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Virtual Reality-Based Hajj Manasik Practice Digitization System with 360 Degree Video

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Abstract

Hajj guidance is a simulation activity carried out by pilgrims so that pilgrims can better prepare themselves. Even though they have carried out the guidance for Hajj, sometimes the congregation still feels that they do not understand the material they are learning and feel that they have not learned enough about the object of Hajj by using guide books, especially the practice of the Hajj. But pilgrims have not taken the guidance of other Hajj because of the cost, time and place they need. By using virtual reality based on 360-degree videos, pilgrims can understand the material better and can perform the pilgrimage independently without being hindered by time, place and cost. The research was conducted using Research and Development (R&D) research methods and then using a quantitative approach to approach the application. The instruments used in this research include material expert test sheets, media test sheets, and user usability test sheets. The results show that virtual reality (VR) based on 360-degree video is a media that is feasible to use and has very good benefits for prospective pilgrims.

Keywords
applications; digitization system; hajj manasik; virtual reality; 360 degree video

I. Introduction

Hajj is the 5th pillar of Islam that must be done by a Muslim if they are capable to do it. Considering the relatively high cost and the long departure schedule, careful preparation is needed before hajj jamaah doing the hajj ritual. Before doing the hajj rituals, hajj jamaah will doing a Hajj simulation. This ritual is a provision for hajj jamaah before leaving for Mecca. Guiding the jamaah is the duty of the government as an effort to foster, service and protect the jamaah. Even though the the jamaah have been received the determined teory, a simulation using tools that resemble the original and written material to be read back at home, sometimes hajj jamaah still feel they do not understand the teory presented and are needed later in hajj rituals. According to a survey of 50 Muslim respondents aged 25-50 years who own and use Android, as many as 60% of respondents still do not understand about Hajj. 58% said this was due to the limited time and 28% due to the lack of clear explanations in the manual provided.

Researchers have also conducted unstructured interviews to ten people with an age range of 20 to 50 years old who have performed the Hajj rituals. The interview found that the jamaah still felt lacking in the rituals of Hajj that had been done. However, hajj jamaah also do not take another Hajj rituals due to time, place and cost constraints. Hajj jamaah also agree if a technology is developed to study Hajj material and can be used to practice Hajj rituals independently.

Technology developments are already in a period of shifting from technology where the operation uses a lot of human power to use a fully automatic computer system or what is known as digital technology. This change from conventional to modern can be seen from

changes in the equipment used in society. Social media is an example of a relatively recent development of information technology (Marbun *et al*, 2020). One of the technology that is developing and popular in 2018 is virtual reality. With virtual reality users can interact with an environment that is simulated by a computer. The environment can be a simulated original environment or a new environment.

Simulating real environments in virtual reality can be done using 360-degree videos. 360 degree video is a video created by the camera system recording the entire direction simultaneously with 360 degree rotation, where the user can shift and rotate the point of view to watch from different angles. 360-degree photos can make an image look with a wide viewing angle. 360-degree video provides an overview of the environment from various perspectives so that users feel like they are in that location. Virtual reality can be combined with 360-degree videos so that users can get a more real experience in interacting with the virtual world.

Based on the statement that humans are only able to remember 20% of what is seen and 30% of what is heard. While 50% remember from what is seen and heard and 80% from what is seen, heard and done at once, it is hoped that with the development of Hajj rituals learning applications that use 360-degree videos with virtual reality that are good and can provide benefits to hajj jamaah.

II. Research Method

The research conducted using R&D research methode. The research steps follow the steps of Sugiyono's research and development method with additional steps outlined in Figure 1.

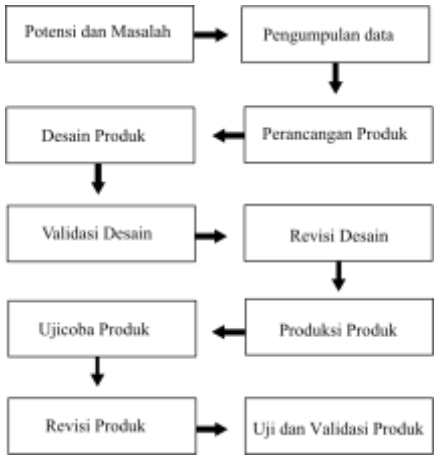

Figure 1. *Research Steps*

2.1 Research Parameters

The research is conducted by doing a feasibility test and a usability test. The feasibility test and usability test are done by giving questionnaires and asking for an assessment from stakeholders, which is the Hajj guidance guides, media expert and hajj jamaah.

