DEVELOPMENT OF MOBILE-BASED ELECTROCARDIOGRAM (ECG) PROTOTYPE APPLICATION

Muhammad Yasin Tahir 1, Eko Budi Setiawan 2

Program Studi Teknik Informatika, Universitas Komputer Indonesia 1,2,

Jl. Dipatiukur 112 Bandung 1,2

yasintahir_@live.com 1, eko@email.unikom.ac.id 2

ABSTRACT

Based on some data from the health research of the Republic of Indonesia, heart disease is the most significant contributor to mortality. However, some can be prevented. Even sufferers of the disease who have been diagnosed by a doctor or disease still present the most significant disease. By utilizing the technology that is available at this time, a tool is built that can be used to diagnose a person early. Based on the results of the research obtained, it can be concluded that the electrocardiogram (ECG) application prototype that has been built can be used according to the objectives to be achieved accurately.

Keywords: ECG, heart, diagnosis, application.

1. INTRODUCTION

An ECG (Electrocardiogram) is a test that is performed to see electrical activity in a person's heart, usually the result of an EKG on an ECG paper or on a screen that describes a line in the form of activity on a heart. The ECG test results are usually read by a doctor or cardiographer to see whether there is abnormal or unusual activity in a person's heart or not [1].

With the advancement of technology, the development of ECG devices continues to be developed from year to year to make it easier for patients and doctors to obtain information from the patient's heart condition [2]. Therefore, in this study, an ECG application will be built using the AD8232 module. Where the application that is built can be used to monitor and analyze the results of mobile-based ECG tests.

2. LITERATURE REVIEW

2.1. Electrocardiography (ECG)

Electrocardiography (ECG) is a device used to record signals formed from the electrical activity of the heart. This signal is taken by attaching the electrode to a certain point on the patient's body. ECG recordings have a specific shape so that it can be used as a reference to determine the condition of one's heart health by a cardiologist. ECG signals have a voltage of up to 0.3mV and a frequency range between 0.03 - 100 Hz. This signal is detected and recorded using an electrocardiography device. The ECG, consists of several waves, where each wave represents one heart rate (one time the heart's electrical activity). ECG waves can be seen in Figure 1.

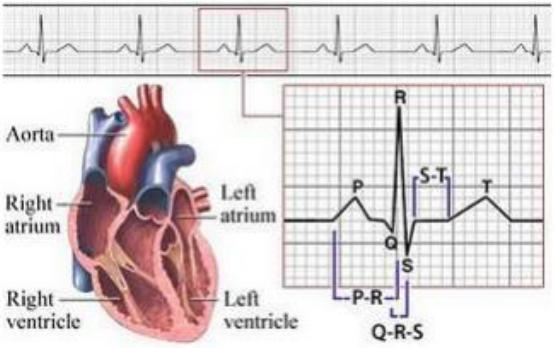

Figure 1 ECG Waves

2.2. Internet of Things

Within a few years, the Internet of Things (IoT) received significant attention in research. IoT is part of the future of the internet which will consist of billions of intelligent "objects" communication [3]. IoT allows physical objects to see, hear, think and do work by asking them to "talk" together. IoT transforms these traditional objects into smart by exploiting the underlying technology [4]. There have been many uses of the Internet of Thing in various fields, ranging from education, health, and social.

2.3. Mobile Application

In this very rapid technological development, mobile applications are often found in everyday life. The mobile application according to buyens comes from the word application and mobile which can be interpreted as an application program that can be run or used even if the user moves from place to place [5]. The mobile application can also be found in several fields ranging from education, health, and social.

3. RESEARCH METHODS

The flow steps of the research conducted in this study can be seen in Figure 3.

