elements such as animation, graphic and video encourages parents to attract the attention of their children. The use of devices like smartphones and tablets can facilitate the children to learn. There are many studies that proved that there are improvements in terms of children’s performance before and after they used the multimedia mobile application as a learning tool.

Mobile AR applications with the ability of mobile devices with features and properties such as portability, social interactivity, connectivity, context sensitivity and individuality (Huizenga et al., 2009) have made learning experience more meaningful. Based on the previous studies most of the users felt motivated, enjoyed

and the research shows a positive educational effect on participants that leads to students achieving higher levels of engagement in learning performance.

Software Development

In order to ensure effective learning outcomes from educational courseware or mobile application, careful planning is required before the development process begins. ADDIE Instructional Design Model is used in this mobile AR application development methodology. The ADDIE model for instructional system design (ISD) is a basic model that can be applied to any kind of learning solution. The ADDIE model has five step processes namely, analysis, design, development, implementation, and evaluation as illustrated in the Fig. 1. Development of mobile Jawi AR application is not similar to the development of any other mobile application. Jawi AR requires extra consideration in order to produce a usable application that best suited to the intended target user. This paper discusses the process of designing phase only.

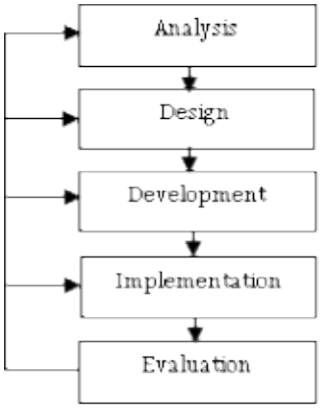

Fig. 1. ADDIE Model

Design Phase

The design phase involves the development of the conceptual model for the M-JawiAR which involves the learning theory and the medium to be used in the application; the teaching and learning approach to be implemented and the components involved in this application as well as AR technology. This model is again evaluated and revised based on the literature review in order to detect any inconsistency that may be involved. The structure design of Jawi AR content is also created based on syllabus of standard 3 SRA JAIS. The flowchart and story board are also created during this phase. The flowchart will show the flow of the application while the story board exemplify the sequence of learning and the interface layout that will be provided to the user. The layout also includes the multimedia elements that are designed to suit the learning process. The consideration is made based on the conceptual model that has been created to make sure the purpose of teaching and learning is aligned. The flow of design phase is shown in Fig. 2 below.

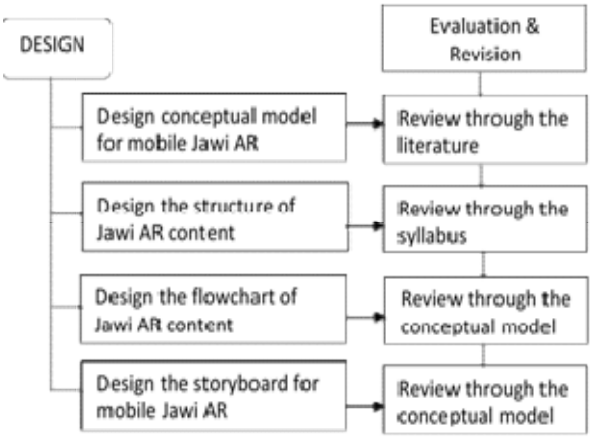

Fig. 2. Flow of Design Phase

Conceptual Model

The design of M-JawiAR is based on real world environment and digital environment. The conceptual model which involves the concepts to be used can be depicted in Fig. 3 below. The framework lists the following components as the important components to be included in the development of M-JawiAR. Overall, the components are input device, display, tracking and registration, Mobile apps Jawi AR module and intuitive interaction.

- Input device
  The input device used is mobile phone as this is a mobile application.

- Display
  The display used is based on mobile phone screen.

- Tracking and registration
  The tracking and registration are using markers and mobile cameras in the smartphones or mobile phones. The image in the Jawi book is used as a marker.

- Mobile apps Jawi AR module
  The module is based on SRA standard three syllabus which consists of read syllables, read Jawi sentences and write Jawi words. The development of this module for prototype development which is used in the apps (digital environment) are multimedia fusion elements like texts, audio, video, animation, 2D graphic, 3D model and AR technology. The learning theories involved are cognitive and Social & Humanis. The learning approaches used are visual and auditory as provided by AR technology.

- Intuitive interaction
  The interaction provided are namely, hold, rotate and zoom when using the mobile application.