2.2 Research Instruments

a. Literature Review

Reference searches done to identifying the problems using the internet and looking for the latest news related to the problem. As for the literature study, it was done by looking for journals about 360-degree videos and virtual reality.

b. Observation

Observations are made by researching and recording about the problems that occur and are felt by the hajj jamaah, what kind of solution is desired and the best place to conduct research.

c. Interview

Interviews were conducted by researchers with the intention of obtaining direct data from related parties. Interviews were conducted with hajj jamaah and the organizers of the Hajj rituals.

d. Documentation

The author collects data from existing documents such as articles, journals, books and so on, so that the author can obtain notes related to virtual reality research on Hajj rituals such as: an overview of Hajj rituals, materials needed in Hajj rituals, the use and utilization of virtual reality, the advantages and disadvantages of virtual reality and so on.

e. Questionnaires

The questionnaire is intended for stakeholders, which are material experts, media experts and hajj jamaah. The scoring of the questionnaire uses a Likert scale. The Likert scale is a measurement scale developed by Likert in 1932. The Likert scale has four or more questions that are combined to form a score or value that represents individual characteristics, for example knowledge, attitudes and behavior as shown in the following table:

Table 1. Likert Scale

Description	Score
Very Bad	1
Bad	2
Enough	3
Good	4
Very Good	5

2.3 Testing Instrument

The test instrument used in this study was a feasibility test questionnaire and a usability test. The feasibility test will be divided into two tests, which are the media feasibility test by media experts and the material feasibility test by material experts. Furthermore, the usability test is the stage to determine the assessment of the application and the usefulness of the application to prospective users, which are the hajj jamaah.

2.4 Feasibility Test and Usability Test Data Analysis Techniques

Questionnaire data from the test results from stakeholders were then analyzed using a descriptive percentage technique with formula.

$$P = \frac{\sum R}{N} \times 100\%$$

With P as the stakeholder's score percentage, ∑R as the stakeholder's sum of score, and N as e maximal score. The percentage obtained is then interpreted into qualitative sentences using the eligibility criteria as shown in the following table:

Table 2. Rating Classification

Score Percentage	Interpretation
84%-100%	Very Feasible
69%-84%	Feasible
53%-68%	Feasible Enough
37%-52%	Not Feasible
20%-36%	Very Not Feasible

This research is said to be successful if the stakeholders obtain results that are in the range of 84% ≤ score ≤ 100% or 68% ≤ score ≤ 83% with the interpretation is "Very Feasible" or "Feasible".

III. Results and Discussion

3.1 Results

a. Problems and Potential

After conducting interviews and searching the literature described previously, it was concluded that hajj jamaah still feel inadequate with the rituals of Hajj that have been done and are constrained by time, place and cost to do the Hajj guidance again. To bridge these problems, 360-degree video can be utilized. Video 360 allows users to thoroughly explore the surrounding scenery. Virtual Reality is an effective promotional media that utilizes new technology to add to the audience's new experience of an environment as a whole.

b. Data Collection

The scope of material that will be included in the application is adjusted to the Circular Letter About Pelaksanaan Bimbingan Manasik Haji Tingkat Kabupaten/Kota dan Kantor Urusan Agama Kecamatan published by Direktur Jenderal Penyelenggara Haji dan Umrah Serta Pembekalan Ketua Regu dan Ketua Rombongan Kementerian Agama Republik Indonesia. In the circular letter's 2nd attachment there is a table detailing the integrated Hajj ritual guidance material which consists 15 points which are the source of the scope of material applied in the application.

The material is divided into two types of presentation which are written material and material that delivered directly through 360-degree videos. The scope of the material contained in the written material is adjusted to the Circular Letter, point 9 about Bimbingan Pelaksanaan Ibadah Haji with additional material, while the scope of the material contained in the 360-degree video is adjusted to the Circular Letter point 10 concerning the Praktik Pelaksanaan Ibadah Haji/Manasik Haji

The material contained in the written material and 360-degree video is adapted to the material contained in the Hajj and Umrah Manasik Guidance Book issued by the Director General of Hajj and Umrah Organizers 1441 H/2020 M Ministry of Religion of the

Republic of Indonesia while the material contained in the 360-degree video is delivered live by Hajj Manasik Guide.

