# Aplikasi *Virtual Tour 360 Degree Panoramic* di Gedung Baru Kampus Universitas Komputer Indonesia

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**ABSTRACT**

Based on the results of a survey conducted on 40 students of the Master through questionnaires, stated that as many as 86% showing students WELCOME know only a part of the layout space public facilities in the new building WELCOME, 8% know everything and 6% did not know the layout of space public facilities WELCOME new building.

To be able to know the layout of public facilities in the new building WELCOME, takes an interactive multimedia application that can simulate the real state of the environment of new buildings campus Master. Applications made by using the virtual tour panorama cube method where this method produces the image quality is good enough, because every panoramic image there are 6 pictures on each side, allowing users to be able to see 360 degrees in all directions.

Results of research conducted in the form of application development 360 Degree Panoramic Virtual Tour in the New Campus of University Computer Indonesia. Based on the results of tests performed by means of a questionnaire to 30 students of the Master, showed that the application of the Virtual Tour Master can help students to better understand the layout and information from Public facilities in the new building campus Master.

Keywords: 360 Degrees, Cube Panorama, Interactive Multimedia, Unikom, Virtual Tour

## 1. INTRODUCTION

### 1.1 Background

University Computer Indonesia or Master is one private university in the city of Bandung. UNIKOM has classrooms, labs and other public facilities were quite a lot, and therefore required an interactive multimedia application that can assist in spreading the layout of existing public facilities in Unikom. Moreover, with the launch of a new campus building Master on August 30, 2016 which certainly also increased the new environment on campus Unikom.
Based on the results of a questionnaire distributed to student / student Unikom attached in Appendix I Results Questionnaire Against Student / i Unikom, that 86% of the total students in the given questionnaires argue that they do not know all the layout of the campus the new building of the University Computer Indonesia, where they were puzzled by the particular layout of the room, so the information is reasonably necessary for those who do not have time to visit but would like to know the shape of the new building UNIKOM campus.

One way to convey information about the layout of existing public facilities in the new building of the campus Master based on the results of the final project created earlier is to build an interactive multimedia applications that can help Unikom introduce the campus of new buildings to the student / student of his. Interactive multimedia that will be built is a result of the development of photographic technology, known as the Virtual Reality Photography or more popularly known as the Virtual Tour.

The method will be used in the manufacture of the Virtual Tour itself is by stitching photos and change the outcome of stitching the photos into a cube panorama, where the method of the cube panorama This has advantages in terms of image quality due to the shape of a cube, which has six sides so that the placement of pictures made on each side.

Based on the problems that have been described, I would do research titled Application Development Virtual Tour 360 Degree Panoramic in the New Campus of University Computer Indonesia, which aims to facilitate student / student Master in giving an overview layout of public facilities contained in the new building campus Unikom and also to disseminate information about the picture the layout of public facilities contained in the new building in a more interactive campus Master.

### 1.2 Formulation of the problem

Based on the background described, it can be concluded that the problem arises is how to build applications that can provide information about the layout of public facilities contained in the new building to the campus Master students and prospective students / student Unikom.

### 1.3 Purpose and objectives

Based on the problems studied, the purpose of this thesis was to build a Virtual Tour Applications Using methods cube panorama in the New Campus of University Computer Indonesia.

The purpose of the construction of the Virtual Tour are:

1. Facilitate student / student in the Master layout gives an overview of public facilities contained in the new building UNIKOM campus.
2. Disseminate information about the picture the layout of the public facilities located in a new building in an attractive campus Master.

### 1.4 Research Methodology

The research methodology used in this study has several stages including problem identification, data collection, software development and system testing. Below is an overview of the research methods used:

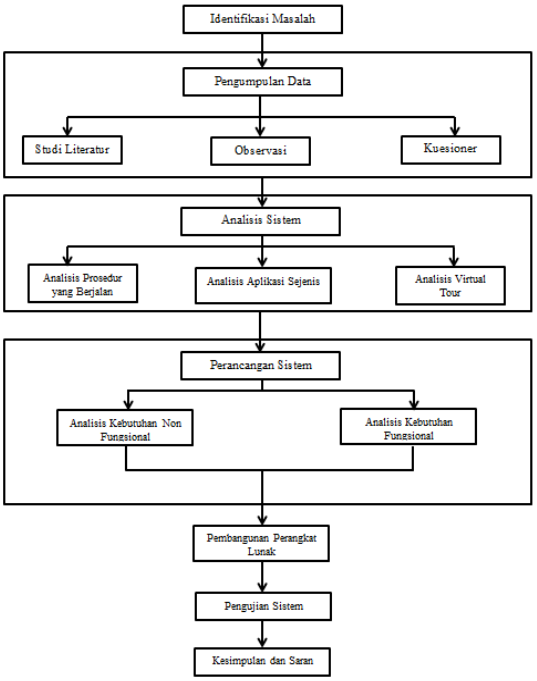



Figure 1. Research Methodology

### 1.5 Multimedia

According to Hofstetter (2001) is the use of multimedia computers to display information which is a combination of text, graphics, audio and video so that users can navigate, interact, create and communicate with the computer.

In addition to the combination of these multimedia objects, there are also four other important components, namely:

a. Their computers to organize what will be seen and heard, and what will interact with its users

b. The presence of the links that connect the information available

c. Their navigation tools for people to use the information available

d. There is a procedure for users to collect, process and communicate information and ideas.

### 1.6 Virtual Tour

The virtual tour is a simulation of a location consists of a series of images. The series of images are aggregated (stitch) to produce a 360 degree panorama. Virtual tour itself is usually used to give a 'never was' somewhere just by looking at the screen. Presentation virtual tour can be done by using pictures or video, but it can use three-dimensional models. For presentation using pictures, can be used a panoramic photo. Kind of panoramic photos also affect the results generated virtual tour. For a panoramic kind Cube allows the user to view in all directions.

### 1.7 Methods Pictures Panorama

There are several ways to create a virtual tour, where these methods to manipulate the media two-dimensional (2D) in the form of three-dimensional (3D) to form a room or space that is then given a view control a first person perspective so that it can represent or virtualize 2D object that seem real (estate) to the user's application.

a. cylindrical

Cylindrical panoramas is a panoramic circular like a tube. Consisting of a single very wide panoramic image. This type depicts as if the user is placed right in the middle of the circle, and allows the user to look around horizontally, amounting to 360 degrees

b. spherical

Spherical panorama is a spherical panorama. Consisting of a single panoramic picture made specifically, so that it can be formed in such a way as a ball. This type depicts as if the user is placed right in the middle of the ball, and allows users to view freely in all directions

c. Cubic

Or Cube Cubic panoramas panorama is cuboid, consisting of 6 pieces of the image, such as on each side of the cube. This type depicts as if the user is placed right in the middle of the cube, and allows users to see all six sides, front-back, left-right and up-down.




Figure 2. Method Panorama Pictures

## 2 RESEARCH

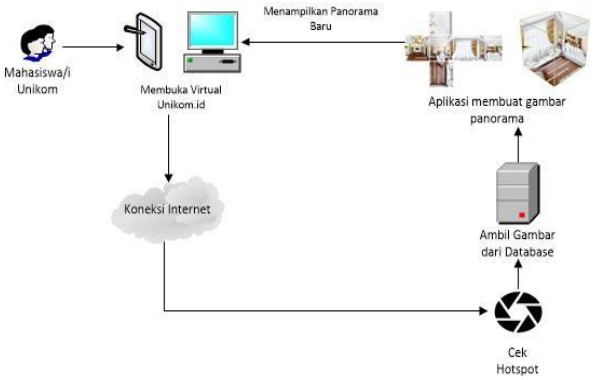
### 2.1 Problem analysis

Based on the background described, it can be concluded that the problem arises is how to build applications that can provide information about the layout of public facilities contained in the new building to the campus Master Master students.

Thus the existing problems, they invented a multimedia application that can introduce shapes and campus UNIKOM to student / student of his, of which this application is an interactive application that can simulates as if the user is in place such as first-person perspective, so users felt were in UNIKOM campus buildings. In addition, there are also extra-additional information on every floor so that applications be made more attractive. Information such as classrooms, lecture rooms, space department secretary or other spaces in general.

