Design for Android-Based Virtual Tour Application Using Polygonal Modeling and Extrude Face

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Abstract

STMIK Amik Riau is the first Computer College in Riau under the *Kopertis* Region 10 which has an activity based on the information technology sector. This certainly requires the campus management to take advantage of technological developments in every academic activity. STMIK Amik Riau has quite a lot of facilities and infrastructure to support academic activities. However the problem is that the introduction to campus area system has not followed the current competition trend, because the campus introduction system used is still web-based and utilizes social media such as Facebook and Instagram. In order to improve the services of the campus, a virtual tour application that presents android-based campus area information is designed. This application is designed android based by using Polygonal Modeling and Extrude Face Polygonal modeling is an approach to modeling objects using points that determine the area of a surface so that it can create fields from three-dimensional (3D) models. With the application of Android-based technology, the resulting application is expected to be easily accessed because almost all levels of society nowadays have used a Android smart phones. This certainly facilitates the public and students in obtaining information about the shape of the building and the area around campus.

1. Introduction

Higher Education is an institution expected to be able to produce competent human resources in various fields of science. The base of activities in STMIK Amik Riau is the information technology and information science sector, which certainly requires the campus management to take advantage of technological developments in every academic activity including promotion. However the problem is that the campus' environmental introduction system has not followed the current competition trend, because the campus introduction system used is still web-based and utilizes social media such as Facebook and Instagram. This certainly requires the STMIK Amik Riau to be able to provide attractive and interactive android-based information services, so that it can improve competitiveness in the field of information. From the problems described, the researchers conduct a study with the title "Design for Android-Based Virtual Tour Applications Using Polygonal Modeling And Extrude Face". This application is a result of the development of multimedia information technology and three-dimensional (3D) technology. The Virtual Tour application itself is an application that can display 3D

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views so as to make users as if they were physically involved. By using this application, people will find it easier to get information about the shape of buildings and the area around the campus without having to be on there themselves since the shapes of buildings and the area around the campus are presented in 3D and can be accessed directly via smartphone devices. This application is expected to be one of the solutions to improve information services to the community, as well as to the freshmen who enroll at STMIK Amik Riau.

2. Literature Review

2.1 Virtual Tour

Virtual tour is a technology that allows a person to do a simulation of a real object by using a device that will display a three-dimensional (3D) atmosphere to make users as if they were physically involved and allows users to increase situational awareness and increase the power of sight, capture and analysis of virtual data significantly (Wulur, Sentinuwo, dan Sugiarso, 2015). This technology will display a picture of a location that can be seen with a 360 degree viewpoint. Virtual tour technology is very helpful in simulating something that is difficult to present directly in the real world. Virtual area generally present a visual experience, which is displayed on a device such as a computer or smartphone. Virtually simulated area can be made to resemble the real world. Presentation in a virtual tour can be done by utilizing images, videos, and three-dimensional (3D) models.

2.2 Polygonal Modeling

Polygonal modeling is an approach to modeling objects using points that determine the area of a surface so that it can create fields from three-dimensional (3D) models (Setiawan dan M Suyanto, 2016). Polygon is a two-dimensional (2D) shape in the form of n-shape where n is the side that amounts to three or more. In general, polygons are surface shapes of three dimensions (3D) in which are composed of vertices, edges, and faces. A polygon can be analogous to a single triangle, which later when developed and arranged can form a three-dimensional (3D) object. The polygon forming elements are as follows:

1. Vertex

Vertex is a collection of points that become the coordinates of a surface in modeling objects.
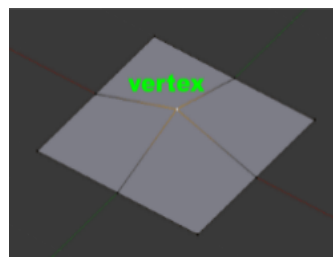

Figure 1. : Vertex Element

2. Edge

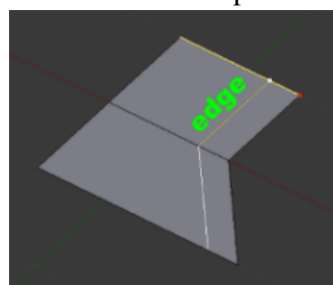Edge is the line segment that connects a vertex point to other vertex points.

Figure 2. : Edge Elements

3. Face

Face is triangular or rectangular elements that forms a polygon consisting of a collection of vertices and edges.
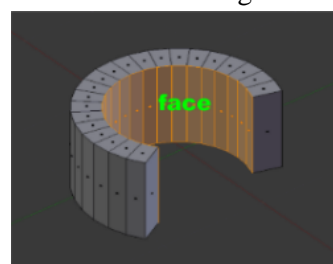

Figure 3. : Face Elements

The application of the polygonal method in creating a 3D model using a blender application consists of several stages.
1. First, selecting the basic objects available in the blender application as needed.