When selecting a place for making 360-degree videos for applications, observations were made using the internet about places that are usually used as places for the practice of Hajj rituals that can be used as places to take videos. Firdaus Fatimah Zahra is one of the places to choose from. The author conducting unstructured interviews with the Manager of Firdaus Fatimah Zahra, Mr. Sarwono Priyo Nugroho. Interviews were conducted by asking about Firdaus Fatimah Zahra's activities and the facilities needed in the application plan.The interview found that Firdaus Fatimah Zahra is the right place because Firdaus Fatimah Zahra is still active as a place for performing Hajj rituals by hajj jamaah from all over Indonesia and Firdaus Fatimah Zahra has complete facilities. Based on the observations of the facilities and locations that have been done, the observations concluded that Firdaus Fatimah Zahra is a place that can be used as a place to take 360 videos of the practice of Hajj rituals.

There are several considerations in determining the tutor in a 360-degree video. After conducting guidance and searching for related data, it was concluded that the 360-degree video material for the practice of Hajj rituals will be delivered by the Hajj Manasik guide who has experience in the Hajj ritual guidance process and has mastered the material. The material that will be presented in the video is also adjusted to the 10th point Circular regarding the Praktik Pelaksanaan Ibadah Haji/Manasik Haji. The author then communicated with the organizers of the Hajj rituals and after interviews and agreements were made, Mr. Mudakir as the Islamic Religious Education Teacher at SMK Negeri 6 Semarang and the Advisor for Hajj rituals in Firdaus Fatimah Zahra will be the material tutor on the 360-degree video of the practice of Hajj rituals.

c. Product Planning

The application will be compiled using the data and information obtained at the data collection stage. The application developed consists of two concepts of material delivery which are the written material accompanied by pictures. The second concept is the delivery of material that is packaged in the form of a 360-degree video. The process of making this virtual reality application design is done by designing the display of Use Case Diagrams.

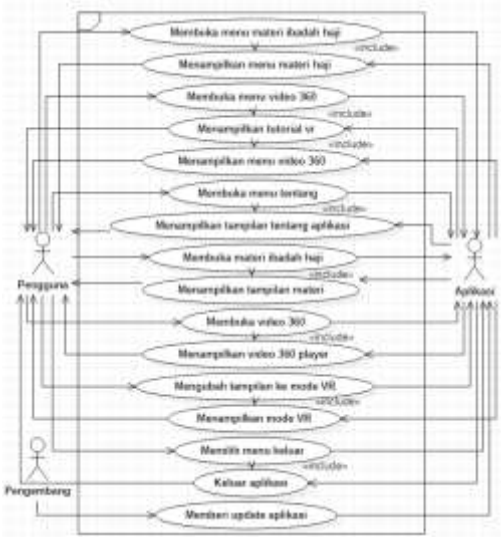

Figure 2. *Use Case Diagram*

Figure 2 is a use case diagram of the application. Use case diagrams are made to describe the behavior or behavior of the system to be created. With use case diagrams, developers can find out what functions are in a system and who can use these functions. In this use case diagram there are three actors, namely users, developers and applications.

d. Product Design

This virtual reality Hajj Manasik application consists of some page as:

1. Landing Page

Virtual reality hajj manasik application's landing page is the page that will appear after the splash screen is complete. On this page there is an application identity such as the title and logo. In addition, there are three buttons, namely the user guide button, the application exit button and the entry button. The design results are shown in the image 3.

Figure 3. *Landing Page Design*

2. Homepage

The home page of the application is the main page of the application. The home page contains several menus, namely the application material menu, the 360-degree video menu of the Hajj rituals and the about menu. Users can select the menu menu by sliding and pressing on the desired menu. In addition to these menus on the home page, there are also two buttons, namely the back button which will direct the user to the start menu and the user manual button to enter the user manual menu. The design results are shown in Figure 4.

Figure 4. *Homepage Design*

3. Menu Page for Hajj Practice Materials

The material menu page is a page that contains materials for the Hajj rituals. There are 12 content menus that users can choose from and consist of four pages. The materials are Types of Hajj, Legal Requirements for Compulsory Hajj, Ihram, Miqat, Thawaf, Sa'I, Wukuf, Mabit, Throwing Jamrah, Tahallul, Activities After the Peak of Hajj and an Mustajab Place to Pray. The results of the design are shown in Figure 5.