### 2.2 System Architecture

System architecture analysis phase is the stage to get a picture of the life of the system to be built. Overview of the system architecture can be seen in Figure 3




Gambar 3 Arsitektur Sistem

### 2.3 Flow System Built

The system will be built is a web-based application Virtual Tour technology that uses Virtual Reality Photography with the cube method panorama. Virtual reality photography technology used for this kind of technology can manipulate the image as if the user was in the area. Web is used as a means of a virtual tour application is built so that these applications can be easily reached by all students of the University Computer Indonesia. The purpose of this application is made to be able to show the layout of the facilities that are common to the new campus building environment WELCOME faster, easier to use by the user and must be made more interactive. The process of rendering an image of the virtual tour application that will be created is to use WebGL, which is included into the Javascript API. Flow virtual tour application system can be seen in figure 4

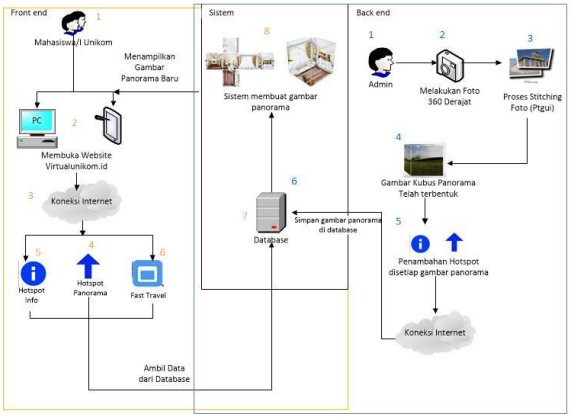



Figure 4 Flow System Built

### 2.4 Building Panorama image

Virtual tour application development in the new building is intended that UNIKOM campus student / student UNIKOM easier to recognize shapes and UNIKOM campus environment. In this application, the user as if it were in a building environment Unikom and can look thoroughly using photography and virtual reality technology can also interact with features that exist in the application's virtual tour UNIKOM

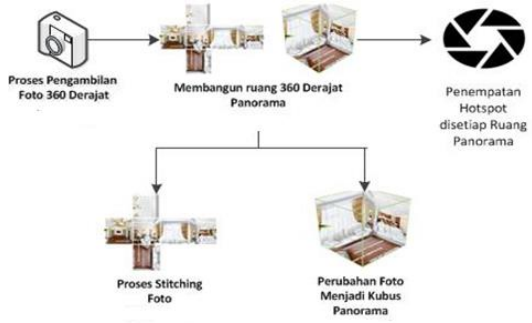



Figure 5 Building Panorama image

In making the application virtual tour, the steps that must be done first is to photograph as a whole (360 degrees) in places or points that will be used as space 360 degree panorama, after it carried out the process of stitching the images of the images was then presented into a 3D space , after it was placed hotspots in the 3D image as a feature to navigate so that the user can explore the campus WELCOME through the browser on his computer.

#### 2.4.1 Making Process 360 degree photos

The process of shooting is done by taking pictures as much as possible by taking a picture rotate sequentially. Between one photo to another photo there must be an object or image that is an exact match, it is because when the process of stitching the next ditahap program requires an image or object that is identical to one with a sewn between images more images.

### 2.4.2 Build 360 Degree Panorama Lounge

After the shooting process is completed, then the process is done next is the construction of an 360-Degree Panorama. In this process there are several steps that must be done to make the results of the individual photos into a panorama photograph cube. The first No photo stitching process then combine these photos into a large photograph of the piece. And the second is to change the photo into a panorama photograph cube.

#### 2.4.2.1 Photo Stitching Process

Image stitching is a merger between two or more adjacent images. That basically two or more images taken by adjacent parts or objects are always exactly the same. Image stitching process using an object / image the same for combining images with each other, having the same image already is found then the picture is stitched with each other so that it becomes a big picture complete.

To perform the stitching process must first be found to the point where parts of the same photo. It is assumed that when the photos were taken, are required to have the parts or exactly the same images. To find the parts that are exactly alike. Program looking for an image or pixel points are identical between one image with another image and so on. The search process image pixel identical or point is marked with the same number and color of one image with another image, or can we call node.