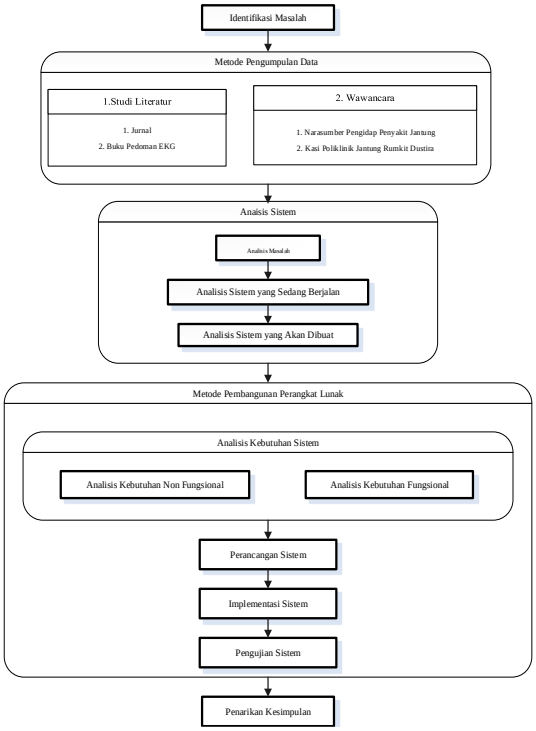

Figure 2 Research Methods

4. RESULT AND DISCUSSION

4.1. System Architecture

The architecture of the system to be built is like Figure 4 below, where:

1. First the User requests the device to do ECG detection where the previous device has been connected to the ECG Module to get analog data from the module, then it is processed to get the ECG graph data along with the normal graafic analysis and then the data is sent to the Server via the Internet.
2. Request on the server to save data to the server.
3. Respond from the server in the form of message data successfully saved.
4. The message respondent data is successfully stored on the server.

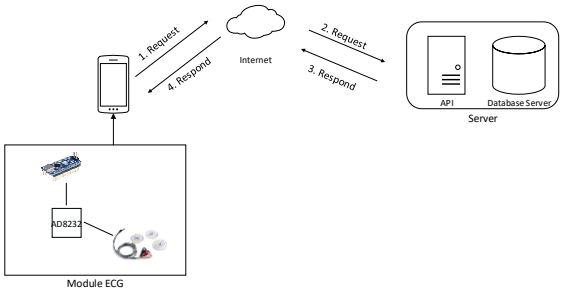

Figure 3 System Architecture

4.2. Use Case Diagram

Use Case is a general figure of the system design that will be created. In the use case, this application has 2 actors namely Admin and User. The Use Case diagram can be seen in Figure 5.

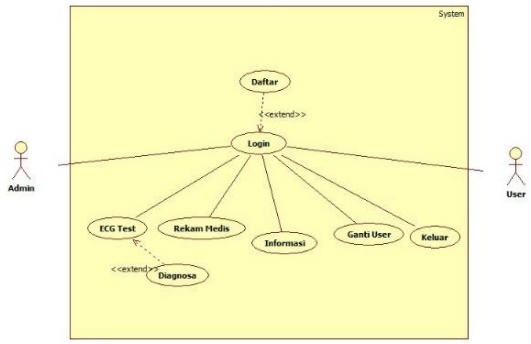

Figure 4 Use Case Diagram

4.3. Hardware Requirements Analysis

For the system to run correctly, a device is needed to suit the needs of the system. The following are the minimum hardware specifications required to use the software properly:

1. An Android device with a 1.2GHz processor
2. 2GB RAM
3. AD8232 ECG Development Heart Rate Kit Module Monitor heart sensor activity
4. ECG Electrode Pad

4.4. Software Requirements Analysis

The following are the minimum specifications of software needed on the system to be built:

1. 1. KitKat Android Operating System
2. 2. Windows 10 Operating System
3. 3. Web Browser
4. 4. Database Server

4.5. Database Design

Database design is a process to model the data needed to support the system design process with the aim of making it easier to interpret the structure of information. The database relation scheme built can be seen in Figure 6.

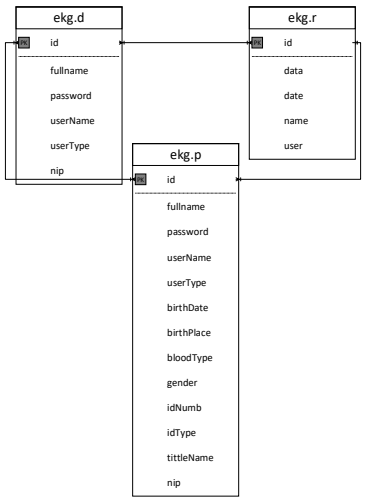

Figure 5 Relationship Scheme

4.6. Designing Menu Structure

In designing a system, a menu structure is needed to abort menus and sub-menus contained in the application. Following is the menu structure provided in this system.

