Telemedicine System for Electrocardiogram to Improve Public Health Services

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ABSTRACT

This study was aimed to create a Telemedicine System for Electrocardiogram Medical Records to improve public health. Issues of public health in remote areas include lack of transport infrastructures, facilities, lack of medical experts, and limited means of communication, leading to slow treatment for patients. Meanwhile, heart diseases killed thousands of people in the world. To improve the quality of and spreading health services provided by public health services and hospitals, a breakthrough and innovation are required. There should be a type of health service and service facility available in all areas, including remote areas, which is easily accessible by everyone. Telemedicine system is a primary solution which can be applied for those who live in remote areas. Telemedicine is an application of clinical medication which uses telephone, internet, and other communication networks to transfer medical information. By this transfer, medical information can be used for health consultation and sometimes for remote medical procedures. The Telemedicine system is beneficial for people who live in remote areas or distant locations.

Keywords
Telemedicine system, Electrocardiogram

1. INTRODUCTION

To improve the quality of and spreading health services provided by public health services and hospitals, a breakthrough and innovation are required. There should be a type of health service and service facility available in all areas, including remote areas, which is easily accessible by everyone. Efforts in the field of health to keep improving service capacity for health service users keep developing. One of the currently developed efforts is telehealth or e-health which is a remote health service. Generally, the concept of ehealth includes 5

parts which are collection of medical data from patient's body, transmission of medical record data, medical analysis and medical treatment. The current information technology enables the processes to be performed indirectly. At the most basic scale, telehealth is local or only covers certain area. Communication of medical data in e-health is by server with monitoring equipment installed on to patients' body. Generally, the transmitted medical data covers 2 type, which are continuous data, including heartbeat or heart rate signal.

Telemedicine system aims to be a means of communication between general practitioners and specialists in remote locations. Telemedicine system aims to benefit people living in remote areas or distant locations, accelerate patient's access to referral centers, facilitate aids while waiting for direct assistance from private doctors, make patient feel close to home where family and friends provide direct support. Currently, telemedicine is applied virtually for all medical fields. The technology can connect computers to enable them to communicate and exchange

data. So, computer network can connect different computers in different buildings, different cities, and even across the world.

2. RELATED WORKS
2.1 Telemedicine System
Telemedicine System for ECG
Telemedicine system consists of a portable telemedicine unit and a server for base unit. Telemedicine system can be used to record and report patient's condition, teleconsultation, telediagnosis and tele-eduction. It records and reports patient's health, especially related to critical condition of patient's carried by ambulance in the nearest public health center. With telemedicine system for ECG, patients in remote areas can be treated quickly. To support this service, portable telemedicine unit is equipped with measurement of 12 lead ECG signal, blood pressure, heart rate and temperature, and user interface to input patient data to be sent to server in base unit. In Teleconsultation, specialist in hospital provide consultation to doctor in public health center in remote area who directly interacts with patient. The doctor in public health center provides the patient's medical record data and discusses patient's condition with expert. Final diagnosis is made after discussion between the doctors by reading the sent ECG result.
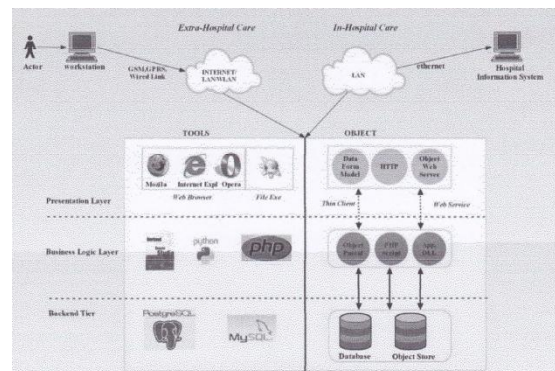

Fig 1 : Architecture of Three Tiered System

Telemedicine is an application of clinical medication which uses telephone, internet, and other communication networks to transfer medical information. The term telemedicine is often misinterpreted as e-health or telehealth. Telemedicine only refers to clinical services, while telehealth covers clinical and non-clinical services, such as education, administration, and medical research. Meanwhile, e-health is a term which covers telehealth, electronic medical record, and other components in health IT (information technology).

