“Hijaiyah” interactive learning for pre-school students

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Abstract. Limited time allocation for Islamic education in primary schools is an obstacle for the students to understand the lesson. The core of Islamic education is to understand reading and to write letters Hijaiyah. The concept of traditional learning patterns and lack of time made the level of understanding of students is low. Hence, learning media are needed to attract student’s attention. Especially in children of the present era who are challenged with various types of technology, including mobile phones, televisions, and computers. The role of IT-based media can be a solution in current learning. In the learning process, especially for children, is learning that gives birth to a pleasant atmosphere. Images and sounds that appear will make children not get bored quickly so that they can stimulate learning in children. In learning that involves the media in the process of learning certainly must consider aspects of early childhood development. Augmented Reality can be utilized in various fields, including education. In learning, there are Quantum Learning theories, which explain visual, audio, and kinesthetic (VAK) methods. From here, Augmented Reality and Quantum Learning theories are interconnected. In this application, there will be Hijaiyah letters that are simulated in the form of AR with a sound and how to pronounce it. This application is to help the learning process of Hijaiyah letters, only by scanning the Hijaiyah letters from the Android camera.

1. Introduction

Hijaiyah letter learning is only taught by teachers (ustadz / ustazah) who mastered tajwid in Al Quran and only taught in Islamic religious subjects 1-2 hours per week. This time allocation is still very lacking because students are required to be able to master all the material taught, including reading and writing the letters Hijaiyah. Teaching religion given to children from an early age is essential, especially children in kindergarten as a basic guideline in the introduction of learning in good and polite behaviour. Also, the learning media used are still in the form of books or static images that tend not to appeal to students in terms of visualisation [1].

In a study conducted by Azuma in Zhang that Augmented Reality (AR) is a combination of real and virtual objects in a real environment, runs interactively in real time, and there is integration between objects in three dimensions, namely virtual objects integrated into the real world [1,2]. Combining real and virtual objects is possible with appropriate display technology, interactivity is possible through specific input devices, and functional integration requires effective tracking.

In other research conducted by Hirotaka states that the introduction of markers in augmented reality can be recognised in real time so that it produces an interactive application [3]. By applying Quantum Learning theory and assisted with Augmented Reality which emphasises the visualisation of Hijaiyah letters, it is expected that users from among students or the general public who want to learn Hijaiyah letters can more quickly understand the material taught easily and efficiently.
2. Methods

2.1. Hijaiyah

Hijaiyah Letter is an Al-Quran letter written in Arabic. Hijaiyah letters consist of 29 letters of Hijaiyah, and each has a way of reading. As for how to read Latin letters Hijaiyah, which currently does not have universal standards, depending on each country for how to pronounce it [4].

![Figure 1. Letter Hijaiyah](image)

2.2. Augmented reality

The utilisation of Augmented Reality as an Interactive Learning Media Introduction to Temples in Malang Based on Android Mobile [5]. In this study applying Augmented Reality to support interactive learning introduction of temples in the Malang region based on Android, which is expected to help motivate the younger generation to start participating in preserving and preserving the cultural heritage of the nation [5].

The research, entitled "Augmented Reality Enhanced Computer Aided Learning for Young Children". In this study, Augmented Reality is implemented in the field of education; this research introduces gamification to the process to ease the burden on children. In addition, trying to involve schools as well as being part of the education cycle that makes parents a part of the learning process / education of their young people and Augmented Reality combined with pleasant sounds makes learning more interactive and fun done in research, Ahmed, et al. Markers are media to scan used in augmented reality technology. Markers are usually presented in square form. The outline used to detect markers has a contrasting colour with the background of the marker image. The colours used are black and white. A good marker is a marker that can be detected easily in all circumstances [6,7].

![Figure 2. Example of marker.](image)

2.3. Fast corner detection

FAST (Feature Form Accelerated Segment Test) is an algorithm developed by Edward Rosten, Reid Porter, and Tom Drummond [8]. FAST corner detection This is made to accelerate computing time in real-time with the consequence of reducing the accuracy of angle detection. FAST corner detection starts by specifying a point p at the coordinates \((x_p, y_p)\) in the image and comparing the intensity of the p point with 4 points around it. The first point lies in the coordinates \((x, y_{p-3})\), the second point lies in the
coordinates \((x_p + 3, y)\), the third point lies in the coordinates \((x, y_p + 3)\), and the fourth point lies in the coordinates \((x_p - 3, y)\). The example of FAST method shown in figure 3.

