



**RANCANG BANGUN APLIKASI *DAILY DU'A* UNTUK ANAK USIA
DASAR MENGGUNAKAN *MARKERLESS AUGMENTED REALITY***

TUGAS AKHIR

Shofwatul Afifah
41518010100

UNIVERSITAS
PROGRAM STUDI TEKNIK INFORMATIKA
FAKULTAS ILMU KOMPUTER
UNIVERSITAS MERCU BUANA
JAKARTA
2022



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Tugas Akhir

Diajukan Untuk Melengkapi Salah Satu Syarat
Memperoleh Gelar Sarjana Komputer

Oleh:
Shofwatul Afifah
41518010100

PROGRAM STUDI TEKNIK INFORMATIKA
FAKULTAS ILMU KOMPUTER
UNIVERSITAS MERCU BUANA
JAKARTA
2022

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NIM : 41518010100

Nama : Shofwatul Afifah

Judul Tugas Akhir : Rancang Bangun Aplikasi *Daily Du'a* Berbasis Android
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NIM : 41518010100
Nama : Shofwatul Afifah
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NIM : 41518010100
Nama : Shofwatul Afifah
Judul Tugas Akhir : Rancang Bangun Aplikasi *Daily Du'a* Berbasis Android Untuk Anak Usia Dasar Menggunakan *Markerless Augmented Reality*

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(Ir. Emil R. Kaburuan, Ph.D., IPM.)

Ka. Prodi Teknik Informatika

ABSTRAK

Nama : Shofwatul Afifah
NIM : 41518010100
Pembimbing TA : Saruni Dwiasnati, ST, MM, M.Kom
Judul : Rancang Bangun Aplikasi *Daily Du'a* Berbasis Android Untuk Anak Usia Dasar Menggunakan *Markerless Augmented Reality*

Doa merupakan sarana berkomunikasi antara manusia dengan Allah *Subhanahu wa ta'ala*. Pembelajaran doa hendaknya dilakukan sejak kecil agar tertanam keimanan ke dalam sukma. Anak usia dasar dapat disebut dengan periode intelektual, di mana minatnya terfokus pada sesuatu yang dinamis. Aplikasi *Daily Du'a* merupakan aplikasi doa harian dengan desain *User Interface* yang simpel dan modern, dilengkapi dengan *markerless augmented reality* pada bacaan sholat. Dengan mengaplikasikan AR, aplikasi ini dapat digunakan sebagai media pembelajaran yang memotivasi anak agar tertarik dalam belajar mengamalkan doa dan bacaan sholat beserta maknanya. Metode yang digunakan pada pembuatan aplikasi adalah metode *Multimedia Development Life Cycle*. Aplikasi berisi 16 audio dan ilustrasi doa sehari-hari seperti doa sebelum makan, doa naik kendaraan, dan doa sebelum belajar. Aplikasi ini juga dilengkapi teks Arab, Latin, dan arti dalam bahasa Indonesia dari setiap doa. Teknologi *augmented reality* diterapkan di aplikasi ini pada bacaan doa sholat. Hasil pengujian menunjukkan bahwa aplikasi doa harian berbasis Android menggunakan *augmented reality* ini cukup efektif untuk menjadi salah satu wadah pembelajaran dan meningkatkan kemampuan menghafal doa harian pada anak usia dasar.

Kata kunci: aplikasi, doa, *augmented reality*, *markerless*, android

ABSTRACT

Name : Shofwatul Afifah
Student Number : 41518010100
Counsellor : Saruni Dwiasnati, ST, MM, M.Kom
Title : Design An Android-Based Daily Du'a Application
for Elementary Age Children Using Markerless
Augmented Reality

Prayer du'a is a means of communicating between man and Allah Subhanahu wa ta'ala. Prayer learning should be done from childhood in order to be embedded in the faith into the soul. A child of primary age can be called the intellectual period, in which his interests are focused on something dynamic. Daily Du'a AR application is a daily du'a prayer application with a simple and modern User Interface design, equipped with markerless augmented reality on du'as of salah prayer. By applying AR, this application can be used as a learning medium that motivates children to be interested in learning to practice daily du'a and du'as of salah and their meanings. The method used in making applications is the Multimedia Development Life Cycle method. The app contains 16 audios and illustrations of daily du'a prayers such as du'a before eating, before riding a vehicle, before studying, etc. The app also features Arabic, Latin, and Indonesian texts of each du'a prayer. Augmented reality technology is applied in this application to du'as of salah reciting. The test results show that this Android-based daily du'a prayer application using augmented reality is quite effective to become one of the learning platforms and improve the ability to memorize daily du'a prayers in elementary age children.