The history of telemedicine system [C.S.Pattichis.E Kyriacou,dkk] is closely related with the sustainable growth of computer technology and system in general. Computer technology grows rapidly according to Moore's law [G.E.Moore]. The most relevant growth includes improves speed of processing and memory capacity at lower cost. To anticipate this, it leads to significant

development in mobilehealth system and service [R.H Istepanian, et al.] which leads to broad spectrum of design of new application [E.Kyriacou, et al.]. This application ranges from remote diagnosis and treatment, Electrocardiogram assisted by application and diagnosis computer, telemedicine system dependent on data compression technology for transmission through wireless network infrastructure. On the other hand, more bitrate is available through revolutionary wireless transmission network [6], realizing that the previous communication is only available for cable infrastructure. The scope practically expands across the world with the latest 3G and satellite system. Despite the rapid growth of telemedicine system, wireless network is still prone to error, bitrate is sustainable and the improved efficiency of compression will soon meet the demands of data bandwidth. The purpose is to condense the current wireless medical telemedicine video system and highlights the trend and challenges related to system-based diagnosis

2.2 Telemedicine Technology

Telemedicine technology consists of hardware and software technologies.

2.2.1 Telemedicine hardware Technology

a. Computer/internet network

This technology can connect computers so they can communicate and share data. Computer network can connect different computers in different buildings, different cities, and even across the world. The technology is widely known as. This computer network isn't only wired but also wireless. Computer network, including internet can create synchronous and asynchronous telemedicine.

b. Satellite

Satellite can reach remote places. Currently, satellites are used for communication infrastructure such as telephone. Satellite expands the scope of telemedicine remote areas or locations where it's difficult to build wired network infrastructure.

c. Handphone

The main function of handphone is voice and text (SMS) communication, but there are many additional features such as:

2.2.2 Telemedicine-supporting software technology:

a. Chatting and conference technology

Chatting is usually done between 2 different people on different computers. Meanwhile, conference can be done by more than two different people in the same forum. Some of the software are yahoo messenger, google talk, etc..

b. Image processing

Image processing is a field of study in the world of computer software. This field studies image (illustration, photo) processing techniques. Image processing offers techniques to alter image, including fixing image before it's sent elsewhere.

c. Data compression technology

This technique convert large data into small data. The conversion doesn't remove information in it. Because compressed data is different from the previous data, decompression process is required.

3. SYSTEM DESIGN
3.1 Basic Design

The main character of information technology is the ability to capture/receive, process, and transfer information from one location to another through communication network i (Handayani Tjandrasa; 2005)
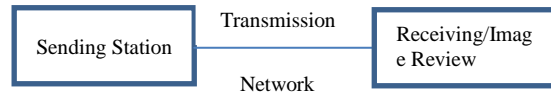

Fig 2 : Telemedicine systems

3.2 ICT Equipment

The equipment required to send diagnosis result is computer network (data) in the form of a server for data processing center.

C.Network architecture

The network types usually used to implement telemedicine technology by hospital-scale were: Small Hospital, Medium Hospital, and Central Hospital (Central data).
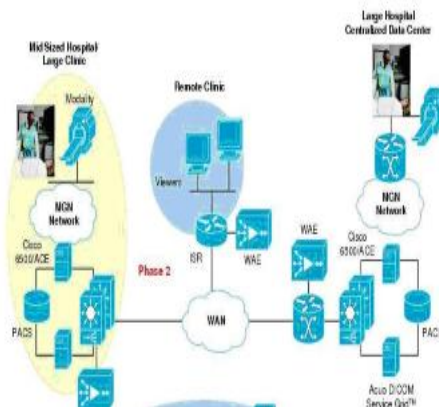

Fig 3 : Selection of Telemedicine System Communication Network

4. DESIGNING SYSTEM
4.1 Designing System

Use Case Diagram

The targets of use case model include defining the functional and operational needs of a system. After analysis of the needs of the system and users' desires are understood properly, the next stage is translating telemedicine system for electrocardiogram to improve public health service in the form of use case diagram.
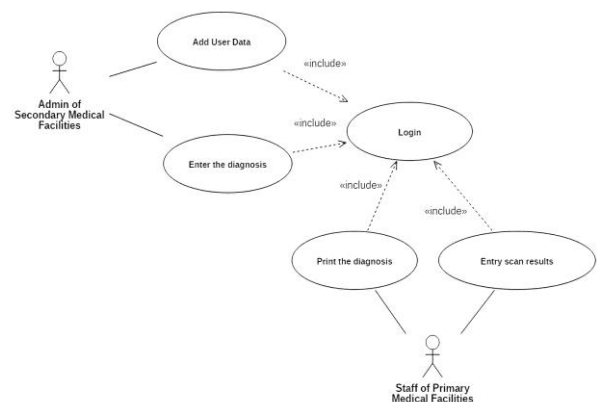