Figure 5. *Material Menu Page Design*

4. Practice Materials of the Hajj

Material page is a page that contains written material from the material menu selected by the user. There is an explanation of the selected material in the form of writing, pictures and videos. Some materials consist of several pages. The design results are shown in Figure 6.

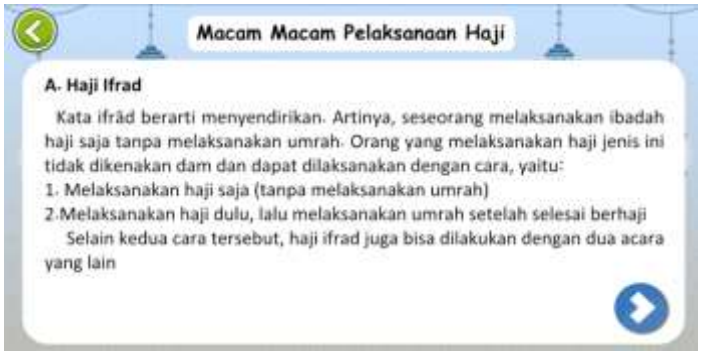

Figure 5. *Material Page Design*

5. Hajj Practice Video Menu Page

Hajj Practice Video Menu Page is a page that appears when the user selects a separate 360-degree video menu of Hajj rituals on the 360-degree video page of Hajj rituals. On this page there are 10 video menus that users can choose from. The results of the design are shown in Figure 6.

Figure 6. Video Menu Page Design

6. 360 Degree Video Page

The 360-degree video page is a video player page that will appear when the user selects a video. The video player developed utilize the gyroscope sensor found on each smartphone so that users can already feel the 360-degree sensation without using a VR Box. The design results are shown in Figure 7.

Figure 7. *360 Degree Video Page Design*

7. 360 Degree Video virtual reality mode

Virtual reality mode is a mode where the video selected by the user will be divided into two right and left display screens so that they can be viewed using a VR Box. The results of the design are shown in Figure 8.

Figure 8. *360 VR Video Fashion Page Design*

e. Design Validation

The user interface design of the Hajj ritual virtual reality application that has been made will be validated and analyzed by the lecturer. The design validation process is done by showing and requesting input from Mundakir Mr. Mudakir as the Islamic Religious Education Teacher at SMK Negeri 6 Semarang and the Advisor for Hajj rituals in Firdaus Fatimah Zahra. With design validation, it is hoped that the media design can be suitable and can be used by potential users as well as possible.

f. Design Revision

After getting validation and input on the designs made, revisions are done according to these inputs and suggestions. The results of the revision are to give the application some explaining animation and change the menu's picture to be more suitable to the picture is referencing.

g. Application Production

1. Recording 360 Videos with Samsung Gear 360 Degree Camera

360-degree video recording process using a Samsung Gear 360 camera sm-c200. The 360 camera used consists of two lenses in front and back which are capable of capturing 180-degree images horizontally and vertically. The recording process is done in coordination with the Hajj rituals supervisor who is willing to become a model and conducts Hajj ritual guidance in front of the camera. Before the video recording process was done, the author made observations and field preparations regarding what to pay attention to when conducting the video recording process on Wednesday, June 2, 2021. The video recording was done at Firdaus Fatimah Zahra on Saturday 18 September 2021.

2. Stitching Video 360 derajat

Stitching is the process of sewing or merging two video cameras front and back or double fish eye into an equirectangular. Video with an equirectangular view that will be able to be used or viewed with multiple platforms. The stitching process is done using the Adobe Premiere Pro application. Before the stitching process is done, the unused portion of the video is also edited using the same application. The stitching process is shown in Figures 9, 10 and 11.

Figure 9. *Video Results 360 (Double Fish Eye)*

Figure 10. *360 Video Stitching Process*

Figure 11. *360 Video Results (Equirectangular)*

3. Make the application in Unity 3D

After going through the design process and taking materials, the next step is the application development process. The application was developed using Unity 3D software as shown in the 12 image.