Figure 4. : Basic objects in Blender

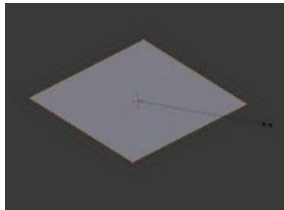2. Second, determining the scale of the object as needed.

Figure 5. : Determining The Scale of The Object

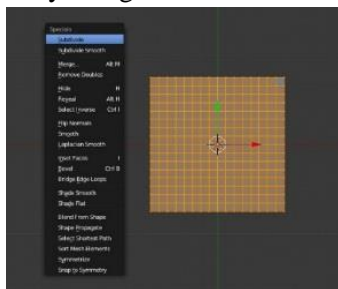3. Next, determining the number of polygon needed by using subdivide tools.

Figure 6. : Setting The Number of Polygon

4. Then, selecting objects on the polygon (vertex, edge, and face) to form the object as desired.
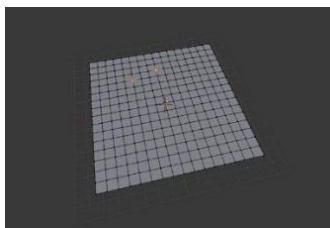

Figure 7. : Selecting Objects

5. After the object is formed, editing the object to form a desired model.
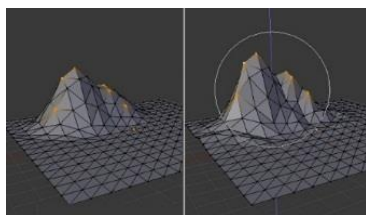

Figure 8. : *Object Editing*

6. The last stage is rendering to see the result of the 3D model by using polygonal modeling.
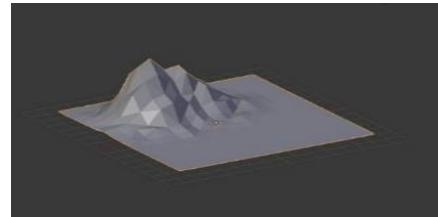

Figure 9. : The Result of Rendering

2.3: Extrude Face

Extrude face is a technique used to form new polygons on a three-dimensional (3D) model by adding face elements to certain axes (Hidayat, 2015).
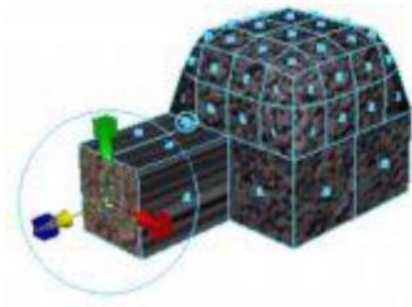

Figure 10. : *Extrude Face*

This technique is used to facilitate users in editing three-dimensional (3D) models using polygonal modeling. The stages in conducting extrude face are as follows:

1. Open the *blender* application and select the three-dimensional (3D) model that you want to extrude by entering edit mode.
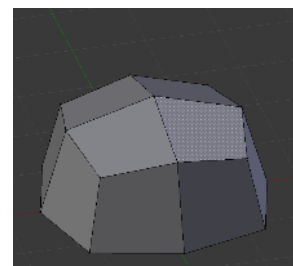

Figure 11. : 3D Model

2. Activate face select in the object, and select face on the object's surface that is wanted to be extruded.
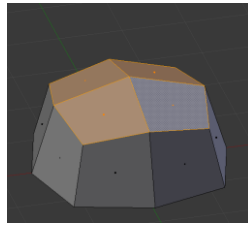
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Figure 12. : 3D Model Face Selection

3. Activate extrude region in tools in blender application, then determine the direction of the coordinates of the new face in extrude.
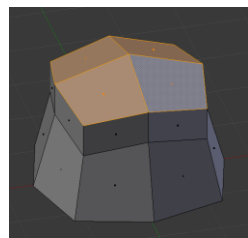

Figure 13. : The Result of Extrude Face

3. Designing System

The designing system was done as an analysis, understanding, visualization and communication for system developers. This stage consists of designing system activities and designing interfaces.