Fig 4 : Use Case Diagram

Activity Diagram

Activity diagram login describes login process by user to enter a system. It's shown in the figure of activity diagram below
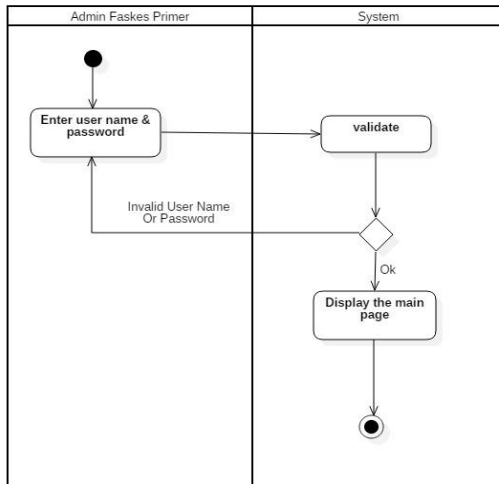
Activity Login.
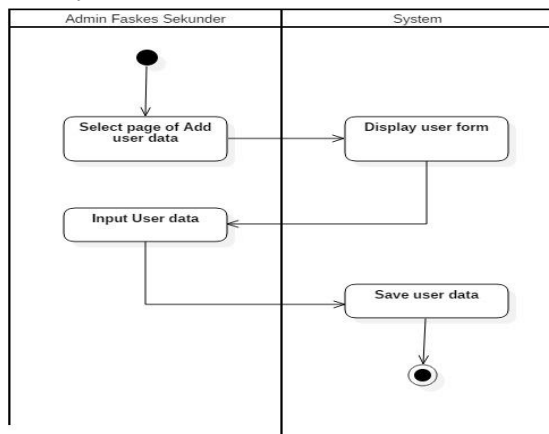

Fig 5 : Activity Login

Activity Add User

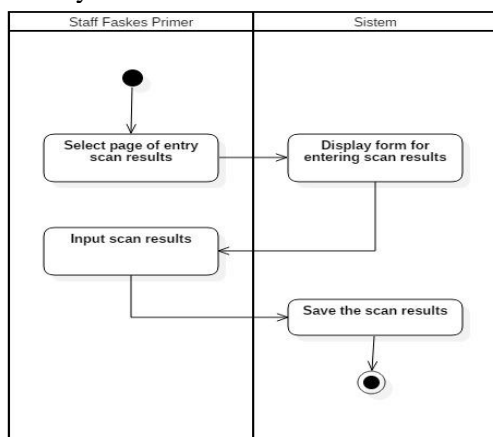**Fig 6 : Activity Add User**

Activity Entri Scan Result ECG

Fig 7 : Activity Entri Result Scan ECG

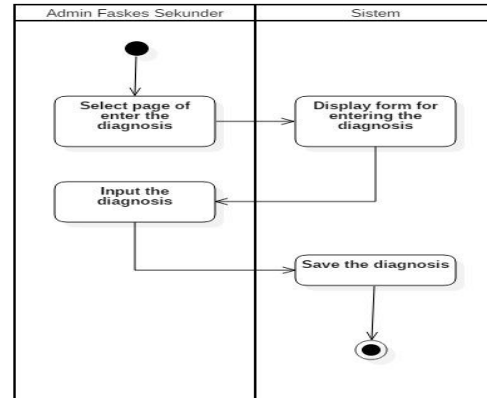Acitivity Entri Result Diagnosis

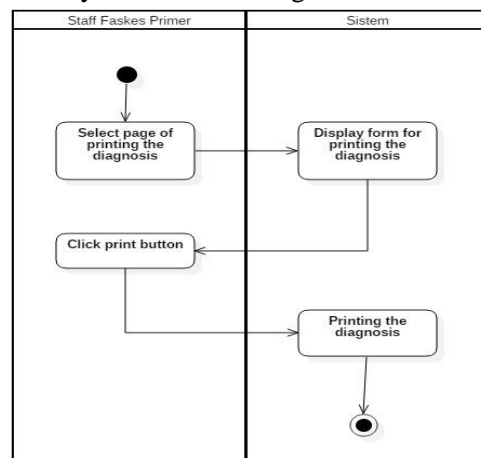**Fig 8 : Activity Entri Result Diagnosis**