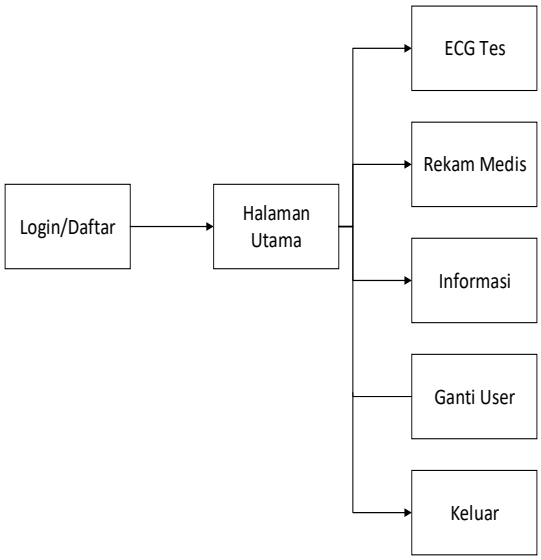

Figure 6 Menu Structure

4.7. Hardware Implementation

The hardware that is implemented in the construction of this application is the hardware requirement that was determined in the previous analysis phase. However, the hardware implemented can be seen in Table 2.

Table 1 Hardware Implementation

Server		
No	Hardware	Spesifikasi
1.	vCPU	4 core
2.	RAM	4GB
3.	Harddisk	SSD 70GB
Pengguna		
No.	Hardware	Spesifikasi
1.	Monitor	1080x1920p
2.	Processor	Octa-core 2Ghz
3.	Memori	4GB RAM & 64GB ROM
4.	Network	4G
5.	Arduino	Nano
6.	Electrode Pad	3 buah
7.	ECG Module	AD8232

4.8. Software Implementation

Software needed to implement this application can be seen in Table 3.

Table 2 Software Implementation

Server		
No.	Software	Spesifikasi
1.	Web Browser	Mozilla Firefox, Google Chrome, Opera, Microsoft Edge
Pengguna		
No.	Software	Spesifikasi
1.	Operating System	Android Nougat 7.0

4.9. Interface Design

Perancangan antarmuka merupakan suatu media komunikasi yang digunakan ketika pengguna akan berinteraksi dengan sistem.

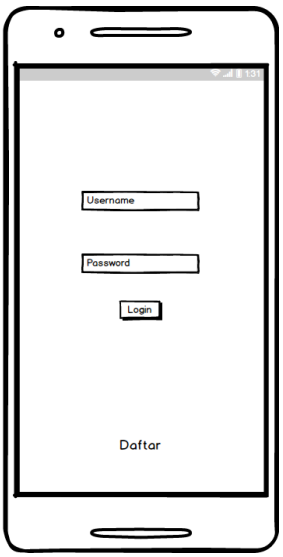	- Click Login to go to F03 - Click Register to go to F02
- Adjust screen size - Background color adjusts - Fonts, size adjusts	

Figure 7 Login Interface Design

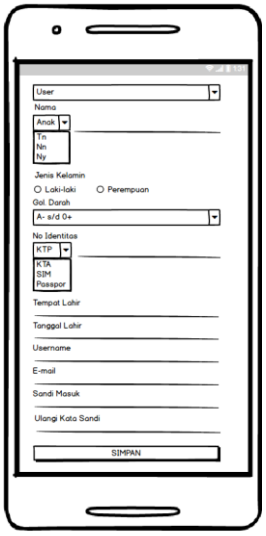	- Click Save to go to F01
- Adjust screen size - Background color adjusts - Fonts, size adjusts	

Figure 8 Design of User Register Interface

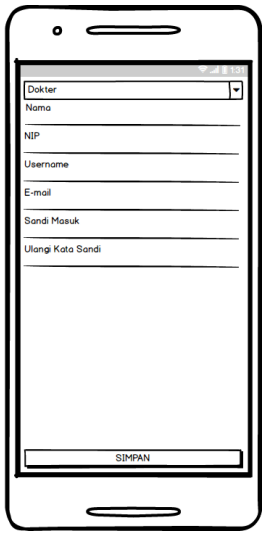	- Click Save to go to F01
- Adjust screen size - Background color adjusts - Font, size adjust	

Figure 9 Design of Admin Register Interface

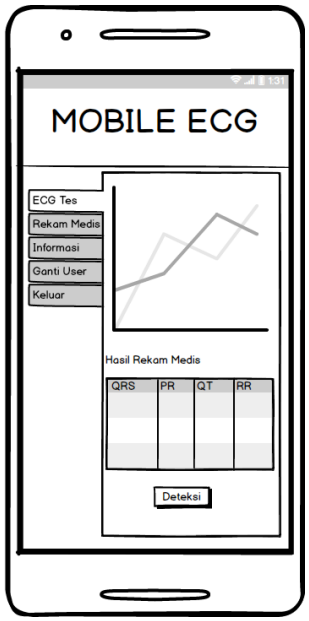	- Click Detection will go to F04 - Click Medical Record will go to F05 - Click Information will go to F06 - Click Change User will go to F01 - Click Exit will close the application
- Adjust screen size - Background color adjusts - Fonts, size adjusts	