Key words:
application, prayer, augmented reality, markerless, android

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**DESIGN AN ANDROID-BASED DAILY DU'A APP USING MARKERLESS
AUGMENTED REALITY**

Shofwatul Afifah¹, Saruni Dwiasnati²

^{1,2}Informatics Engineering, Faculty of Computer Science

^{1,2}Universitas Mercu Buana

^{1,2}Jl. Raya, RT.4/RW.1, Meruya Sel., Kec. Kembangan, Jakarta, Special Capital Region of Jakarta
11650

E-mail: ¹shofwatulafifah@gmail.com, ²saruni.dwiasnati@mercubuana.ac.id

ABSTRACT

Prayer du'a is a means of communicating between man and Allah Subhanahu wa ta'ala. Prayer learning should be done from childhood in order to be embedded in the faith into the soul. A child of primary age can be called the intellectual period, in which his interests are focused on something dynamic. The Daily Du'a AR application is a daily du'a prayer application with a simple and modern User Interface design, equipped with markerless augmented reality on du'as of salah prayer. By applying AR, this application can be used as a learning medium that motivates children to be interested in learning to practice daily du'a and du'as of salah and their meanings. The method used in making applications is the Multimedia Development Life Cycle method. The app contains 16 audios and illustrations of daily du'a prayers such as du'a before eating, before riding a vehicle, before studying, etc. The app also features Arabic, Latin, and Indonesian texts of each du'a prayer. Augmented reality technology is applied in this application to du'as of salah reciting. The test results show that this Android-based daily du'a prayer application using augmented reality is quite effective to become one of the learning platforms and improve the ability to memorize daily du'a prayers in elementary age children.

Keywords: Apps, Prayer, Augmented Reality, Markerless, Android

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***Correspondence Address:**
saruni.dwiasnati@mercubuana.ac
.id

I. INTRODUCTION

Pancasila, with its first precept of the Almighty Godhead, is a philosophy that is appropriate and closely related to religion [1]. Each religion has different rules and ordinances

but the same purpose is to worship and ask God for protection. Oneway to worship and ask for that protection is through prayer [2].

Prayer learning should begin from childhood in order to embed faith into the soul. However, not all Muslim children have studied

in Islamic schools or in the Qur'an Education Park (Taman Pendidikan Al-Qur'an or TPA). So that not a few Muslims, from the level of children to adults, have not practiced various daily du'a prayers according to the sunnah and prayers of the Prophets Muhammad (peace be upon him). In fact, prayer is the quintessence of worship, a weapon for believers [3], the pillar of religion and light in heaven and earth [4]. Du'a prayer is a means of communicating between human and Allah Subhanahu wa ta'ala [5].

The rise of vices behavior on earth is also the root of the absence of du'a prayer. Vices arises because of the weakness of faith. Faith according to language means to justify and entrust. Whereas according to the term, faith is to justify in the heart, to pledge verbally, and to practice with the limbs [6]. Faith is volatile, it can decrease and increase based on the religious knowledge possessed by a person [7]. Diminished faith due to infidelity in Him. On the contrary, iman increases because of something that adds to it, namely good deeds. One of the good deeds that can be practiced in daily life is du'a and salah praying.

Everything that is commanded in Islam has a lot of wisdom, one of which is the worship of prayer. As stated in the Qur'an surah Al-Ankabut verse 45, salah can prevent from heinous acts and munkar. Salah prayer according to language is du'a, and according to terms are special words and deeds beginning with takbiratul ihram and ending with salaams [8]. Stools should be introduced and taught to children aged seven years. The Prophet Muhammad also taught prayers to children when they were seven years old. In the phase of child development, the age of seven years and above has been able to receive and work on logic materials simply [7].

Meanwhile, there is a reality that there have been scattered daily du'a prayer applications that have been enjoyed by thousands of users. Some daily prayer apps are for early childhood, and some are for adults. Unfortunately, it is still rare to find daily prayer applications with special specifications for children of basic age.

A child of early age or preschool age is a child aged 0-6 years old [9]. A child of primary age is a child aged 7-11 years old and above or in the education system can be called a child of primary school age. The way of thinking of primary-age children is different from that of preschoolers and adults [8]. A child of primary

age has the characteristics of a distinctive way of thinking.

Primary age children are commonly referred to as the intellectual period [10]. Children's knowledge increases rapidly with age, the skills mastered are increasingly diverse. The interest of the child in this period is mainly focused on everything that is moving or something dynamic. The implication is that children tend to perform a variety of activities that will be useful in the development process in the future [11].

