EMERGENCY MEDICAL SERVICE MOBILE APPLICATION FOR EMERGENCY, RADIOLOGY, AND PATHOLOGY DEPARTMENTS IN HOSPITAL PEKAN

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ABSTRACTS

This project review is about an Android mobile application developed to solve the issues that communicate between emergency department, radiology department, and pathology department. In this project, Emergency Medical Service Mobile Application’s objective is to manage the data transaction between different departments and develop a prototype mobile application for 3 different departments to improve their data transaction. Methodology used in this project is waterfall model that consists of 5 phases include planning, analysis, design, implementation, and maintenance. Therefore, through the development of this Emergency Medical Service Mobile Application, it helps 3 departments have better communication and data transferring in more convenient way and easy to manage.
ABSTRAK

Proyek ini adalah berkaitan tentang pembinaan satu aplikasi Android yang bertujuan untuk menyelesiakan masalah komunikasi antara jabatan kecemasan, jabatan radiologi, dan jabatan patologi. Dalam projek ini, objektif *Emergency Medical Service Mobile Application* adalah mengurus transaksi data antara jabatan yang berbeza serta membina satu prototaip aplikasi mobile yang bertujuan untuk meningkatkan kualiti dalam transaksi data untuk 3 jabatan berbeza. Metologi yang digunakan dalam projek ini adalah model air terjun yang terdiri daripada 5 fasa seperti perancangan, analisis, reka bentuk, pelaksanaan, dan penyelenggaraan. Oleh itu, ia dapat membantu 3 jabatan mengekalkan komunikasi yang baik dan pemindahan data yang lebih senang dan mudah diurus.
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PART 1

INTRODUCTION

1.0 Introduction

Mobile phone is a wireless handheld device that uses to receive telephone calls over a radio link in a wide geographic area. It is connect to a wireless communications network cellular network which provide by a mobile phone operator through the satellite or radio wave transmissions. Initially mobile phones were invented for portable calling devices. Nowadays, mobile phone able to support advanced features such as text messaging, multimedia messaging service (MMS), email, Bluetooth, Internet access, gaming, photography and business applications.

The first concepts of cellular phone class were made from cars and trucks. However, there was no technology existed to support it. The world's first handheld mobile phone was produce by Motorola on 1973. Martin Cooper, a senior engineer at Motorola made the first call on 3 April 1973. The phone weighed 1.1 kg and measured 23x13x4.45cm. The prototype can call up to 30 minutes of talk-time and took 10 hours to recharge. DynaTAC 8000X was released by Motorola in 1983. It offered 30 minutes of talk-time, six hours standby and able to store 30 phone numbers. It was mobile phone launched on the first US 1G network by Ameritech. IBM Simon (world's first smartphone) was introduced in 1993. It was the combination of mobile phone, fax machine, pager, and PDA. It has the features of calendar, address book, clock, calculator, email, notepad, and a touchscreen with a QWERTY keyboard and it was using 2G systems.[1]

The emergency medical service mobile application is special design for doctor or medical officer to request medical order from Radiology Department and Pathology
Department by using mobile phone. The details such as patient’s name, age, gender, patient injured time, level of emergency, trauma, mechanism of injury and medications can be viewed in the emergency medical service mobile application via mobile phone. The doctor read the detail of patient anytime anywhere as emergency reference or medical history via mobile phone when there is any case happens. Radiographer or medical laboratory technician can respond directly based on the x-ray equipment preparation and medical laboratory test while waiting the patient who sends to ICU. Besides that, there is an extra feature for Radiology Department, the emergency medical service mobile application able to send picture to radiographer. This give a very clear image for radiographer so that they can decide the type of radiography equipment they need to prepare for the patient and minimize human error compare gather patient details by using audio technology. A medical request was sent to radiographers and medical laboratory technicians and medical notification will pop up in the mobile phone once doctor sent the medical order. The medical laboratory report will be sent back by medical laboratory technician once they have medical laboratory result by emergency medical service mobile application via mobile phone or computer. Radiographer will inform the emergency department once x-ray film was produced and the medical officer will collect the x-ray film at Radiology Department.