Activity Print Result Diagnosis

Fig 9 : Activity Print Result Diagnosis

4.2 System Testing

In this test, the computer specifications will be used as follows:

Domain	: ekghealth.com
IP Address	: 103.84.194.34 (Shared)
CGI Access	: Enabled
Username	: ekghealth
Pasword	: SEMOGAsukses88!
Cpanel Theme	: paper_latern
Home Directory Root	:/home
Quota	: 1.000MB
Name Server 1	: ns1.bantenhost.com
Name Server 2	: ns2.bantenhost.com

1. Login Form Information System telemedicine electrocardiogram

Fig 10: Form Login Information System telemedicine electrocardiogram

2. Main menu
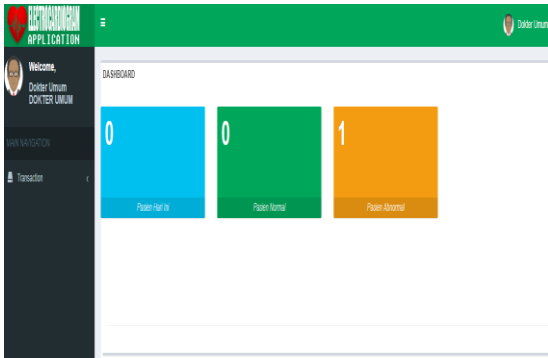   Form the main menu of electrocardiogram application for general practitioners

Fig 11: Form the Main Menu of Electrocardiogram Application for General Practitioners
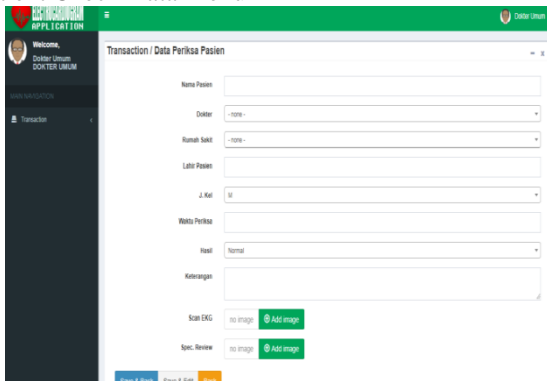
3. Patient Check Data Menu

Fig 12: Patient Check Data Menu

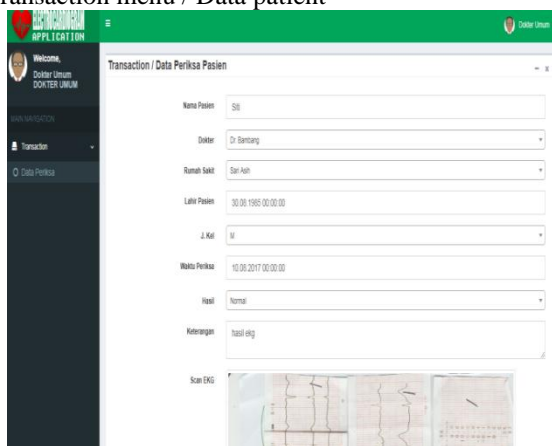4. Transaction menu / Data patient

Fig 13: Transaction menu / patient data

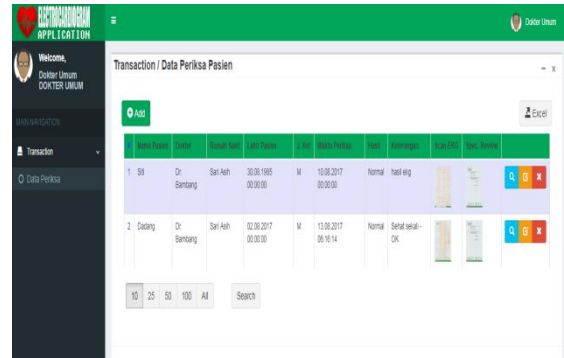5. Transaction Form / Patient Check Data

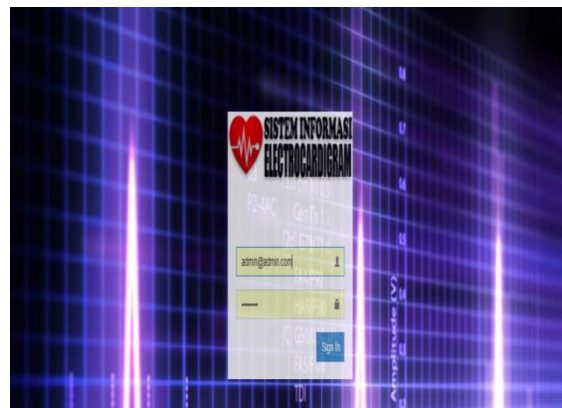**Fig 14: Transaction Form / Patient Check Data**