Vuforia uses the FAST algorithm corner detection to define how well images can be detected and tracked using the Vuforia SDK. This rating is displayed in the target manager and return for each target upload via the web API. Rating augmentable can range from 0 to 5 for each figure given. The higher the rating augmentable from the target image, the stronger the detection and tracking capabilities it contains. A rating of zero indicates that the target is not tracked at all by the system augmented reality, while the five-star rating indicates that an image can be easily tracked by a system augmented reality.

2.4. Fisher-Yates method

Randomisation aims to make the game more interesting because the questions that appear cannot be predicted. For this reason, the algorithm is used fisher-yates shuffle in the process of randomising the nodes. Steps and steps of the algorithm fisher-yates shuffle The original version of this algorithm was first published in 1938. Fisher-Yates Shuffle (named after its inventor, Ronald Fisher and Frank Yates) was used to change the order of entries given randomly. The permutations generated by this algorithm appear with the same probability \([9]\).

Research and discussion for the method of fisher-yates shuffle have been carried out by other researchers \([10]\). It can be concluded that randomisation uses the Fisher-Yates Shuffle algorithm successfully applied in arithmetic games as scramblers of questions and answers that will appear in each game, and the issue is not repeated. The following is an example of manual randomisation. There is an array \(n = \{1,2,3,4,5\}\)

The result:

- Determine the value \(n\)
- Select a random number \(x\) where \(1 \leq x \leq n\), for example is 4
- Switch position \(x\) with the last number in range \(1 - n\) then from \(\{1,2,3,4,5\}\) to \(\{1,2,3,5,4\}\)
- Select number \(x\) to list array for example \(t = \{4\}\)
- Reset value \(n\), where \(n = n - 1\) Now which is processed \(n-1\) then it is processed only \(\{1,2,3,5\}\)
- If \(n\) still full fills the requirement \(n> 0\) then it returns to the random number selection process \((x)\) where \(1 \leq x \leq n\) (process b)
  a. \(n\) now is \(n - 1\), \(5 - 1 = 4\) Let \(x\) be 2
     then from \(\{1,2,3,5\}\) to \(\{1,5,3,2\}\)
     Then \(t = \{4,2\}\)
  b. \(n\) now is \(n - 1\), \(4 - 1 = 3\) Suppose \(x\) is 1
     then from \(\{1,5,3\}\) to \(\{3,5,1\}\)
     Then \(t = \{4,2,1\}\)
  c. \(n\) now is \(n - 1,3 - 1 = 2\) Let \(x\) be 3
     then from \(\{3,5\}\) be \(\{5,3\}\)
     Then \(t = \{4,2,1,3\}\)
  d. \(n\) now \(n - 1\), \(2 - 1 = 1\)
     then \(t = \{4,2,1,3,5\}\)

2.5. Business process system

The system that will be planned consists of software/applications with designs according to field studies that have been carried out no. The system is interrelated with one another according to the field studies that have been carried out, the system consists of a marker and an android application with a merger between the camera, and there are matching letters Hijaiyah to do three dimension depictions into android.

This application uses a camera marker process that is inputted through a rendering process that detects three-dimension objects if the marker issues Hijaiyah letters, the rendering process generated from the marker has taken place, and this process is formed in three dimension objects.
Description:

- User opens the Application that has been provided by a teacher
- User directing the camera smartphone to the marker that has been downloaded.
- The smartphone camera will capture this marker and the matrix transformation of the marker will be a reference for all objects. The virtual
- The smartphone will process and will be displayed on the screen in the smartphone form of three-dimensional objects.
- Then three dimension emerging markers will be simulated by sound
- There are games that can display the score of each question to detect the level of understanding in memorising letters Hijaiyah.
- In the process of question and answer game, the user can press the Hijaiyah button from the question displayed by voice according to the user’s understanding in memorising the letters Hijaiyah
- If the process has taken place, the application will display the final score
- For the test in memorising, Hijaiyah letters matched through the scan of each marker that has been provided by the teacher if the marker does not fit the three dimension objects will appear

**Figure 4. Business process system.**

### 2.6. Design system

Use case Diagram is a diagram in the Unified Modelling Language (UML) which models the behaviour of a system. In the use case diagram, it describes the interactions between users and the system itself. The use case diagram of the application that will be developed explains the interaction between the user and the application. Interactions that occur between the user and the application that is the user can see the Hijaiyah letter information, in the interaction, this application will display static information from the letter Hijaiyah.