1.1 Statement of problem(s) and objective(s)

1.1.1 Problem Statement

Several problems are detected when patient are send to hospital. One of the problems is the medical officer need to brief doctor about the details of the patient through the phone while waiting the patient send to hospital. Medical officer need to write down the detail and condition of patient by hand and the record take quite a long time to finish and will pass to doctor later on.

The staffs in the Radiology Department and Pathology Department are not alert and mentally standby when the patient was send to the hospital. The medical staffs or doctor only know the situation when the paramedic back to the hospital and this process are spend a lot of time for the medical officer to understand the condition of patient.

Besides that, based on the severity of patient condition from paramedic, doctor has to decide whether need to request medical order from Radiology Department and Pathology Department. The information was told without image or picture, radiographer based on doctor’s order in the medical order form prepares the radiology equipment. If
the doctor got the wrong information, the wrong medical order will pass to Radiology Department. The wrong equipment preparation progress will waste a lot of time.

1.1.2 Objective(s)

The objectives of the project are:

i. To manage the data transaction between different departments include emergency department, Radiology Department and Pathology Department.

ii. To design and develop prototype of emergency medical service mobile application for 3 departments, emergency department, Pathology Department, and Radiology Department.

iii. To produce patient injured report for Radiology Department to make faster decision on emergency case treatment.

1.2 Review of existing projects

1.2.1 Review of Electronic Medical Record for Effective Patient Monitoring Database

The system is design to help monitor patient more effective to avoid problems such as loss of information, paper-based, blur images, and large number of patient with less staff in both local and foreign hospital. Generally, Electronic Patients Medical Records (EPRM) offer suitable searching capabilities and assists doctors and nurses in managing patient’s medical records. Besides help doctors and nurses in making quick decision. [2]

There are some patient monitoring systems that are related to Doctor Mobile Application. The medication and documentation in Hospital Putra-Jaya is in Electronic Medical Record (EMR), the medical concern will flow into the Pharmacy Information System and EMR. The system will help doctors and nurse give a quick respond for medicine to patients in a short time and avoid waiting process. Doctor Mobile System send the medicine list directly to pharmacy without waiting and this have the similarity with the EMR. EPRM combine few sub-systems together such as remote patient monitoring system, Mobile Tele-medicine, GSM-network based patient monitoring system, Hospital Universiti Kebangsaan Malaysia patient monitoring system, and Hospital Selayang Electronic Medical Record (EMR).
1.2.2 Review of Universal Architecture Prototype for Patient-Centric Medical Environment

In this thesis, a health care system based on mobile phone provides the remote monitoring and emergency alarm for both doctors and patients. The system transfers the recorded electrocardiogram (ECG) and electroencephalogram (EEG) signals from the patients’ sensors to the mobile phone by Bluetooth. [3] The mobile phone then transfers the recorded data with location information by 3G/GPRS/WIFI services. When there is any emergency cases occur, an SMS will directly send to doctors’ mobile via mobile phone.

The main features of the system are designers can design and optimize the system due to their requirement by following the proposed solution. The health care signals can be measured from sensors and displayed or recorded on the mobile phone anytime via 3G network. The mobile phone can detect the cardiac arrest signal from the sensors. Once the cardiac arrest signal is detected, a SMS will send and it will notify the first aid center.

Throughout this system, it does not have the function to transfers the ECG and EEG signal to other departments and it is specially design for doctors and patients. The technology of using WIFI is similar as Doctor Mobile Application and Doctor Mobile Application not only can view the information of patient besides it can also forward the information to other departments if necessary.

1.2.3 Review of Mathematical Analysis of Agent Swarm Behavior in an Agent-Based Electronic Health Record System

The thesis shows that a mathematical model to analyze agent swarm behavior in an agent-based system. The mathematical model are applying to Agent-Based Health Record System (ABHRS). [4] The ABHRS is an electronic health record system use to allow patient health records to save scattered and distributed way through a computer network into one consistent and complete data set or patient health record. ABHRS is an example of multi-agent swarm system and it able to self-organize. ABHRS will in fact have predictable attributes such as mobile agents at Doctor, Pharmacy, and Lab sites. Based on the ABHRS concept, patient records are store in the system and could be view anywhere. We can add mobility to record in the system by using mobile agent technology as long as there is Internet connection to or from the site.