1. Form Login admin

Fig 15: Form Login admin

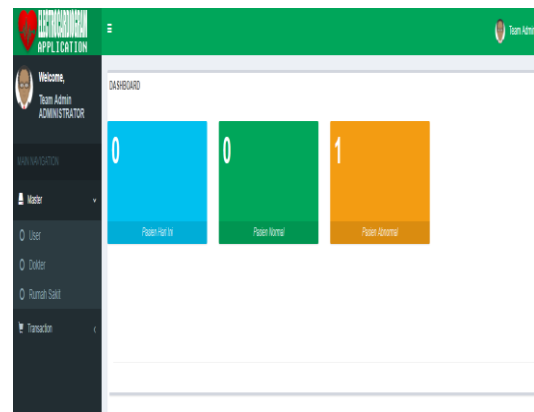2. Form elektrokardiogram application team admin administrator

Fig 16: Form elektrokardiogram application team admin administrator
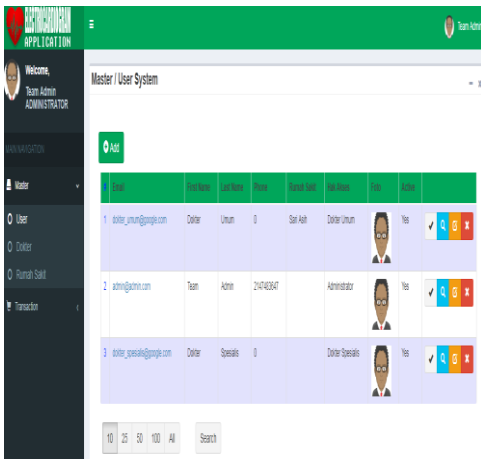
3.   Form master /User Systems

Fig 17 : Form master /User Systems

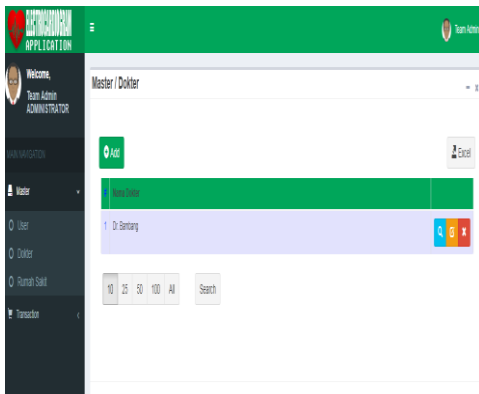4.   Form master /doctor

Fig 18 : Form master /Doctor

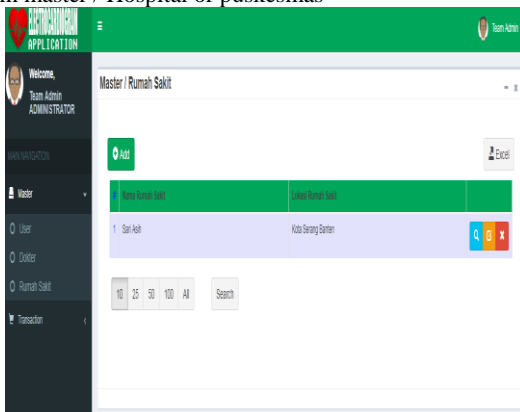5.Form master / Hospital or puskesmas

Fig 19 : Form master / Hospital or puskesmas

5. CONCLUSION

1. Consultation and interpretative services can be done faster and more efficiently.

2. Medical consultation service between doctor and patient can be provided without being in the same location.

3. ECG result diagnosis can be delivered quickly in emergency and non-emergency situations.

4. Fast service for ECG specialist who needs to consult with another ECG specialist.

5. Increasing knowledge and opportunity to develop the science of ECG and doctors.

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