Children's interest in something dynamic is the reason for the creation of a daily prayer android application for children of basic age using multimedia and Augmented Reality. Multimedia is one of the learning media that combines several media elements (text, images, graphics, sound, music and others) presented in digital media [12]. Multimedia aims to present information in a form that is quite fun, stoic, and easy to understand. Augmented Reality (AR) is a technology that combines virtual objects in two dimensions (2D) or three dimensions (3D) into a real environment in real time [13]. Augmented Reality is different from Virtual Reality which completely replaces reality, Augmented reality is just adding or complementing reality [14].

Augmented Reality applications are generally marker-based, that is, they must use a special marker to run the application. The drawback is that the use of markers on AR makes the application a dependency, since the application can only be run if the marker is available [15]. So that authors made an augmented reality application markerless method. Markerless is a method of tracking augmented reality using objects in the real world as markers or without the need to use special markers. Augmented reality with this markerless technique uses natural tracking techniques instead of fiducial markers [15]. By applying AR, this daily prayer application can later be used as a learning medium that can motivate elementary age children to be interested in learning to practice du'a prayer and its meaning.

The authors chose to create an Android-based daily du'a prayer application. Android is an operating system developed for Linux-based mobile devices [16]. The android platform is chosen because android is among the most used smartphones by Indonesia society [17]. Besides, Android also has a wide variety of

features and advantages that other platforms do not have [18].

The authors built an android-based daily prayer application for elementary age children called Daily Du'a, containing a collection of daily prayers with a simple user interface design and a modern dashboard, equipped with augmented reality. The app contains 16 audios and illustrations of daily du'a prayers such as du'a before eating, before riding a vehicle, before studying, after rainfall, etc. The app also features Arabic, Latin, and Indonesian texts of each du'a prayer. Augmented reality is applied in this app on salah prayer reciting.

The Multimedia Development Life Cycle (MDLC) is a method applied in the development of the Daily Du'a application. The MDLC method is an appropriate method in designing and developing a media application which is a combination of image, sound, video, animation and the other media. This method is preferred as a method in application system development because this is suitable for system development in multimedia applications and the stage is that they can exchange positions according to research needs.

1.1 Related Research

A related study by Maiyana with the title "Utilization of Android in Designing Du'a Prayer Collection Applications" concluded that the application developed can facilitate the process of memorizing daily du'a prayers efficiently and does not take a long time. In addition, the use of the application is considered more portable than the use of printed daily du'a prayer collection books [16].

Previous research conducted by Eri Satria et al. with the title "Design and Build an Android-Based Dhikr and Daily Prayer Application" explained that this daily du'a prayer application refers to the hadiths of the prophet consisting of selected verses. The method used is the Multimedia Development Life Cycle (MDLC). The application has a voice player feature that can be listened to [19].

According to research conducted by Helmiah and Hardianti with the research title "Designing Interactive Media for Prayer Collections for Early Childhood Based on Multimedia" explained that the application was made to facilitate the learning system and provide solutions for more effective learning

methods and a more enjoyable learning process, so as to attract students interest in learning. The application was created using software Adobe Flash CS6 [20].

Related research on UML by Fifin Sonata and Vina Winda Sari with the title "Utilization of UML (Unified Modeling Language) in Designing Customer-To-Customer Type E-Commerce Information Systems" developed a C2C model using UML. The novelty of C2C modeling using UML is the characteristics of UML that allow identification of which objects affect the system. C2C modeling using UML can provide benefits to e-commerce customers who are still new to C2C transactions and to their sellers. This research resulted in a modeling design using UML that allows each object to be clearly visible and easy to understand [21].

The research conducted by Putri Rahayu with the title of research "Designing an Islamic Prayer Learning Mobile Application Using Augmented Reality" developed an application for daily du'a prayer learning on Android-based mobile devices using augmented reality technology. The method used is Waterfall and the application has a feature of displaying sounds and animations of 3 dimensions of daily du'a prayers with the help of a marker that has been integrated with augmented reality. As a result, the average student likes and is more enthusiastic about learning daily prayer using islamic prayer learning applications using augmented reality. Based on the calculation of the response result through the questionnaire, it was obtained that the average teacher's response entered into a positive response which is the use of this application was able to increase children's motivation and interest to learn and memorize daily du'a prayers. It was also supported by the acquisition of the average score of all children's learning evaluation is 93.25 [22].

Randy Gusman and Meyti Eka Apriyani in their research entitled "Utilization Analysis of Markerless User Defined Target Method in Augmented Reality Prayer Shubuh" developed an application that uses the markerless user defined target method and tests the use of the method using parameters such as flat surface color contrast, object shape, distance, light and camera angles when tracking. The results of the study found that all objects can be used in the markerless user defined target method. The best objects for displaying 3-dimensional objects are

the flat surface of the paper with good contrast, a 45° tracking angle using a bright light source that is not perpendicular to the marker and an ideal distance of 15 cm to 25 cm [15].