Figure 10 Designing the ECG Test Interface

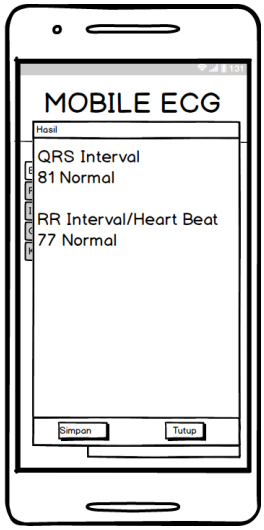 - Adjust screen size - Background color adjusts - Fonts, size adjusts	- Click Save to save the test results to the database - Click Close will close the pop-up test results

Figure 11 Designing the ECG Test Results Interface

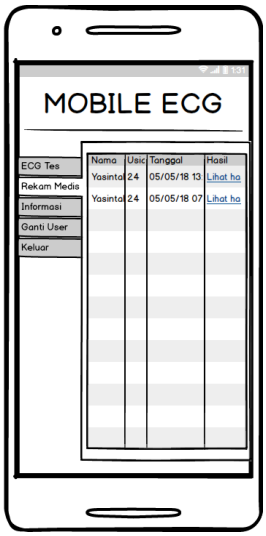 - Adjust screen size - Background color adjusts - Fonts, size adjusts	- Click View Results will display test results data - Click the ECG Test to go to F03 - Click Information will go to F06 - Click Change User will go to F01 - Click Exit will close the application

Figure 12 Design of Medical Record Interfaces

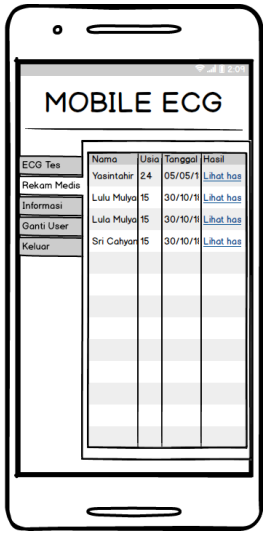 - Adjust screen size - Background color adjusts - Fonts, size adjusts	- Click View Results will display test results data - Click the ECG Test to go to F03 - Click Information will go to F06 - Click Change User will go to F01 - Click Exit will close the application

Figure 13 Design of Admin Medical Record Interface

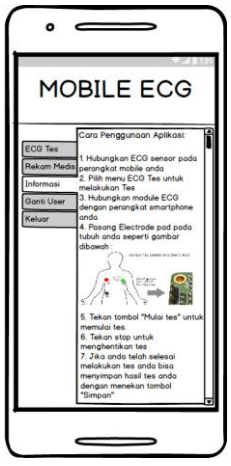 - Adjust screen size - Background color adjusts - Fonts, size adjusts	- Click View Results will display test results data - Click the ECG Test to go to F03 - Click Information will go to F06 - Click Change User will go to F01 - Click Exit will close the application

Figure 14 Information Interface Design

4.10. Message Design

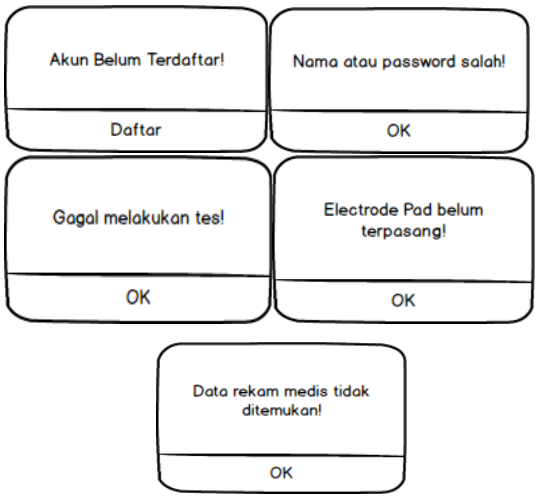

Figure 15 Message Design

5. CONCLUSION

Based on the results of the design made, the design of a mobile-based electrocardiogram (ECG) prototype application is in line with what is expected for further addition of algorithms that can increase the results of being corrected for ECG signals obtained more accurately.

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