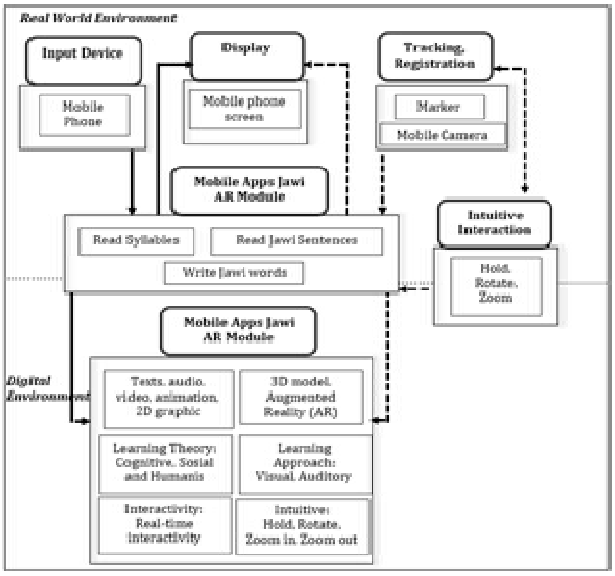

Fig. 3. Conceptual Model of M-JawiAR

The Structure Design of Jawi AR

The structure design of Jawi content based on syllabus of standard 3 SRA JAIS can be visualized in Fig. 4. The structure consists of lesson 1 to 6 and each lesson is divided into unit 1 and 2. The structure consists of AR components. Basically, each lesson has the same AR components which are 3D object with voice, narration or voice that read the text and animation of Jawi letter.

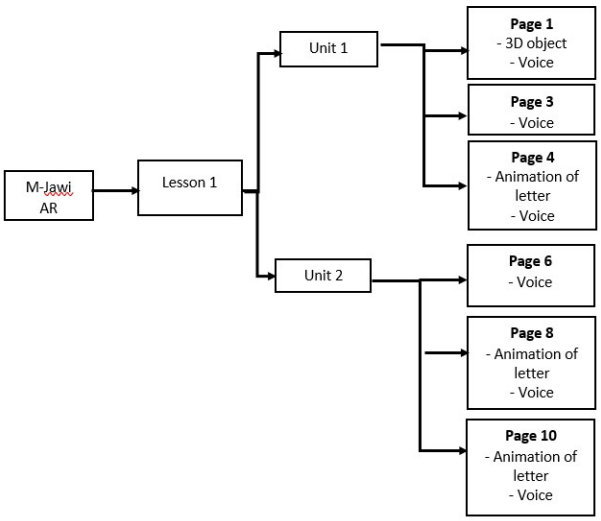

Fig. 4. The Structure of M-JawiAR

Flowchart

Flowchart is a graphical representation of the sequence of operations in an information system or program. Fig. 5 shows the flowchart from the beginning until the end of application. The application starts by providing user an introduction screen. Next, the user can start to scan the Jawi AR Book using the camera in the smartphone. Users are given choices from lesson 1 to 4. Each lesson contains two units which are Unit 1 and 2. Unit 1 in lesson 1 is about reading a Jawi syllable. When user scans an image in unit 1 for example frog, a 3D virtual model of frog will appear on the mobile phone screen. User will hear the narration that reads the word frog. The word frog is in Jawi. By hearing the narration students learn Jawi word before proceeding to the reading activity. Upon mastering the word reading activities, the learner can continue to further enrich their sentences reading ability through reading. This technology uses AR that combines the reality and virtual environment together to make a learning process more interesting.