Previous research by Atmoko Nugroho and Basworo Ardi Pramono entitled "Augmented Reality Mobile Application Based on Vuforia and Unity on 3D Object Recognition With Case Study of M Building of Semarang University" made an augmented reality application using the waterfall system development method. The app is built using Unity3D and Vuforia. This research resulted in a learning aid application to make it easier for college students to understand augmented reality material through mobile devices. So that students can also understand how mobile augmented reality can help college students see a real 3D objects interactively [23].

A related study by Anastasya Griselda et al. entitled "Making an Android-Based Farm Animals Learning Augmented Reality Application" concluded that children prefer learning methods that use modern technology rather than manual learning. So it is very necessary to learn using technology so that children are more enthusiastic about learning [24].

Previous research by Adi Darmanto et al. with the research title "Implementation of Augmented Reality Procedures for Prayer Using the Marker-Based Tracking Method" resulted in the application "Ayo Belajar Sholat" which contains guidance on how to do salah prayer in the form of three-dimensional animation. In addition, this application is equipped with a card (marker) that represents each prayer movement. The animation of the prayer can move when the user scans the desired marker. As a result, animations can appear on the smartphone screen. This application development stage uses the Waterfall model steps and marker-based tracking. The use of AR applications for learning to pray can increase students' interest and understanding in implementing salah prayer movements [25].

Based on several relevant research studies above, there are differences between the applications made by authors and the previous studies. These differences include prayer applications using Markerless Augmented Reality where previously used markers. Another difference is authors combine du'a and salah praying in a single AR application. The

app also combined the use of Android Studio, Unity, and Vuforia to build a single app. Daily Du'a AR brought together several features in previous studies, such as the audio player feature while displaying text and visuals with a more modern user interface design using a cardview in Android Studio, equipped with Augmented Reality of salah prayer movement and the reciting.

II. METHODOLOGY

Every application need a method is that is a reference in the process of making and designing an application [26]. The software development method used in this study is the Multimedia Development Life Cycle (MDLC). MDLC has six stages, including concept, design, material collecting, assembly, testing, and distribution.

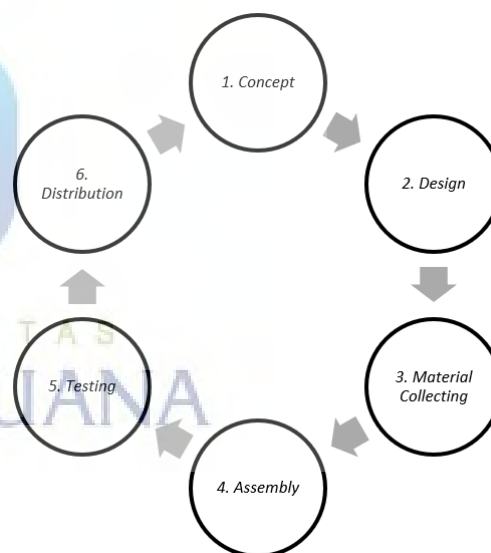


Figure 1. MDLC Stages

The description of the stages of the Multimedia Development Life Cycle (MDLC) as in Figure 1 is as follows:

1. Concept

The stage to determine the goals and who the users of the audience identification program are. Analyze the needs that will be needed for product development. In addition, it determines the type of application (presentation, interactive, etc.), the purpose of the application (information, entertainment, training, learning and others) and general specifications.

2. **Design**
The stage of making specifications in more detail regarding the architecture of the program, style, appearance and material needs of materials for the program. In this stage, a storyboard, flowchart view, object diagram navigation structure and screen view design are created.
3. **Material Collecting**
The stage where the collection of materials that suit the needs. At this stage is carried out the collection of materials such as drawings and audio necessary for the next stage.
4. **Assembly**
The stage at which all multimedia objects or materials are arranged. Application creation based on storyboards, flowchart views, object diagram navigation structures and screen display designing originating from the design stage. At this stage, the creation of programs using programming languages is also carried out.
5. **Testing**
Done after the completion of the creation stage and all data has been entered.
6. **Distribution**
The stage where the application is stored in a storage medium to duplicate the multimedia application.

MDLC method is preferred as a method in *system* development because it suitable for *system* development in multimedia applications. Moreover, the stage in this method can swapped positions according to research needs.

