DEVELOPMENT OF SMART MIRROR USING RASPBERRY PI BASED ON IOT

Rasmandika Ramdhan Nugraha[1], Iskandar Ikbal[2]

[1,2] Teknik Informatika – Universitas Komputer Indonesia
Jalan Dipatiukur No. 112-114 Bandung, Jawa Barat 40132
Email : rasmandika95@gmail.com, iskandar.ikbal@email.unikom.ac.id

ABSTRACT

Bandung Lautan Photographer has three main parts, namely Photographer, Model, and Makeup Artist. The average person at the Artist Makeup Section has more than one job. The purpose of this research is to help the makeup artist in Bandung Lautan Photographer to remind the schedule, client data and the notes they have made so that they can be seen when they are busy or when applying makeup and mirroring. Smart Mirror is a mirror that can display data in the form of schedule data, client data and records that can be seen by a makeup artist while in a mirror. Before smart mirrors display data, users are required to login using fingerprints. In addition the mirror will display a notification that will remind the client schedule or data both when the user has logged in or has not logged in. Own data can be added by a makeup artist through an application on a mobile device. The data form on the mobile application has been adjusted to the needs of a makeup artist based on the results of interviews with the artist makeup section coordinator at Bandung Lautan Photographer. Based on the results of the test it can be concluded that the smart mirror device is enough to make it easier for a makeup artist, especially in reminders of client schedules and data. This system is expected to continue to be developed and can help not only on the makeup artist section.

Keyword : Internet of Thing, Application, Android, Bandung Lautan Photographer, Makeup Artist

1. INTRODUCTION

Bandung Lautan Photographer is a community engaged in photographers. In the Bandung Lautan Photographer community there are three parts that play an important role, namely the photographer, model and makeup artist. Every year the Bandung Lautan Photographer community organizes an event themed in photography. The event is an event to build a good friendship relationship or work relationship between the photographer, model and makeup artist. In addition, the Bandung Oceanographic event is a promotional event to add clients and increase work popularity.

Based on the interview with Zihan Nurul A as the coordinator of Bandung Lautan Photograper (BLP) makeup artist, almost all makeup artists at BLP have more than one job, namely as a makeup artist and other work such as teaching, entrepreneurship and so on. Therefore most makeup artists have an uncertain schedule every day. The uncertain schedule sometimes makes makeup artists have problems in setting schedules. Whether it's a schedule of activities outside the scope of the makeup artist scope or the schedule for meeting clients. Aside from schedule issues, another problem that often occurs is when many clients make appointments on a particular day sometimes making a makeup artist wrong when categorizing the client to be assigned. This affects the equipment they will bring and use to make up.

Although it has been recorded on mobile devices, the above problems still occur. This is because not all makeup artists in Bandung Lautan Photographer like to open mobile devices while preparing to do activities or while dressing. Both decorate others and make up for themselves because when opening a mobile device the focus becomes disturbed by the content on their mobile devices.

Based on the above problems, we need a media that can display each schedule or client data of a makeup artist and can be seen when preparing to do activities or make makeup without always having to open a mobile device.

2. CONTENT

2.1 Teoritical Base

2.1.1 Application

The application is a software used by computer eaters to help complete the work. A programming language is needed for which can be in the form of assembler, compiler or interpreter if you want to develop your own application [1].

Programming language functions to write programs with easier language, after that it is changed to a language that can be understood by the computer. Good design and procedures are needed to develop an application to solve complex problems [1].

2.1.2 Android

The following is a discussion about the meaning of android, history and version:

1. Pengertian Android

Android is an operating system on mobile phones that is open and based on the Linux operating system. Initially Android Inc. who is a newcomer who made software for cellphones bought by Google Inc. Then the Open Handset Alliancei was formed, a consortium of hardware, software and telecommunications companies that aims to develop Android [2].