3.1 Designing System Activities

Designing system activities was done to visualize the activities done within the system. The model employed was use case diagram. The use case diagram employed within this study is presented in figure III.1.
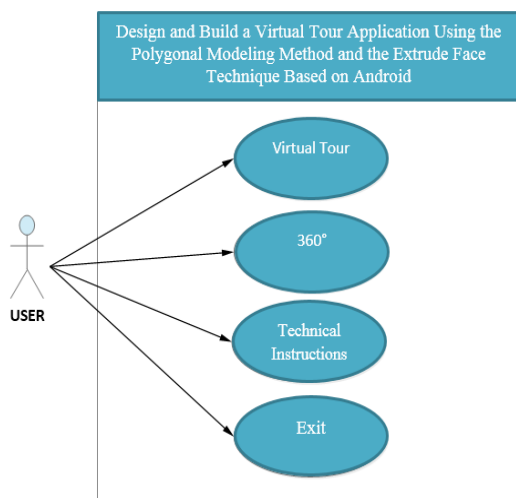

Figure 14. : *Use Case Diagram System*

The following is the explanation of the use case diagram shown in Figure 3.1. above: Users are actors who interact with applications designed to get the information needed. The interactions that can be done by users include:

1. Users can tour the campus area virtually and navigate using virtual analog available on the system.
2. Users can see the shape of the building with a 360 degree viewpoint by using the rotate and scale slider available on the system.
3. Users can see the instructions for using the application in the menu provided.
4. Users select the "exit" button so that they can exit the application.

3.2 Designing the Main Page

Designing the main page is intended to display the starting page when a user accesses the system.
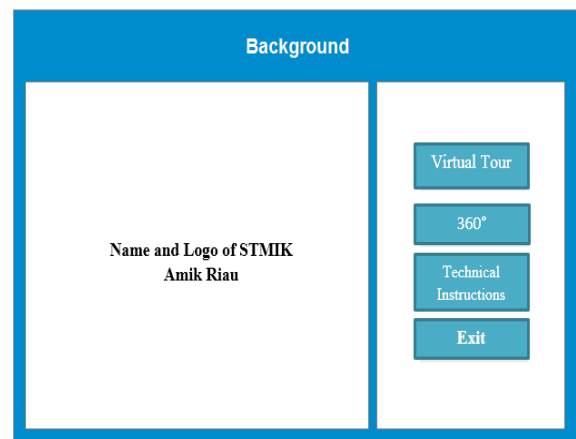

Figure 15. Designing a 3D Model

Designing 3D model is the process of making building models and campus STMIK Amik Riau area using polygonal methods and extrude face techniques using blender applications. The steps in making 3D models with the application of polygonal methods and extrude face are as follows:

1. Select the default object available in the blender application.

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Figure 16. : *Default Blender* Object

2. Adjust the viewport camera to make it easier to adjust the size of the object as needed. Adjusting the size of the object can be done by pressing the S button on the keyboard, then pressing the X, Y, or Z keys on the keyboard to change the size of the object at coordinates (X, Y, or Z) as needed.
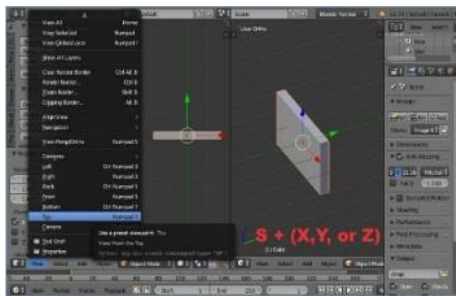
Figure 17. : *Viewport Camera*

3. Select face on objects to determine which part will be edited.

Figure 18. : *Selecting Face*

4. Edit the object by using the extrude face to produce a new face on the object. This process can be done by pressing the E button on the keyboard, then pressing the X, Y, or Z keys on the keyboard to add face at coordinates (X, Y, or Z) as needed.
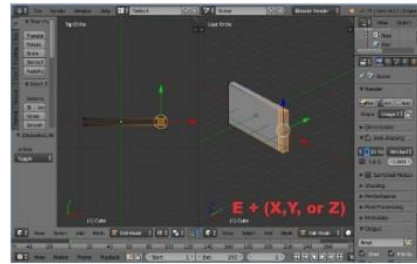
Figure 19. : *Extrude Face*

4. Adjust the number of faces on the surface of the object (polygon) as needed. Adjusting the number of faces in the polygon field can be done by pressing the CTRL + R keys on the keyboard.