In this research, there are 7 stages which is more spesific stages. These stages including: 1) identifying problems and audiences, 2) conducting a literature study of previous research, 3) making application designs, that is Mockups and UML, 4) collect and create multimedia prayer data, 5) build an application using Android Studio and Unity, 6) *testing* an application, and 7) make a report on the research results. For an illustration of the stages of research can be seen in Figure 2

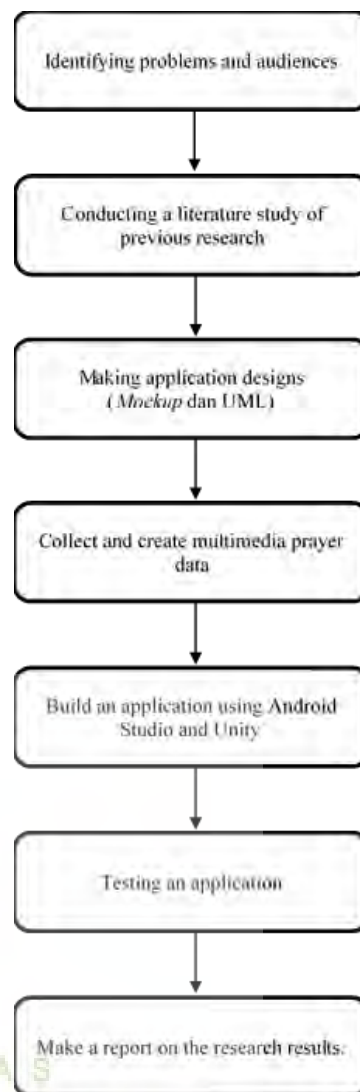


Figure 2. Stages of Research

The first stage of the study is to identify the problem and determine the audience. Where not a few Muslim children and even adults, have not practiced various daily prayers according to the sunnah and du'a prayers of the Prophets. In reality, it is rare to find a daily du'a prayer application that is specific to basic age children. Whereas children of basic age have distinctive ways of thinking characteristics in contrast to early childhood (preschool) and adults.

Then a literature study was carried out on related studies. Based on the study of literatures, the child's interest in the period of basic age is mainly focused on everything that is moving or dynamic. The use of multimedia and augmented reality in prayer applications has been proven to increase the effectiveness of prayer learning in children. However, the use of markers on AR makes the application become dependency, so

researchers make applications with markerless augmented reality.

Then the design of the mockup design and UML (Unified Modeling Language) of the application to be built is carried out. Mockup creation using Adobe Illustrator CS6 and UML creation using StarUML UML is one of the tools/models for designing object-oriented software development [21]. This UML application contains 1 usecase diagram and 5 activity diagrams.

Before the application started to be built, it first collects and creates data, that is audio materials, text, and visuals of daily prayers. Materials are obtained from various sources, and for some drawings are made by themselves using Adobe Illustrator CS6. After all the materials were collected, Daily Du'a AR application can started to built.

The daily prayer app is built using Android Studio, Unity, and Vuforia. Android Studio is an Integrated Development Environment (IDE) or an official integrated development environment that is specifically designed for the development of the Google Android operating system [27]. Unity is a software that processes images, graphics, sounds, inputs, and others intended to create a game or application. It can be either 2D or 3D. Vuforia is augmented reality Software Development Kit (SDK) for mobile devices that allows the construction of AR applications [23].

After the application has been completely build, testing is executed. This study will look at whether the application was successfully created and whether it will affect the effectiveness of du'a prayer learning in basic age children.

III. RESULTS AND DISCUSSION

III.1 Concept

The purpose of the application is for learning, which is to increase the effectiveness of understanding various daily du'a prayers. The intended audiens is a child of primary age.

This android-based daily prayer application called Daily Du'a, contains a collection of daily prayers with a simple user interface design and a modern dashboard, equipped with augmented reality. The media in this application is a combination of image,

sound, and text media. The audio of each prayer can be play and pause.

Augmented reality is applied in this app on salah prayer. The simulation of prayer movements is made into the form of a two-dimensional (2D) AR markerless. In this feature, there is a combination media of audio and visual image.

III.2 Design

At this stage, a UML (Unified Modeling Language) diagram is created and the appearance of each application menu is described. The UML designed for this application are use case diagrams and activity diagrams.

The following use case diagram diagrams the relationship between an actor (user) and system activity.

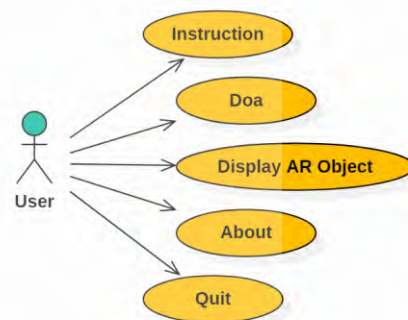


Figure 3. Usecase Diagram

The following Figure 4-8 is an activity diagram of each activity on the use case in Figure 3.