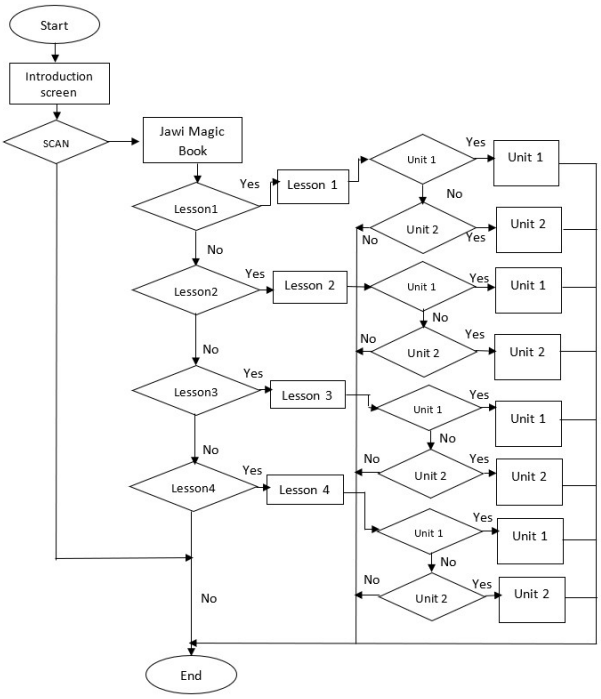

Fig. 5. The Flowchart for Learning M-JawiAR

Proposed design of M-JawiAR

AR system can use QR code. This is the most common type of Marker-based Augmented Reality. 2D bar-code is the simplest type of AR markers. The more complex type consists of bright colours and meaningful pictures. When a smartphone having Marker-based AR application scans a pattern such as a bar-code or a symbol through the camera, the software recognizes it and superimposes a digital image on the screen. 3D or animated digital image is used for a better experience. The Marker-

based AR approach is also called as Recognition-based Augmented Reality. Fig. 6 below can effectively illustrate the working principle of Marker-based type of AR applications.

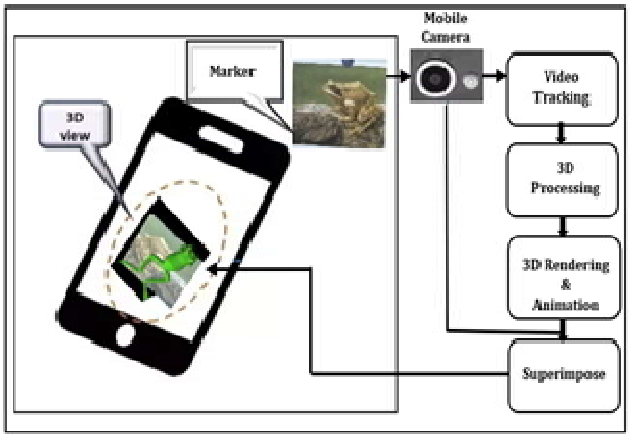

Fig. 6. AR System Configuration

Storyboard

Storyboarding is also a part of multimedia design process. This storyboard shows the look and feel of the application that will be developed. It shows how the interface of the system looks like. Some of the storyboard can be seen in Fig. 7 below.

The proposed design of mobile AR application of M-JawiAR can be shown in Figure 8. User can interact with the AR application. User can scan a pattern such as a bar-code or a marker like a frog in the Jawi book using smartphone, through the camera, the software recognizes it and superimposes a digital image like the 3D model of frog on the screen with the narration. The M-JawiAR used markers printed on a book as a tangible interface that serves as a physical handler in interacting with a virtual object in the AR environments. Using AR technology, users can interact with the virtual objects as they would with an object in the real world.

Fig. 7: The Storyboard of Lesson 1

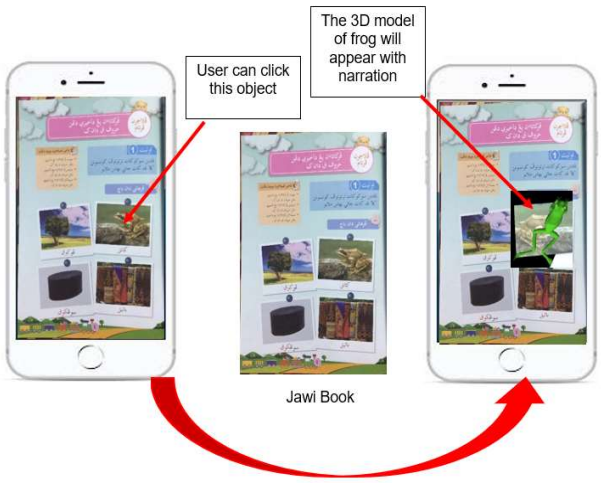

Fig. 8. The Proposed Design of M-JawiAR

III. Conclusion

An intuitive interface design will give a good impact to the learners in acquiring the knowledge. Understanding the design requirements or process helps the developers to produce useful, interactive and usable AR applications. The research is carried out to attract children or users to learn Jawi and increase their interest and

understanding in the subject. This article presents the process of designing an interactive interface for M-JawiAR application for students in SRA JAIS. The study highlights the process of designing phase, conceptual model of mobile jawi AR, the structure design of jawi AR content, and the flowchart for learning jawi prototype. The output or findings from relevant designing phase will be proposed as a guideline for a development of M-JawiAR application.

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