2. Android History

Initially there were various types of operating systems on mobile devices including the Symbian operating system, Microsoft Windows Mobile, Mobile Linux, Iphone and others. However, among the existing operating systems do not support the standards and issuance of APIs that can be used as a whole and at a low cost. Then Google joined in with the Android platform, which promises openness, affordability, open source and quality framework.

In 2005, Google acquired the Android Inc. company. to begin the development of the Android platform. Where involved in this development are Andy Rubin, Rich Miner, Nick Sears, and Chris White. In mid-2007 a group of industry leaders jointly formed an alliance of open mobile device analysis, Open Handset Alliance (OHA). Part of the goal of the alliance is to innovate quickly and respond to consumer needs better, with the initial product being the Android platform. Where Android is designed to serve the needs of telecommunications operators, handset manufacturers, and application development, OHA is committed to making Android open source with the Apache Version 2.0 license [2].

2.1.3 Java Script

JavaScript is a script language based on objects that allow users to control many aspects of user interaction in an HTML document. Where the object can be a window, frame, URL, document, form, button, or other item. All of them have properties that are interconnected with them and each has a name, location, color values and other attributes [3].

2.1.4 Internet of Thing

Internet of Thing is a concept that utilizes connectivity that is continuously connected to have various capabilities such as remote control data, all of which are connected to local and global networks [4].

2.1.5 Raspberry Pi

Rasberry Pi is an electronic circuit in the form of a single board computer that is like a credit card and functions like a complete computer using an ARM system on a chip that is integrated on a PCB. Rapberry Pi can be connected to the monitor screen via an available connector such as HDMI or can use the Connector Converter such as HDMI to VGA. Raspberry Pi hardware does not have a real-time clock, so the OS must utilize the server network timer as a replacement. But this easily developed computer can be added with many real-time functions and many others, via GPIO channels (General-purpose input / output) via the I²C (Inter-Integrated Circuit) interface [5].

2.1.6 Fingerprint Sensor

Fingerprint sensors have been widely used starting from the attendance system (Attendance / Attendance System), access control (controller system) to as a personal identity. Although the way the fingerprint system works is very complicated, but in a few seconds it can be known whether it matches the user or not [6].

2.1.7 Web Service

Web service is a collection of data (database), software, or part of a software that can be accessed by various devices remotely with a particular intermediary [7]. In general, web services can be identified by using URLs like only the web in general. But what distinguishes web service from the web in general is the interaction provided by web services. Unlike web URLs in general, web service URLs only contain a collection of information, commands, configurations or syntax that are useful for building certain functions of the application [8].

2.2 Analysis and Design

2.2.1 Problem Analysis

The development of smart mirrors using Raspberry Pi and Android is a system designed and used to view a user's schedule. In addition to the schedule, users can also view client data and notes so that users do not need to always open the smartphone when they want to or are ready to work. As for the research carried out there are problems that occur so that this system is made:

1. Having more than one job makes an erratic schedule that makes a makeup artist in Bandung Lautan Photographer sometimes experience problems in arranging schedules, especially the schedule for dressing a client.
2. When many clients who make appointment appointments on a particular day sometimes

make a makeup artist wrong in categorizing the client. This results in the items being prepared for the makeup process.

Therefore, a solution is needed to deal with the problems that are happening, namely a smart mirror system that aims to:

1. The system is expected to facilitate the makeup artist in viewing the client's schedule and data, especially when preparing to do activities or while dressing.
2. The system is expected to facilitate the makeup artist in seeing the client category to prepare the equipment needed when dressing.