Figure 12. *Application developing with unity 3D*

4. Guidebook Creation

In order to provide information on the use of the application to potential users, a virtual reality Manasik Hajj application guide book was created. The Guidebook contains procedures for use per step which are explained with screenshots of the application display along with arrow instructions and written explanations.

h. Product Trial

The trial of the Manasik Haji virtual reality application product was done using Blackbox testing. The test was done by researchers by asking three users with devices that have different specifications to try and record every aspect of the functionality of the features in the application. The features tested were 149 features. Tests get results where there are some features that cannot be used or are not in accordance with the device used.

i. Product Revision

Revision of the Manasik Haji virtual reality application product is done by fixing errors or errors found at the product trial stage as well as the input provided for the application. Then after the revision, the author re-tested the Blackbox by trying and noting every aspect of the functionality of the features in the application. The features tested were 149 features. Tests get results where every feature provided by the application is successful according to the expected realization.

j. Product Test and Validation

In this section several things will be presented, namely (1) the results of testing the feasibility of the virtual reality Manasik Hajj application material (2) the results of testing the feasibility of the virtual reality Manasik Hajj application by media experts (3) the results of testing the usefulness of the virtual reality Manasik Hajj application by prospective application users. The following describes the four tests.

k. Application Material Feasibility Test by Material Expert

Testing of virtual reality Manasik Hajj application materials by three material experts namely H. Rosidin Ansori as Hajj Advisor at the Ministry of Religion of Semarang City and Islamic Religious Education Teacher at SMK Negeri 4 Semarang, and Drs. H. Mundakir as Advisor for Hajj Manasik at Firdaus Fatimah Zahra and Islamic Religious Education Teacher at SMK Negeri 6 Semarang, and Rofiun Khafidz, S.Ag, M.SI as Deputy Secretary of the Nahdlatul Ulama Branch Management in Semarang City and Former Chair of the Da'wah Institute.

Testing is done by providing an assessment questionnaire sheet and requesting an assessment of the applications that have been tried from the experts. The scale used in the questionnaire is a Likert scale as listed in table 1 with a value range of 1-5 for the 24 materials shown in the following table.

Table 3. Feasibility Testing Scores by Material Experts

Description	Score		
	Expert 1	Expert 2	Expert 3
Total score	584	629	615
Average	4,4	4,7	4,6
Percentage (%)	88	94	92
Average Percentage (%)		91,3	
Category (According to the assessment classification in Table 2)		worthy	

2. Application Media Feasibility Test by Media Expert

Media testing of the Manasik Haji Virtual Reality application by media experts was done by three experts namely Manikowati, M.Pd. as PTP Madya (Learning Technology Developer) at BPMPK, Indaryanto, S.T. as PTP Madya (Developer of Learning Technology) at BPMPK, M.Kom., and Ahmad Fashiha Hastawan, S. T., M. Eng. as a lecturer in the Multimedia System course at the Department of Electrical Engineering, State University of Semarang.

Testing is done by providing an assessment questionnaire sheet and requesting an assessment of the applications that have been tried from the experts. The scale used in the questionnaire is a Likert scale as listed in table 1 with a value range of 1-5. The following is a table of the results of the tests done.

Table 4. Eligibility Test Score by Media Expert

Description	Score		
	Expert 1	Expert 2	Expert 3
Efficiency Aspect	16	19	20
Display Aspect	34	44	45
Aspects of Technical Quality, Effectiveness	13	19	20
Amount	63	82	85
Average	3,7	4,8	5
Percentage (%)	74,1	96,4	100
Average Percentage (%)		90,19	
Category (According to the assessment classification in Table 2)		Very Worthy	

3. Application Usability Testing by Users

Testing the usefulness of the Virtual Reality Hajj Manasik application by users was done by 15 hajj jamaah who had finished performing the Hajj rituals in Firdaus Fatimah Zahra. The test is done with the help of the Hajj Manasik Superintendent so that the test can be done after the Hajj rituals are completed. It is hoped that with hajj jamaah who have

just completed the rituals of Hajj, the test can obtain credible and precise data. The test results were obtained by distributing questionnaires to the congregation.

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Table 5. Application Test Score Table by User

Score		Categories based on the assessment classification in Table 2
Total Score	Percentage (%)	
65,5	87,3%	Very good

3.2 Discussion

a. Application Material Feasibility Test

The total score of material expert 1 is 584 which if the percentage is calculated with the total score getting a percentage result of 88% and then after being interpreted according to the assessment classification in table 2 it means very feasible, material expert 2 gives a score of 629 with a percentage of 94% which means very feasible, while the total score of material expert 3 is 615 with a percentage of 92% which means it is very feasible. Thus, from the assessments of the three material experts, a percentage value of 91.3% was obtained, which if interpreted in accordance with the assessment classification in table 2 means it is very feasible..