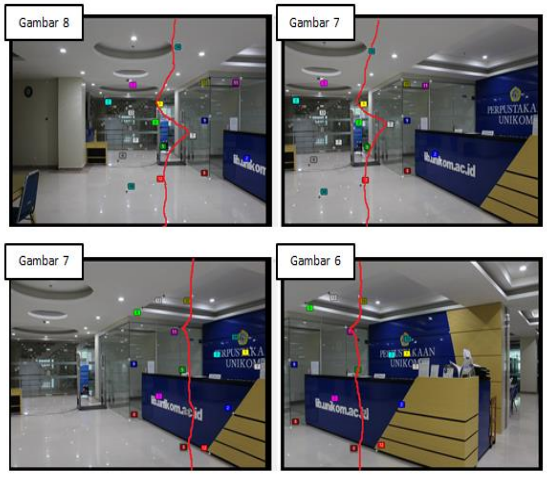



Figure 6 Photo Stitching Process

#### 2.4.2.2 Transform Photos Into Cube Panorama

The method for displaying a panorama cube where there are six different hand stitching the images must be converted into a six-sided cube with conversion software PTGui. Then the six images are stored in the three-dimensional coordinates as table 1 below.

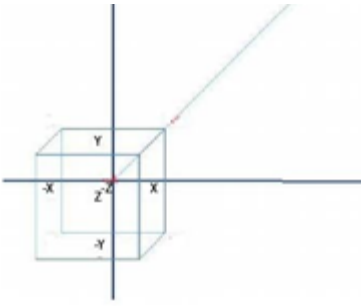
Table 1 XYZ coordinates

| Z. sisi belakang | X. Sisi Kanan |
|---|---|
| Z Koordinat( 0.0, 0.0,-1.0); | X Koordinat(1.0, 0.0, 0.0); |
| Z1 Koordinat (-1.0, -1.0, -1.0); | X1 Koordinat(1.0, -1.0, -1.0); |
| Z2 Koordinat (-1.0, 1.0, -1.0); | X2 Koordinat(1.0, 1.0, -1.0); |
| Z3 Koordinat ( 1.0, 1.0, -1.0); | X3 Koordinat(1.0, 1.0, 1.0); |
| Z4 Koordinat ( 1.0, -1.0, -1.0) | X4 Koordinat(1.0, -1.0, 1.0); |
| **Y. sisi atas** | **X. Sisi kiri** |
| Y Koordinat ( 0.0, 1.0, 0.0); | X Koordinat(-1.0, 0.0, 0.0); |
| Y1 Koordinat (-1.0, 1.0, -1.0); | X1 Koordinat(-1.0, -1.0, -1.0) |
| Y2 Koordinat (-1.0, 1.0, 1.0); | X2 Koordinat(-1.0, -1.0, 1.0); |
| Y3 Koordinat ( 1.0, 1.0, 1.0); | X3 Koordinat(-1.0, 1.0, 1.0); |
| Y4 Koordinat ( 1.0, 1.0, -1.0); | X4 Koordinat(-1.0, 1.0, -1.0); |
| **Y. Sisi Bawah** | |
| Y Koordinat(0.0, -1.0, 0.0); | |
| Y1 Koordinat(-1.0, -1.0, -1.0); | |
| Y2 Koordinat(1.0, -1.0, -1.0); | |
| Y3 Koordinat(1.0, -1.0, 1.0); | |
| Y4 Koordinat(-1.0, -1.0, 1.0); | |

The next step is to make 6 pictures that have been prepared into a panorama cube space. The pictures that have been set up, will occupy each side in accordance with the order.




Figure 7 Panorama Each Side




Gambar 8 Penempatan Koordinat setiap gambar

### 2.5 Placement Panorama Image Hotspot

Hotspot is a navigation marker point for changing locations or informants in the panoramic views. After waking space formed panorama, the application will process the placement hotspot at their respective positions in accordance with the specified coordinates.

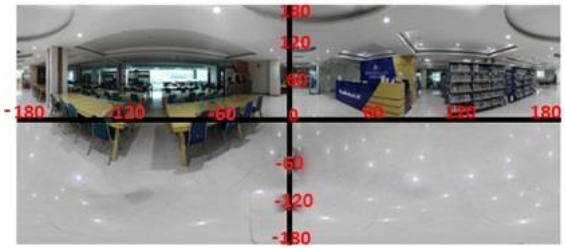


Figure 6 Placement Hotspot Pictures Panorama

### 2.6 Functional Needs Analysis

#### 2.6.1 Diagram Context

Context diagram is a diagram illustrating the inputs, processes and outputs in the system software to be built. Figure 9 below is a diagram of the application context virtual tour Unikom.