In the interaction of seeing three dimension letters Hijaiyah objects, the user can see the Hijaiyah letter objects displayed with technology augmented reality through the user's Android smartphone. In the interaction of hearing the reading of the Hijaiyah letters, the user can hear the sound for the pronunciation of each object letter Hijaiyah by displaying a three-dimension object letter Hijaiyah. Moreover, in the interaction of the Hijaiyah letter recognition game, the user can test the level of understanding in Hijaiyah letter recognition of all information presented.

The first stage of the application will initialise in which there is a further process in the system, then the application will capture the appropriate marker image in the application database and the marker successfully identified will then display the output in the form of three-dimension objects. The three-dimension object created is the letter Hijaiyah and the application used is Blender. To make the objects, Arabic Hijaiyah fonts are needed which can be obtained by downloading from a website page. The
Hijaiyah font is then imported in the Blender application, which formed into a three-dimension shape as shown in figure 5.

![Figure 5. 3D object modelling.](image)

3. Results and discussion

3.1. Marker data test

Table 1. contains data on the results of trials on all markers. Twenty-eight existing data will display data based on the marker object. The information that is displayed is in the form of a three-dimension object from the letter Hijaiyah along with the way of pronunciation.

| No | Figure | Information |
|----|--------|-------------|
| 1. | ![Alif](image) | Alif |
| 2. | ![Ba](image) | Ba |

3.2. User interface

Figure 6 shows display of Hijaiyah letters from Alif letter. On this page will display the sound of the Hijaiyah letter, and there is the previous button to select the reading instructions and choose the sound instructions for reading the Hijaiyah letters. This content is learning content in the application. In addition to displaying shapes, images and sounds of Hijaiyah letters, this application will also be equipped with an educational game for the introduction of Hijaiyah letters. There are two types of game patterns, namely an educational game in the form of multiple-choice quizzes, and a type of augmented reality.

![Figure 6. Display of Hijaiyah letters.](image)
The multiple choices quizzes using artificial intelligence in the randomization pattern. The method used in this scheme is the fisher yates method. As for the augmented reality quiz, the application is equipped with fast corner detection as an engine for processing data. By applying these two methods, the application can run perfectly and more interesting. Figure 7. is a pop-up display or random notification of Hijaiyah letter questions answered by the user and will appear 2 seconds after the question arises. If the answer chosen by the user is correct or answered, then the application will show a notification or pop up "TRUE", and there will be an increase in the game score.

![Figure 7. Pop up display.](image1.png)  ![Figure 8. Display score.](image2.png)

Figure 8. display the results answered by the user from the random questions that will appear for five minutes after the question. The questions appear randomly as many as ten questions, and the number of scores of each user is different depending on the user's understanding in answering the questions.

3.3. Testing
Optimal distance testing is used to find the closest and farthest distance the application needs to recognise markers, display three dimension objects, and display information related to pronunciation sounds. Testing carried out by directing an android device that has directed to the marker with specified distance variation. The testing data vary between 5 cm - 40 cm in each test data. The results of the distance calculations performed shown in table 2.

| Data | Test Results distance (cm) |
|------|----------------------------|
| n    | 5  | 10 | 15 | 20 | 25 | 30 | 35 | 40 |
| 1    | TRUE | TRUE | TRUE | TRUE | TRUE | TRUE | TRUE | FALSE |
| 2    | TRUE | TRUE | TRUE | TRUE | TRUE | TRUE | FALSE | FALSE |
| 3    | FALSE | TRUE | TRUE | TRUE | TRUE | TRUE | TRUE | FALSE |
| 4    | TRUE | TRUE | TRUE | TRUE | TRUE | FALSE | FALSE | FALSE |
| 5    | TRUE | TRUE | TRUE | TRUE | TRUE | FALSE | FALSE | FALSE |

4. Conclusion
Augmented Reality application for Android-based Hijaiyah letter learning is in accordance with the analysis that has been done. The Hijaiyah AR application can provide a learning experience utilising technology. Users can learn easily wherever they are, have creativity and reasoning in the learning process because educational games are presented in the application.

Based on the usability testing through questionnaires that have been given to teachers of Al Huda Islamic Kindergarten, the results can be stated is very satisfying as the educators give an excellent response in carrying out the learning process easily and efficiently. Based on the table in the test data marker, the uniqueness the marker significantly affect the emergence of a three-dimension object in the Augmented Reality application.
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