2.2.2 Analysis of Design System Architecture

Analysis of System Design Architecture is a design of the system to be built. The system will be an android application and also an application on the Raspberry Pi device. The android application will be used to store the data needed in the firebase in the form of JSON. Then the data will be processed in the Raspberry Pi device and will be displayed if the login process is successful. The system design that will be built can be seen in the following figure:

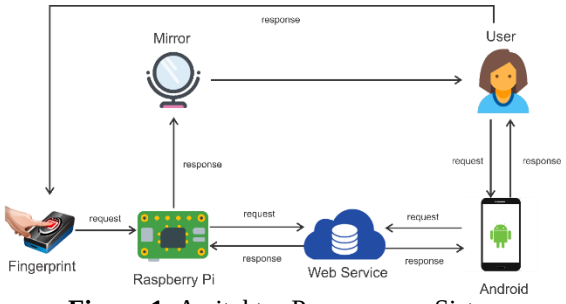


Figure 1. Arsitektur Perancangan Sistem

The following is an explanation of the smart mirror system design architecture and android smartphone application:

1. Users can enter schedule data, client data and records on mobile devices. In addition, users can also manage data that has been entered on a mobile device.
2. Data will be sent to the web service and stored in the firebase. Firebase itself is a database hosted in the cloud. Data is stored as JSON and synchronized in realtime to each connected client [9].
3. Apart from Android devices, users can see data that has been previously entered, on a mirror device.
4. Before the mirror device displays data, users are required to login using fingerprints.
5. The device checks the login status of the user based on the registered fingerprint.
6. If the login process is successful, then the data will be taken by the mirror device and will be displayed to the user.

2.2.3 Analysis of Technology Used

This analysis aims to find out what technologies are used in this study. The technology used in this study is as follows:

1. Firebase

Firebase is a database hosted in the cloud. Data is stored as JSON and synchronized in realtime to each connected client [9]. Firebase is used as a web service to store data. Data will be connected between mobile devices and smart mirror devices.

2. Fingerprint Sensor

Fingerprint sensor is used as a tool to perform authentication on mirror devices. This sensor will check the fingerprint based on the user registered on the mobile device and has stored fingerprint data on the mirror device.

2.2.4 Analysis of Non-Fungsional Needs

1. Hardware Requirements Analysis

Hardware analysis is intended to determine the type of hardware and hardware specifications that will be used to build a smart mirror system. The hardware requirements analysis includes:

1. The device requires an internet connection, in this case the smear mirror device will use wifi as connectivity.
2. The mirror has a rectangular shape.
3. The mirror has a size of 40 x 70 cm and the thickness of the frame is adjusted.
4. The top of the mirror will be used as the output of the existing data and the bottom will be used purely as a mirror.
5. The device can display schedules, client data and notes.
6. The device will use fingerprint sensors as security for data in the mirror.
7. The device can work realtime for 24 hours.
8. The device can automatically turn on when it gets power.

2. Software Requirements Analysis

Software requirements analysis is an analytical process that emphasizes more on aspects of software utilization. Where the software used can support or not the system that will be built. The analysis of software on smart mirrors includes:

1. The mobile operating system must meet the minimum standards, namely Android 4.4 Kitkat
2. The system must be able to run the fingerprint sensor module.
3. The system must be able to run a web service.
4. The system must be able to display schedules, client data and records.

3. Analysis of Fungsional Needs

3.1 Use Case Diagram

Use case is a situation where a system is used to meet one or more user needs. Use case is used to describe the functionality in the part provided by the system. Use case explains what the system must do but does not explain what the system should not do [10].

1. Use Case Smart Mirror

The use case diagram of the smart mirror device can be seen in the following figure:

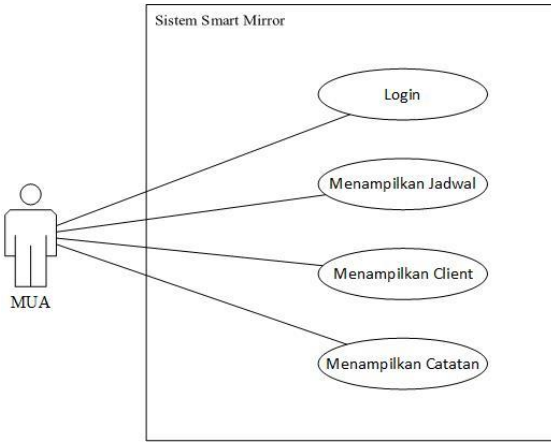


Figure 2. Use Case of Smart Mirror

2. Use Case Aplikasi Mobile

The use case diagram of the mobile application device can be seen in the following figure:

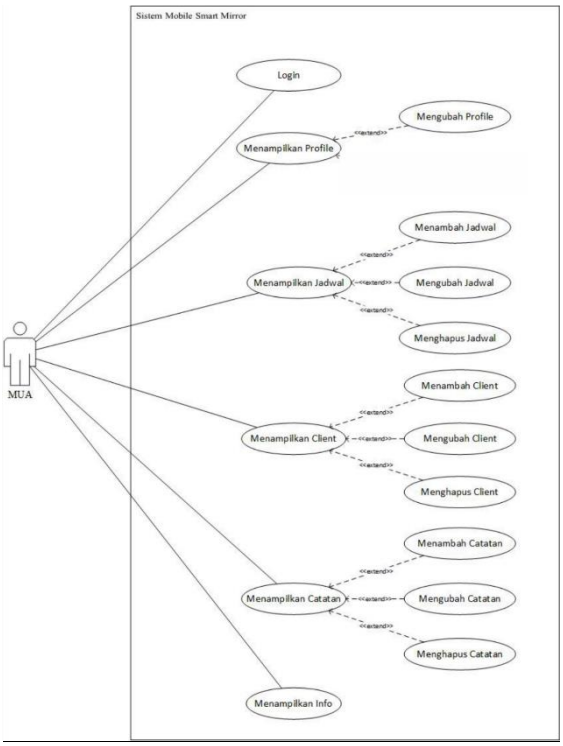


Figure 3. Use Case of Mobile Applicatin

3.2 Implementation and Testing

3.2.1 Hardware Implementation

Hardware specifications used in making smart mirrors can be seen in table 1

Table 1. Hardware Implementation

NO	Hardware	Specification
1	Prosessor	Interl Core i5 1.8 GHz
2	RAM	4 GB
3	Hardisk	1 TB
4	VGA	NVIDIA GeForce 930 MX
5	Keyboard	Standart
6	Mouse	Standart
7	Mini Pc	Raspberry Pi

3.2.2 Software Implementation

Software specifications used in making smart mirrors can be seen in table 2

Table 2. Software Implementation

NO	Software	Specification
1	Operation System	Windows 10
2	Programming language	Java Android & Javascript
3	Text Editor	Android Studio & Sublime Text

4	Framework	NodeJs

3.2.3 Classes Implmentation

The implementation of classes on smart mirror systems is the implementation of designing class diagrams into the form of files that will be used in the creation and running of the system. Here are some of the classes used in the mobile application as follows:

Table 3. Classes Implementation

No	Class Name	File Name
1	MainActivity	MainActivity.java
2	ProfileFragment	ProfileFragment.java
3	EditProfileActivity	EditProfileActivity.java
4	Profile	Profile.java
5	AboutFragment	AboutFragment.java
6	HomeFragment	HomeFragment.java
7	Schedule	Schedule.java
8	ScheduleListActivity	ScheduleActivity.java
9	ScheduleListFragment	ScheduleFragment.java
10	AddScheduleActivity	AddScheduleActivity.java
11	ScheduleDetailActivity	ScheduleDetailActivity.java
12	Client	Client.java
13	ClientListActivity	ClientActivity.java
14	ClientListFragment	ClientFragment.java
15	AddClientActivity	AddClientActivity.java
16	ClientDetailActivity	ClientDetailActivity.java
17	NoteListActivity	NoteListActivity.java
18	NoteAddActivity	NoteAddActivity.java
29	Note	Note.java

3.2.4 Interface Implementation

Interface implementation is an implementation that is done in designing the interface or mockup into file format. In the implementation of the mobile application interface, the design is changed to the .xml file. As for the implementation of the mobile application interface are as follows:

Table 4. Interface Implementation

No	Interface Name	File Name
1	Login Page	activity_login.xml
2	Home Page	fragment_home.xml
3	Profile Page	fragment_profile.xml
4	Edit Profile Page	activity_edit_profile.xml
5	Information Page	fragment_about.xml
6	Schedule Page	fragment_schedule_list.xml
7	Add Schedule Page	activity_schedule_add.xml
8	Detail Schedule Page	activity_schedule_detail.xml
9	Client Page	fragment_client _list.xml
10	Add Client Page	activity_client _add.xml
11	Detail Client Page	activity_client _detail.xml
12	Note Page	activity_note_list.xml
13	Add Note Page	activity_note_add.xml

3.2.5 Raspberry Pi Implementation

In this study the Raspberry Pi used was the Raspberry Pi 3 type B. Raspberry Pi itself was mounted on the back of the mirror device. The specifications for Raspberry Pi 3 type B are as follows:

Table 5. Raspberry Pi Implementation

Component	Specification
SoC	Broadcom BCM2837
CPU	4× ARM Cortex-A53, 1.2GHz
GPU	Broadcom VideoCore IV
RAM	1GB LPDDR2 (900 MHz)
Networking	10/100 Ethernet, 2.4GHz 802.11n
Bluetooth	Bluetooth 4.1 Classic
Storage	microSD
GPIO	40-pin header, populated
Ports	HDMI, 3.5mm, 4× USB 2.0, Ethernet, Camera Serial Interface (CSI), Display Serial Interface (DSI).
Power Sources	5V, 2A

3.2.6 Monitor Implementation

The monitor used in this study is a 14 "LCD monitor LG type W1642S. In the construction of this smart mirror, the monitor is removed and the outer casing is removed. This is so that the monitor can be attached to the glass that will be made. The sample monitor that has been opened in the casing can be seen in the picture.



Figure 4. Monitor Implementation

This implementation will also explain the installation of the monitor. The monitor itself is mounted on the top of the chassis. The monitor that has been opened in the casing is sealed with a mirror so that the image on the monitor can be seen.

3.2.7 Mirror Implementation

Mirror is the most important part in smart mirrors. In this study the glass is made to adjust the size of the LCD monitor as for the glass specifications used can be seen in the table

Table 6. Mirror Implementation

Type	Specification
Size	38 x 70 cm
thickness	2 mm
Layer	One Way 80% Tinted Window

3.2.8 Fingerprint Implementation

In this study the fingerprint sensor is used as a tool to perform authentication on mirror devices. The fingerprint sensor used is the 10A FPM type. The following is a specification of the 10A FPM fingerprint sensor:

Table 7. Fingerprint Implementation

Specification	Information
Supply	DC 3V – 5V
Image Time	< 1,6 second
Size	14 x 18 mm
File	256 byte
Template file	512 byte
memory	1000
PC Interface	UART

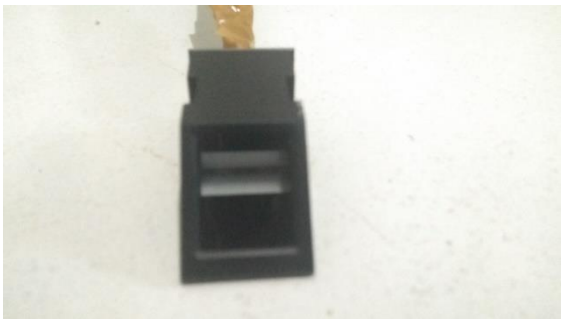


Figure 5. Fingerprint FPM 10A

3.2.9 Fingerprint Sensor Testing

This test is intended to determine whether the FPM 10A fingerprint sensor module installed on the system can function properly or not. Testing is done by checking a number of fingerprints continuously. After that, the accuracy data will be taken by looking at the percentage of success and how much percentage of failure occurred.

From the results of the tests carried out using 5 fingerprints with 50 times the test to determine the part of the finger that is better used in the authentication process, it is obtained based on the following table.