Figure 20. : Set the Number of Faces on Polygon

5. Perform the editing process in stages 4 and 5 to form the desired model.
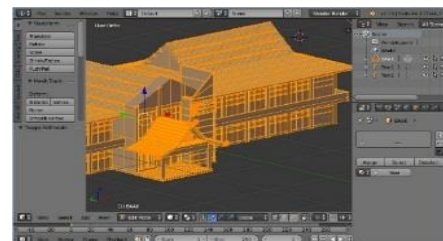
Figure 21. : *Editing Polygon*

6. Color the model as needed.
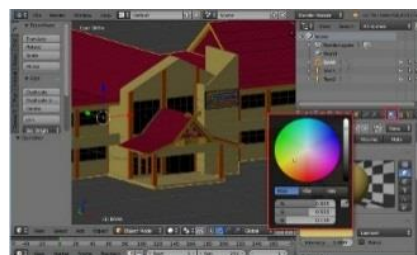
Figure 22. : Coloring the Model

7. Export the 3D model to FBX format to reduce or shrink the size of the objects when planning virtual tours in Unity.

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Figure 23. : *Export FBX*

3.3 Designing *Virtual Tour*

Designing virtual tour is the process of making a virtual tour using a unity application by combining several three-dimensional models that were created in the previous stage so as to form a virtual campus area in STMIK Amik Riau. The steps in designing a virtual tour in a unity application are as follows:

1. Import virtual tour-making materials
2. Set the coordinates of the three dimension (3D) model
3. Import standard assets as plugin character and virtual analog
4. Set the lighting on virtual tour objects three dimension (3D) model.
5. Add characters to the virtual tour so that the camera can move and follow the character's movements.
6. Perform character movement sensitivity adjustment.
7. Add plugin mobile single stick controller as the virtual analog to do a virtual tour with an android device.
8. Write a script to display pop-up information from each of the STMIK Amik Riau campus building models.

4. Test Results

The results of software implementation discuss the implementation of the results of analysis and system design.

4.1 Main Page

The main page is the initial display page when users access the Android-based virtual tour application using polygonal modeling and extrude face techniques

Figure 24. : Main Page

4.2 Virtual Tour Page

The virtual tour page is a page used by users to tour the area of STMIK Amik Riau virtually. As for some of the results of the implementation of the virtual tour page is as follows:

1. Garden / Park

The garden / park is a part of the facility that has functions related to the functions of hydrology, ecology, aesthetics and recreation.

Figure 25. : Garden / Park

2. Lecture Building and B.A.A.K

Lecture and B.A.A.K building is a building used as places for teaching and learning process and for academic administration.

Figure 26. : Lecture Building and B.A.A.K

3. Administration Management Room

The administrative management room is a room that is used for administrative arrangements.

Figure 27. : Administration Management Room

4. Classroom / Lecture Room

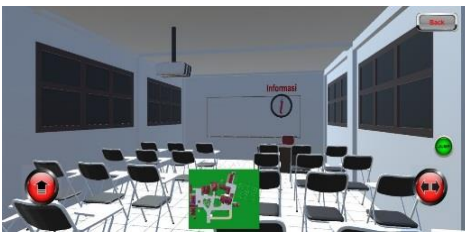Classroom / lecture room is a room used as a place for conducting teaching and learning process.

Figure 28. : Classroom / Lecture Room

Figure 29. : *Musholla* Building

5. Library

Library is a building that contains collection books that are arranged in such a way that they are easy to find and use if at any time required by the reader.

Figure 30. : Library

6. Laboratory

Laboratory is a building that is used as a place for the teaching and learning process of concentration and practice courses.
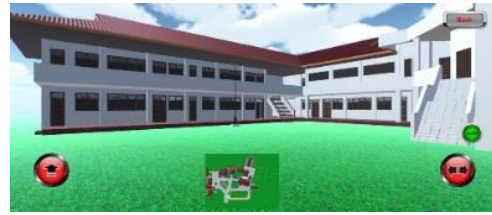
Figure 31. : Laboratory

7. Laboratory Rooms

Laboratory rooms are rooms used as a place for conducting teaching and learning process of concentration and practice courses.

Figure 32. : Laboratory Rooms

8. YKR Convention Hall

The YKR Convention Hall is a building that is used as a place to hold academic activities such as graduation, seminars, workshops and other events.

Figure 33. : YKR Convention Hall

9. Building Information

Building information is a pop up display of information from every building that exists in the form of text and sound.

Figure 34 : Building Information

4.3 360 Degree Building Page

The 360 degree page is the page used by users to view the shape of the STMIK Amik Riau campus building with a 360 degree

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viewpoint. The results of the 360 degree page implementation are as follows:

1. 360 Degree Menu

The 360 degree menu is a view of the building menu on the 360 degree page.

Figure 35. : 360 Degree Menu

2. 360 Degree B.A.A.K and Lectures Building

360 degree B.A.A.K and lectures building represents the appearance of B.A.A.K and lectures building that can be seen with a 360 degree viewpoint.