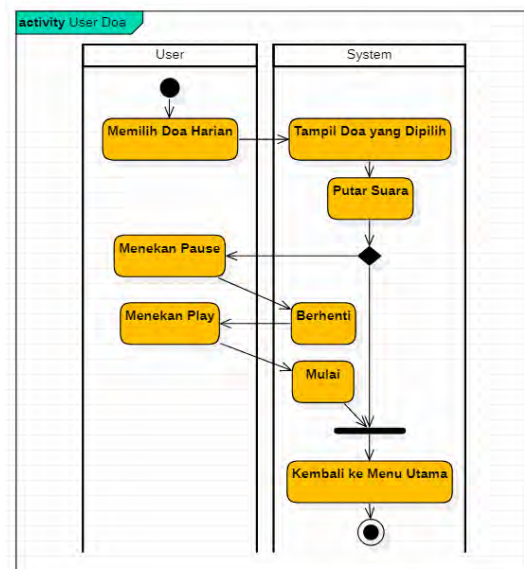


Figure 4. Activity User Doa

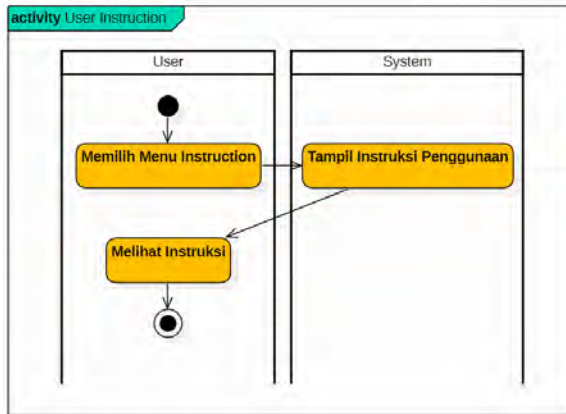


Figure 5. Activity User Instruction

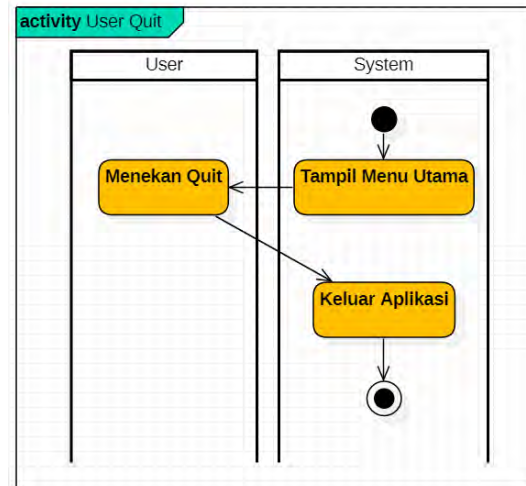


Figure 8. Activity User Quit

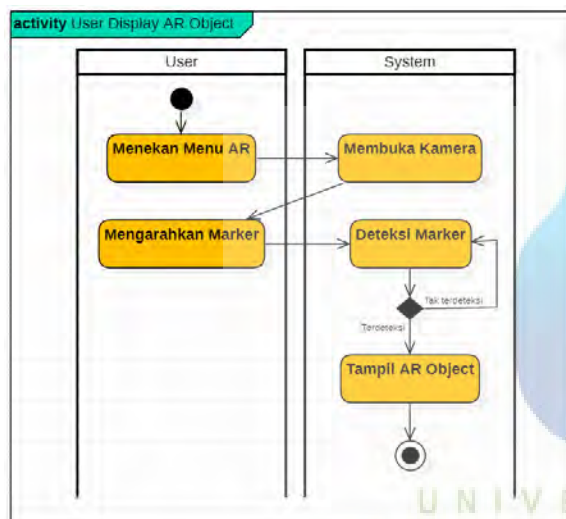


Figure 6. Activity User Display AR Object

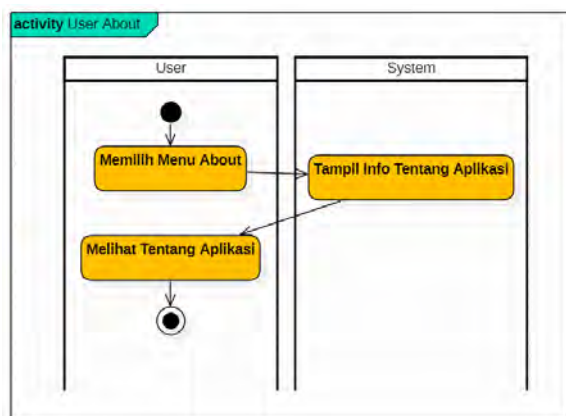


Figure 7. Activity User About

III.3 Material Collecting

Materials or substances supporting the application in the form of audio, text and images that will be used for application, are collected at this stage. These materials are not always finished materials, but there are also materials that researchers make themselves or modify according to application needs.