Table 8. Fingerprint Sensor Testing

Fingerprint	Total	True	Error
Thumb	50	22	28
Index Finger	50	49	1
Middle Finger	50	48	2
Ring Finger	50	42	8
Pinkie	50	39	11

3.2.10 Testing for the Use of Mirror

This test is intended to see how far it is recommended to use the mirror. The distance that is too far will result in a lack of vision of the data displayed on the mirror. Therefore, appropriate distance testing is done so that users can adjust when using a mirror. The results of the closest and farthest distance testing recommended are as follows:

Table 9. Testing for the Use of Mirror

Information	Distance
Nearest distance	50 cm
Farthest Distance	150 cm

3.2.11 Notification System Testing

The notification system test aims to see whether the notifications on the smart mirror device can run properly or not. The notification itself is run at 5 minutes, 15 minutes, 45 minutes, and 1 hour before the time on the scheduled input begins. Notifications are raised in the form of alerts and sounds on mirror devices. The test results are as follows:

Table 10. Notification System Testing

time	Enter time	The notification lights up	condition
5 minute	09.55	09.50	The sound is on
15 minute	09.55	09.40	The sound is on
45 minute	09.55	09.10	Suara menyala
1 hour	09.55	08.55	The sound is on

3. CLOSING

3.1 Conclution

Based on the results obtained from the research conducted in the preparation of the final project and referring to the research objectives, it can be concluded as follows:

1. Smart mirror is quite helpful as a reminder and to see the schedule while making a makeover.
2. Smart mirrors are quite helpful in recording client data and reducing errors in preparing or carrying items needed for the client makeover process.

3.2 Suggestion

This system is far from perfect and there are still many shortcomings, therefore this system still needs to be developed again and emphasizes more on the smart function, not just to see schedules, client data, notes and reminders. Like being able to add something that helps the makeup artist in the client makeover process. In addition, the addition of users to the login process using fingerprints can be made more dynamic.

BIBLIOGRAPHY

[1] J. Hartono, Pengenalan Komputer, Yogyakarta: Andi, 2004.

[2] N. Safaat H, Pemograman Aplikasi Mobile Smartphone dan Tablet PC Berbasis Android, Bandung: Informatika, 2012 (Edisi Revisi).

[3] Suryana, Taryana dan Koesheryatin (2014). Aplikasi Internet Menggunakan HTML, CSS & JavaScript. Jakarta: Penerbit PT Elex Media Komputindo.

[4] Iwan, Acep. (2017). RANCANG BANGUN SISTEM PENGAIRAN DAN PEMANTAUAN UNTUK PRODUKSI TOUGE BERBASIS INTERNET OF THING (STUDI KASUS BLOK TOUGE KOTA CIMAHI). Bandung. UNIKOM.

[5] Kurniawan, Rio. (2016). VIDEO CONVERENCE UNTUK E-LEARNING PADA MINI PC RASPBERRY. Bandung. UNIKOM.

[6] Lukman, Arief. (2017). SISTEM ABSENSI BERBASIS MIKROKONTROLLER MENGGUNAKAN SENSOR SIDIK JARI DI SMAN 1 CIMAHI. Bandung. UNIKOM.

[7] R. Fauziah, "Pengertian dan Cara Kerja RPC, RMI, dan WebService," 27 November 2015. [Online]. Available: http://si283.ilearning.me/2015/11/27/pengertian-dan-cara-kerja-rpc-rmi-dan-webservice/. [Diakses 12 Juli 2017].

[8] Sampurna, Jaya. (2017). PEMBANGUNAN SISTEM PEMANTAUAN RUMAH WALET BERBASIS IOT. Bandung. UNIKOM.

[9] "Panduan Firebase Realtime Database" [Online]. Available: https://firebase.google.com/docs/database/

[10] R. Miles and K. Hamilton, Learning UML 2.0, O'Reilly Media, 2006.