Figure 36. : 360 Degree B.A.A.K and Lectures Building
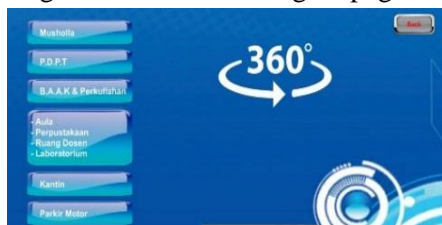
3. 360 Degree Hall, Library and Laboratory Building

360 degree hall, library and laboratory building represents the appearance of hall, library and laboratory building that can be seen with a 360 degree viewpoint.

Figure 37. : Hall, Library and Laboratory Building

4.4 System Help Page

The system help page is a page that displays information about the instructions for using the application.

Figure 38. : System Help Page

4.5 Test Results

The test results are designed to prove that the Android-based virtual tour application used polygonal modeling methods and extrude face runs as expected and has passed the error test. The discussion of the results of this test consists of testing techniques and the conclusions of the test results.

4.5.1 Testing Technique

1. *Virtual Tour Page* Testing

Virtual tour page testing is a test conducted to minimize errors that occur on the virtual tour page, so that the process that occurs on the virtual tour page runs according to its function.

2. Virtual Analog Testing

Virtual analog testing is a test conducted on the movement of the camera using virtual analog, so the camera can move according to the user's wishes. The complete test can be seen in table 4.1.

Table 4.1. Virtual Analog Testing

Page Tes	Testing	Hope Testing	Result Testing	Conclusion
Virtual Tour	Users navigate using the left analog so that they can move forward.	The camera can move forward according to the user's wishes	The camera moves according to conditions.	*Valid*
	Users navigate using the right analog so that they can move towards the right and left.	The camera can move to the right and left according to the user's wishes.	The camera moves according to conditions.	*Valid*
	The user presses "Button Jump" to jump	The camera can jump according to the user's wishes.	The camera moves according to conditions.	*Valid*

3. Mini Map Testing

Mini map testing is a test conducted on the position of the camera on the mini map. The complete test can be seen in table 4.2.

Table 4.2. Mini Map Testing

Page Tes	Testing	Hope Testing	Result Testing	Conclusion
Virtual Tour	Users take a tour of the campus environment virtually	The position of the camera can be seen on the mini map.	The position of the camera is read on the mini map.	*Valid*

4. Campus Building Objects Testing

The campus building objects testing is a test conducted on the appearance of buildings located inside the campus area in the form of three dimensions (3D). The complete test can be seen in table 4.3.

Table 4.3. Campus Building Objects Testing

Page Tes	Testing	Hope Testing	Result Testing	Conclusion
Virtual Tour	Users navigate to a building that is available on the system.	Buildings can be seen in three dimensions (3D).	Buildings can be seen in three dimensions (3D).	*Valid*

5. Building Information Testing.

The booking data processing test is a test conducted on the display of information from each building available on the system. The complete test can be seen in table 4.4.

Table 4.4. Building Information Testing.

Page Tes	Testing	Hope Testing	Result Testing	Conclusion
Virtual Tour	The user presses the information icon contained in each building.	The system can display information contained in buildings in the form of text and sound.	Information appears in accordance with the provisions.	*Valid*

4.5.2 Smartphone Devices Specifications Testing

Smartphone device specification testing is a test conducted to find out whether an application can run on smartphone devices that have lower specifications compared to the device specifications used by researchers. The complete test can be seen in table 4.5.

Table 4.5. Smartphone Devices Specifications Testing

RAM Smartphone	Testing	Hope Testing	Result Testing	Conclusion
4 GB	Run the application on the smartphone device.	The application runs smoothly without any problems.	The application can run as expected.	Valid
3 GB	Run the application on the smartphone device.	The application runs smoothly without any problems.	The application can run as expected.	Valid
2 GB	Run the application on the smartphone device.	The application runs smoothly without any problems.	The application can run, but loading on the virtual tour page takes quite a long time	Invalid

4.5.3 Testing Results

Based on the results of testing of Android-based virtual tour applications using polygonal modeling and extrude face, it can be concluded that this system functions as expected and can run on smartphone devices.

5. Conclusion

From the results of the system design and testing that have been conducted, the following conclusions can be drawn:

1. The system can be a media for introducing the shapes of buildings and the campus area of STMIK Amik Riau.
2. The system can provide a visualization of the shape of buildings and the campus area and can also provide information related to buildings located in the STMIK Amik Riau campus area.
3. Polygonal modeling and extrude face can be applied in the making of campus building models of STMIK Amik Riau.

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