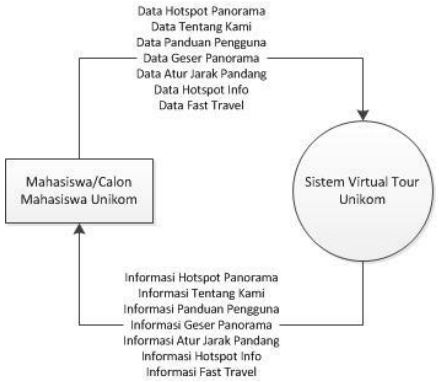
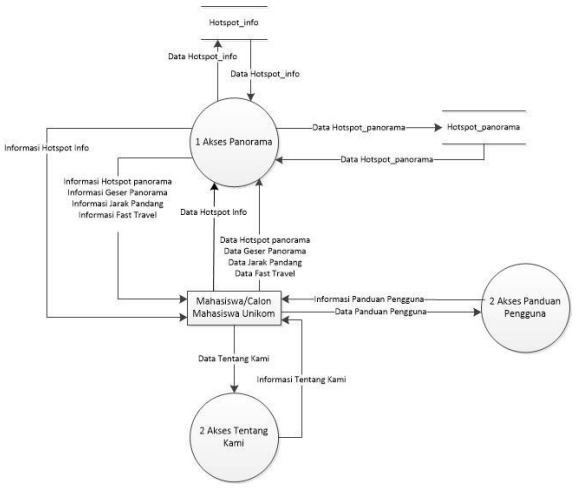



Figure 8 Diagram Context Virtual Tour Unikom

#### 2.5.2 Data Flow Diagram

Data Flow Diagram is a medium to describe aaliran data flowing in an information system. The following is a virtual tour of the application DFD WELCOME

DFD level 1 virtual tour Panorama UNIKOM consists of access, access to us, and to access the user guide, can be seen in Figure 9




Gambar 9 DFD Level 1 Virtual Tour Unikom

DFD Level 2 Panorama Player shown in Figure 10

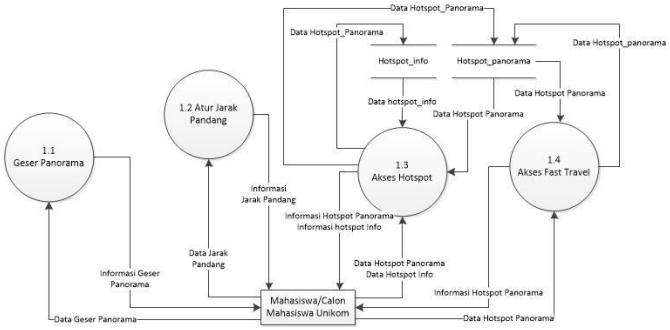



Figure 10 DFD Level 2 Virtual Tour

### 2.7 System planning

The design of the system is part of a software development methodology that should be done after going through the analysis phase. To be able to design the system then do some fruit steps are as follows:

1. Menu Structure Design
2. Design Data
3. Design Interface
4. Designing a Message
5. Semantic Networks

#### 2.7.1 Menu Structure Design

The design of the menu structure is intended to facilitate the manufacture of the systems required by the program to be built. The design of this menu structure will help in designing parts of the actual application and to determine which parts are first accessed by a user later after the program is completed. Figure 11 and 12 below shows the menu structure of the system being designed.

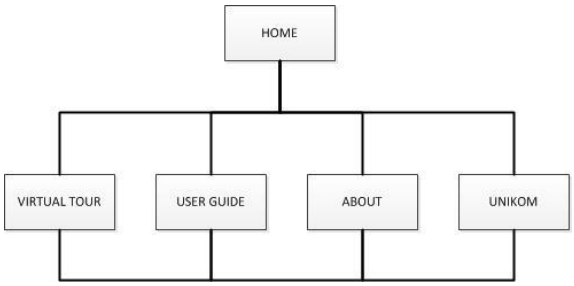



Figure 11 Menu Structure Design

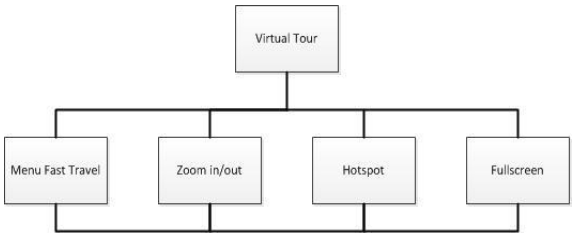



Figure 12 Menu Structure Design (Continued)

### 2.7.2 Design Data

The design of the data is the design of a virtual tour application database that will be created to store the image data and the value of the hotspots that will be stored in JSON.