The audio material of the prayers is sourced from Youtube. Meanwhile, the material for illustrations of prayers is sourced from Pinterest, FlatIcon, and some are created or modified using Adobe Illustrator CS6 software.

The app contains 16 audios and illustrations of daily du'a prayers. The kinds of daily du'a prayers that are material in the application (without AR) are: du'a before eating, du'a after eating, du'a before sleeping, du'a after wake up, du'a when going to the bathroom, du'a before leaving the house, du'a before wearing clothes, du'a when looking in the mirror, du'a before studying, du'a before riding vehicles, du'a for parents, du'a for safety in this life and in the hereafter, du'a after rainfall, du'a upon hearing thunder, du'a before entering mosques, and du'a before leaving the mosque. The app features Arabic text, Latin, and meaning in Indonesian of each prayer.

For the simulation of salah prayers (with 2-dimensions AR) i.e. the prayer of two rakaats ranging from takbiratul ihram to salaams. The specific salah prayer movements and recitations on this application are: takbiratul ihram, du'a iftitah, surah Al-Fatihah, selected short surahs, takbir, du'a during ruku, tasmi, du'a while standing itidal, du'a during sujood, du'a while

sitting between two sujoods, du'a during early tasyahud, du'a during final tasyahud, and salaams.

III.4 Assembly

The software used in the application compilation is Android Studio and Unity. In creating Augmented Reality (AR), the Vuforia SDK is used. The selected Vuforia SDK is called Vuforia AR Extension for Unity so that it can be combined with Unity.

In the first stage of assembly, the main menu display is made in Android Studio including 16 daily du'a prayer buttons (without AR) plus 1 salah prayer simulation button (with AR) and 'about' button containing application developer info. These following figures show main menu display and when clicked one of the button display, using the Android Emulator.