Then in terms of each aspect of the test, based on the table that has been mentioned, there are three aspects of the material which are divided into 24 questions. The first material is written material divided into 12 questions, the second material is video material which is divided into 8 questions, the third material is original video material which is divided into 4 questions..

The test results of the three material experts can be detailed for each question per aspect of the material. In the aspect of written material, there are six questions with an average score and interpreted according to the classification of assessments in table 3.9, namely, the suitability of the name (100% or very appropriate), the suitability of the description (91.6% or very appropriate), the suitability of prayer or hadith (96.1% or very feasible), suitability of sources (90% or very feasible), suitability of images & animations (88.3% or very feasible), suitability of content (87.2% or very feasible).

The next aspect is the aspect of the video material which includes five questions with an average score, namely, name suitability (100% or very appropriate), description suitability (88.3% or very appropriate), sequence suitability (98.3% or very feasible) , prayer suitability (100% or very appropriate), practice suitability (91.6% or very appropriate).

The last aspect is the aspect of the original video material which includes five questions with an average score and is interpreted according to the classification of assessments in table 3.9, namely, the suitability of the name (100% or very appropriate), the suitability of the description (83.3% or very appropriate), the suitability of order (86.6% or very appropriate), prayer suitability (81.6% or very appropriate), practice suitability (76.6% or very appropriate).

Based on the presentation of the test results by the three material experts, the Manasik Hajj Virtual Reality application obtained a final percentage value of 93.7%. which when interpreted is very feasible to use.

b. Application Media Feasibility Test

Based on the tests that have been done, the total score of media expert 1 is 67 with a percentage of 74.4% which if interpreted according to the classification of judges in table 2 means it is feasible, media expert 2 gives a score of 629 with a percentage of 94% which means very feasible, while the total score media expert 3 is 615 with a percentage of 92% which means it is very feasible. Thus, from the assessment of the three media experts, a percentage value of 91.3% was obtained, which if interpreted in accordance with the assessment classification in table 2 means it is very feasible.

Then in terms of each aspect of the test, based on the table that has been mentioned, there are three aspects of the media which are divided into 17 questions. The first media aspect is the efficiency aspect which is divided into 4 questions, the second media aspect is the display aspect which is divided into 9 questions, the third media aspect is the effectiveness aspect which is divided into 4 questions.

The test results of the three media experts can be detailed for each statement. The efficiency aspect includes 6 statements with average values and interpreted according to the assessment classification in table 3.9, namely, the application workflow is easy to understand (86.6% or very feasible), the information system application program information system is easy to operate (93.3% or very feasible), commands/instructions/steps in simple information system applications in providing information/content (93.3% or very feasible), commands/sources/links in information system applications are easy to understand (93.3% or very worthy).

The next aspect is the display aspect which includes 9 questions with an average value and is interpreted according to the assessment classification in table 3.9, The display is attractive and user friendly (comfortable to use) (93.3% or very feasible), The selection of animation and characters/icons is appropriate. (93.3% or very feasible), Using objects/icons that match the substance of the material (93.3% or very feasible), Objects (icons/labels/menus) are easy to understand (93.3% or very feasible) , The layout design is attractive and easy to digest (86.6% or decent), The suitability of objects and transition/animation effects in information system applications is interesting (93.3% or very feasible), Audio/video presentation in media programs can clarify the content (93.3% or very decent), Color composition in information system applications is attractive (193% or very decent), Object clarity (detailed view) (80% or decent).

The last aspect is the aspect of effectiveness which includes five questions with an average score and is interpreted according to the classification of assessments in table 3.9, The application is not boring (86.6% or very feasible), The material included in the application is in accordance with the aim of providing the right information (93.3% or very decent), Originality of information system applications (have originality) (80% or very decent), Overall content is presented systematically and densely (86.6% or very feasible).

c. Application Usefullness Testing

In the usefulness test, there are two tests, namely the application test and the benefit test. The discussion will be divided based on the two tests. Based on the application test table that has been written, the score of 15 hajj jamaah who use the application and interpreted according to the classification of the assessment in the table is 4.16 with a percentage of 83.3% or good, 4.5 with a percentage of 90% or good, 4.16 with a

percentage 83.3% or good, 4.16 with percentage 83.3% or good, 4 with percentage 80% or good, 4 with percentage 80% or good, 4.3 with percentage 86.6% or very good, 4 ,6 with a percentage of 93% or very good, 4.6 with a percentage of 93% or very good, 4.3 with a percentage of 86.6% or very good, 4.8 with a percentage of 96.6% or very good, 4.5 with a percentage of 90% or good, 4.6 with a percentage of 93% or very good, 4.1 with a percentage of 83.3% or good and 4.3 with a percentage of 86.6% or very good.