In this process of data elements grouped into a single database file. There are elements Scene_id, title, map, and some elements of hotspots available in a single panoramic image. JSON schema virtual tour application development UNIKOM campus can be seen in Figure 13 and 14 below:

```
"scene_id": {
            "title": "LANTAI 1",
            "preview": "lt61/preview.jpg",
            "type": "cubemap",
            "cubeMap": [
                "loc/map+x",
                "loc/map-x",
                "loc/map+y",
                "loc/map-y",
                "loc/map+z",
                "loc/map-z"
            ],
            "hotSpots": [
        {
            "pitch" : 100,
            "yaw"   : 100,
            "type"  : "info",
            "text"  : "text"
        },
         {
            "pitch"     : 100,
            "yaw"       : 100,
            "type"      : "scene",
            "text"      : "text",
            "sceneId"   : "scene_id"
        },
```

Figure 13 JSON Schema Example

Explanation

1. Scene_id: Contains the id of the panoramic image data

2. Title: Contains the name of the location of the panoramic image

3. Preview: To see the image before going into a panoramic image

4. Type: To select the format of the panoramic image, Cubemap / Spherical

5. Cubemap: Contains the data array of panoramic images stored location

6. Map + x, Map-x, Map + y, Map-y, Map + z, Map-z: Contains the image path from each side of the cube panorama image

7. Hotspot: Contains an array of data set hotspot panorama

8. Pitch: Contains coordinate data of a panoramic image

9. Yaw: Contains coordinate data of a panoramic image

10. Type: Contains the type of hotspot whether to be a hotspot "info" or hotspot "scene" which is a hotspot for leading other panoramic images.

11. SceneId: Link to get to the next panorama picture

### 2.7.3 Interface Design

The design of the interface is needed to represent the true state of the application to be made. Here is an example perancangna existing interface of the application to be made.

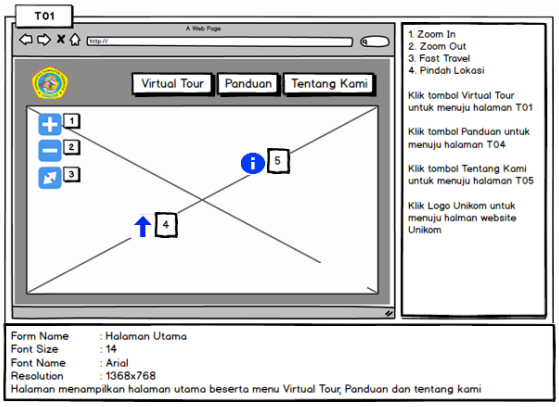



Figure 13 Main Page

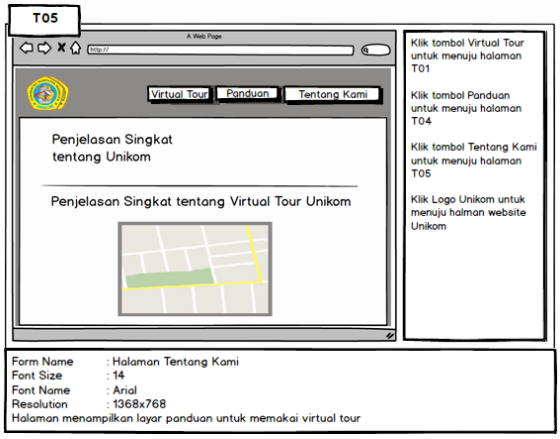



Figure 14 About Us page

### 2.7.4 Design Message

Messages were designed in the context of applications dikemabangkan form of notification messages to start the virtual tour WELCOME. Can be found drawn 15