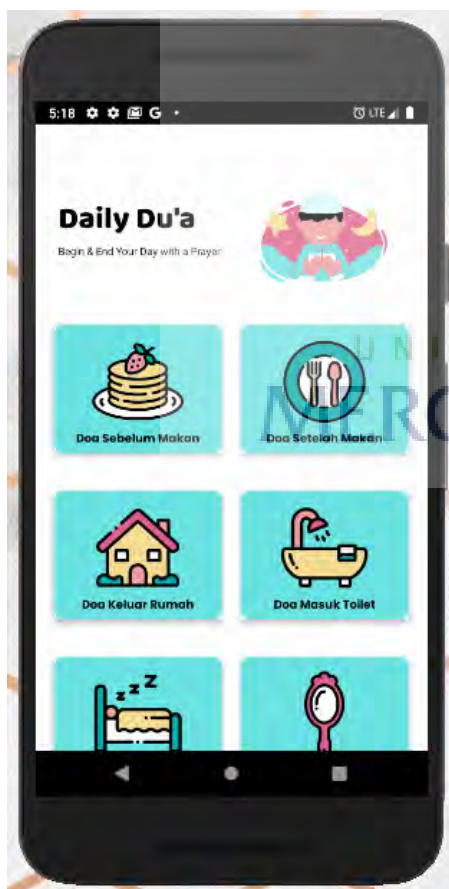


Figure 9. Main Menu

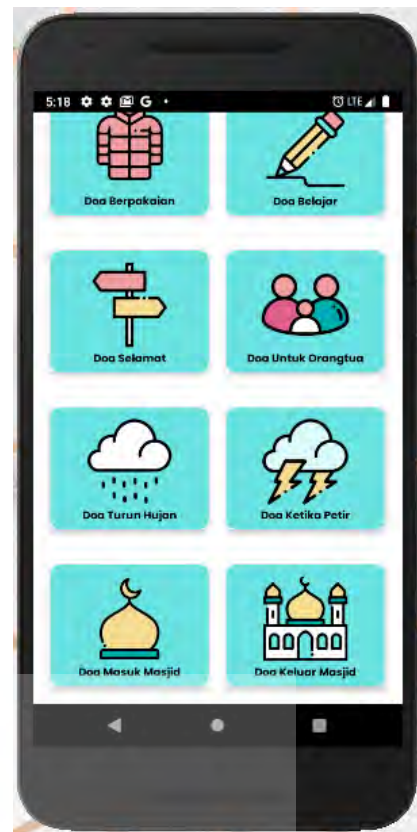


Figure 10. Main Menu when scrolled



Figure 11. Du'a Before Studying

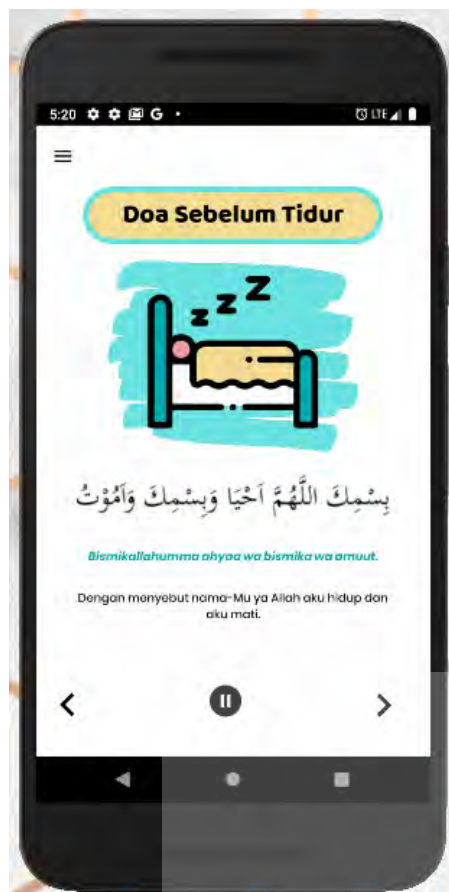


Figure 11. Du'a Before Sleeping

After selecting one of the du'a prayers from the main menu, a display appears as shown in Figure 11. This entire display contains a back button to the main menu, du'a titles, du'a icon images, du'a texts in Arabic, Latin, and Indonesian, play and pause button, previous and next button.

The second stage of assembly is using Unity software to modeling augmented reality salah prayer including audio and image of each movements. It takes Vuforia AR Extension for Unity.

The final stage of assembly is to export the Unity project for Android and then proceed to build that project with Android Studio. So that if you click "Prayer Reading" in the main menu, the camera will automatically open, and augmented reality will appears in user's camera.

III.5 Testing

After the application is completed, an application testing is carried out. The testing phase was executed on respondents of basic age children in the form of limited testing.

III.6 Distribution

The stage where the application is stored in a storage medium to duplicate if the multimedia application will be used with different machines, duplication can be done using a pendrive, or distributed with the internet network. At this stage, if the storage media is not enough to accommodate the application, then compression is carried out against the application.

IV. CONCLUSION

The Daily Du'a app contains 16 daily du'a prayers for elementary age children equipped with markerless augmented reality. The purpose of the application is to increase the effectiveness of comprehension and make it easier to memorize various daily du'a and salah prayers. The method used in building the application is the MDLC method. The test results show that this android-based daily prayer application using augmented reality is quite effective to become one of the learning platforms and improve the ability to memorize daily du'a prayers in children of dasar age.

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KERTAS KERJA

Ringkasan

Kertas kerja ini merupakan material kelengkapan artikel jurnal dengan judul “Rancang Bangun Aplikasi *Daily Du’a* Berbasis Android Untuk Anak Usia Dasar Menggunakan *Markerless Augmented Reality*”. Di dalam kertas kerja ini disajikan: *literature review*, analisis dan perancangan, dataset yang digunakan, *source code*, tahapan eksperimen, dan hasil eksperimen secara keseluruhan. Pada Bab 1 *Literature Review* disajikan hasil *review* atas literatur yang terkait dengan penelitian yaitu: aplikasi berbasis Android, rancang bangun aplikasi doa, konsep AR (*augmented reality*), kognitif anak usia dasar, pemanfaatan multimedia, penerapan metode MDLC (*Multimedia Development Life Cycle*), dan konsep UML. Pada Bab 2 Analisis dan Perancangan berisi analisis konsep dan hasil perancangan (User Interface dan UML) dari aplikasi do’a harian berbasis Android untuk anak usia dasar dilengkapi dengan *Augmented reality*. Pada Bab 3 *Source code* berisi tentang bahasa pemrograman, *tools/IDE*, sistem operasi, dan *library* Android yang digunakan. Pada Bab 4 Dataset dijelaskan dataset yang digunakan, karena penelitian ini mengenai pembuatan aplikasi, maka yang ditampilkan adalah media apa saja yang dibutuhkan dalam membangun aplikasi. Pada Bab 5 Tahapan Eksperimen berisi penjelasan tahapan penelitian secara keseluruhan dan tahapan metode pengembangan perangkat lunak yaitu *Multimedia Development Life Cycle* (MDLC). Pada Bab 6 Hasil Eksperimen ditunjukkan hasil *testing black box* dari aplikasi, dan hasil pengujian terhadap anak usia dasar mengenai efektivitas aplikasi dalam pembelajaran doa.

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