Based on the benefit test table that has been written, the score of 15 hajj jamaah who use the application and interpreted according to the classification of assessment in table 3.9 is 3.8 with a percentage of 76.6% or good, 4.08 with a percentage of 81.6% or good, 4 .08 with a percentage of 81.6% or good, 4.08 with a percentage of 81.6% or good, 4.08 with a percentage of 81.6% or good, 4.25 with a percentage of 85% or very good, 4.3 with a percentage 86.6% or very good, 4.3 with a percentage of 86.6% or very good, 4.5 with a percentage of 90% or very good, 4.08 with a percentage of 81.6% or good, 4 with a percentage of 80% or good, 4.4 with a percentage of 88.3% or very good, 4.3 with a percentage of 86.6% or very good, 4 with a percentage of 80% or good, 4.25 with a percentage of 85%.

Then the next discussion is the discussion of the two table test tools and test benefits based on aspects of testing. In the tool test there are 6 aspects with the average value, namely, the contents of the application "Manasik Haji Virtual Reality" according to the material (89.3% or very good), Design "Manasik Hajj Virtual Reality" is attractive (90.6% or very good), The presentation of animations/transition effects is attractive and easy to understand (96% or very good), The audio/video display presented is clear and adds to the understanding of the material/information (86.6% or very good), The commands in the application are simple and easy to understand (77.3% or good), Objects in the application are clear and appropriate (84% or good).

The next benefit test is an aspect that includes 12 questions with an average value and is interpreted according to the assessment classification in table 3.9, namely, practical "Manasik Hajj Virtual Reality" application media (78.6% or good), Application program "Virtual Hajj Manasik Reality" raises interest to know more about the material/information presented (84% or good), The application program "Manasik Hajj Virtual Reality" can increase motivation in learning the material for Hajj rituals (85.3% or very good), Interesting videos and clear to listen to so that the material can be understood (81.3% or good), the material presented in the video is short and clear so it is efficient (84% or good), watching the video makes it easier to understand the material compared to reading the material (85.3% or very good), Virtual Reality gives a realtime impression (86.6% or very good), Virtual Reality provides freedom of interaction with videos (80% or good), Applications make users feel practical ik manasik hajj anytime (88% or very good), The application allows users to experience the practice of hajj manasik anywhere (84% or good), Video 360 allows users to experience the practice of Hajj rituals repeatedly (81.3% or good), Ease of understanding material with face-to-face explanation using Virtual Reality (84% or good).

Based on the presentation of the test results by hajj jamaah using the application, the Manasik Hajj Virtual Reality application obtained a tool test value with an average percentage of 87.3%, which based on the classification of assessments in table 3.9 means very good. Meanwhile, based on the value of the application benefit test, an average percentage of 83.5% is obtained, which is based on the assessment classification in table 3.9 which means very good.

IV. Conclusion

Based on the results of the research that has been submitted, the things that can be concluded are the Manasik Haji virtual reality application is very feasible to use after getting tested by material experts and media experts with percentage values of 91.2% and 85.2%, respectively. The virtual reality Hajj Manasik application can be concluded as very good or very clearly used and useful by users, namely prospective hajj jamaah. This conclusion is based on the percentage value of the tool test in the usefulness test which gets a value of 87.3% and is adjusted to the classification of the assessment in table 2. The suggestions for further research are that the application provides flexibility and freedom to interact in using applications with 360-degree video and virtual reality mode. . Users can interact by viewing the area during the video in 360 degrees. In the future, media applications can be developed that provide more flexibility and freedom to interact for users, such as the freedom to explore the area and interact with objects in the area. In addition, the application provides convenience to application users by providing applications that can be accessed without using mobile data, but the impact on the application size is relatively large. In the future, it is necessary to develop more media applications with smaller sizes without reducing video quality.

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