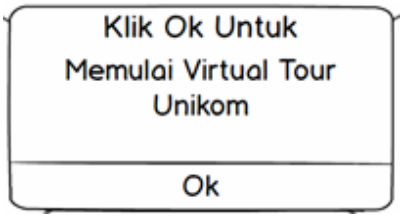



Figure 15 Notification To Start Applications

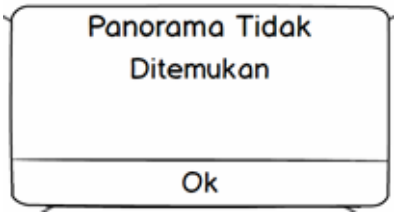



Figure 16 Location Notification intended Not Found

### 2.7.5 Semantic network

After designing the interface, we perform the design of the flow of menus available on program.For describe the relationship depicted in a semantic network that can be seen in Figure 17

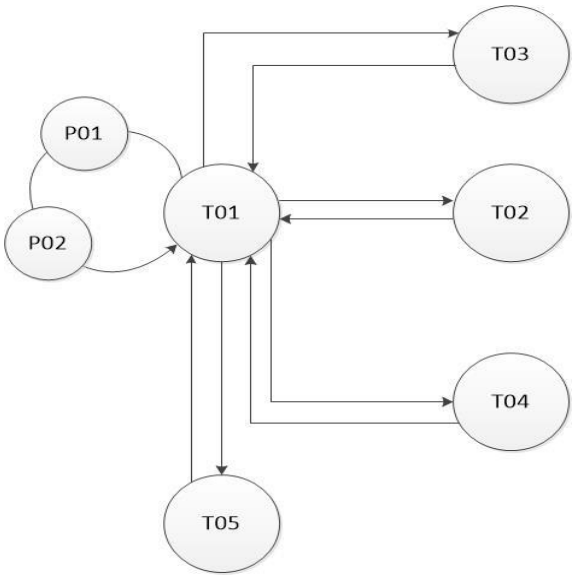



Figure 17. Semantic network

### 2.8 Testing Systems

Testing of the system is the most important thing to do to find a weakness or error of software that will be tested. Testing intended that application is made already meet the criteria in line with expectations.

The first phase of testing is blackbox testing that focuses on the functionality of the application. The second phase is acceptance testing that focuses on the assessment of the applications that are built through a questionnaire to the users of the application.

### 2.8.1 BlackBox Testing

Black box testing focuses on functional software created. Stages of functional testing will include black box testing scenarios, case and test results.

Based on the results of blackbox testing has been done it can be concluded that the application is a virtual tour of this Master has no errors and functional process is running as expected.

### 2.8.2 Acceptance Testing

Acceptance testing is testing conducted objectively. Acceptance testing is done with a study of the prospective users of the system to determine the assessment of the application. Data collected through questionnaires to 30 students of the Master.

Results of Testing of 30 students is as follows

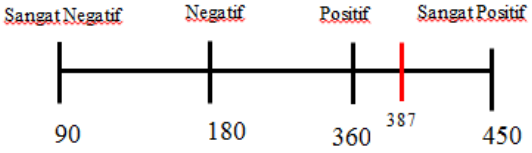



Figure 18. Testing Results A Likert Destinations

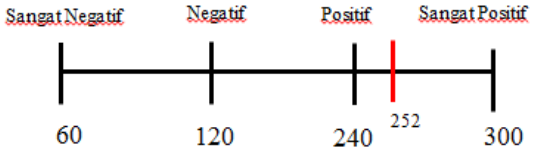



Figure 19. Testing Results Likert Objective B

## 3. CLOSING

### 3.1 Conclusion

The conclusion is based on the analysis, design, implementation, and testing of the system is done as follows:

1. Of the overall questionnaire respondents saw this application is quite easy to get an overview of the layout of public facilities in the new building WELCOME.

2. The virtual tour WELCOME to help provide information and give an overview of new buildings WELCOME attractive manner.

### 3.2 Suggestion

For Virtual Tour Unikom application development in the future, there are some suggestions that can be done, among others:

1 Replace the panoramic image into a video panorama.

2 The addition of interactive maps menu.

3 Adding features such as a tour guide with video or gif format within the application, so that applications become more attractive virtual tour.

4 There are many objects that can be played in panorama player, so that applications become more interactive.

5 Changing the hotspot information from the article into voice format.

6 Adding hotpspot panorama in the small alleys, so that browsing becomes more widespread.

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