Meanwhile there are three important aspects of the system which are the health record may include test results and prescriptions, doctor’s evaluations, and other health
care system utilization factors. Next, each agent in the system is self-regulated. Finally the complete system is described as Self-Organizing. The capability for the system as automatically making each patient data set complete.

Throughout the thesis, each agent can view the patients record very detail in anywhere compare to Doctor Mobile Application can only view it in the hospital and the secure level is higher.

1.3 Current system and its limitation

1.3.1 Emergency Medical Service Mobile Application

Emergency medical service mobile application is a mobile application that used by doctor to transfer detail and condition of the patient to other departments in hospital such as Radiology Department and Pathology Department. The paramedics will analyze the patient condition and send the information to the hospital via Smart Mobile Emergency Application on the way back to hospital. The doctor received the information of patient from the Expert ICU System while waiting patient send to hospital. Doctor Mobile Application acts as the intermediate between doctor and related departments. Information such as patient’s name, age, gender, patient injured time, level of emergency, trauma, mechanism of injury and medications can be viewed by doctor. Doctor will make the decision which medical order he/she wants to request and contact related departments for example Radiology Department to be ready for the X-ray equipment preparation by using doctor mobile application. Doctor does not need to inform the patient information to the related departments by calling the departments but just forward the information where send from the Expert ICU System. After doctor applied the treatment to the patient, he can direct send the medicine list to pharmacy via Doctor Mobile Application. This process will save lots of time and reduce the human careless mistake.

1.3.2 Limitation of Emergency Medical Service Mobile Application

The Emergency Medical Service Mobile Application is specially design for Hospital Pekan, so other hospital may not suitable to use this system due to the management of patient in emergency department is different compare with other hospitals. There are only 2 departments having communication with emergency department which are Radiology Department and Pathology Department by using the
Besides that, this system is mainly help the E.M.C.R to achieve its objective. Basically it is based on the problems faced by Hospital Pekan.

### 1.3.3 The Comparison between Existing Systems

#### Table 1.1 Comparison table between existing systems.

<table>
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<th>UAPPME</th>
<th>ABHRS</th>
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<td></td>
<td>EPRM holds patient’s medical records such as personal information, family member’s information, medical history of patient and patient’s current health report. EPRM able to record, modify, analyze, view, delete and manage patient’s medical information. Besides that, it contains information about staff on duty in a specific ward.</td>
<td>This system can design and optimize based on user requirement. It used to monitor and record simultaneous health care signals. This system detect cardiac arrest signal and notify alarm via short message system via mobile phone.</td>
<td>A complete data set is defined as every pieces of information in a patient’s health record generated by different medical facilities with in the medical care system. Each agent in the system is self-regulated.</td>
</tr>
<tr>
<td>Advantages</td>
<td>1. Interactive and attractive user-interface. 2. Attractive interface and user-friendly.</td>
<td>1. Better usability compare with other systems due to optimize the system depend on user’s requirements. 2. System support in mobile phone platform.</td>
<td>1. System support on mobile platform. 2. Information can be view anywhere as long as there is Internet connection.</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>1. High cost due to expensive telemetry</td>
<td>1. The system does not have</td>
<td>1. Information store in different</td>
</tr>
</tbody>
</table>

Advantages
1. Interactive and attractive user-interface.

Limitation
1. Data only can read in central computer.
2. EPRM not supported in mobile phone platform.

1.3.4 The Comparison between Existing System and EMSMA

Table 1.2 Comparison table between existing systems and EMSMA

<table>
<thead>
<tr>
<th>Feature</th>
<th>Advantages</th>
<th>Limitation</th>
</tr>
</thead>
</table>
| EPRM    | 1. Interactive and attractive user-interface.  
          2. User-friendly. | 1. Data only can read in central computer.  
                        2. EPRM not supported in mobile phone platform. |
| EPRM holds patient’s medical records such as personal information, family member’s information, medical history of patient and patient’s current health report. EPRM able to record, modify, analyze, view, delete and manage patient’s medical information. Besides that, it contains information about staff on duty in a specific ward. | | |
| UAPPME  | 1. Better usability compare with other systems due to optimize the system depend on user’s requirements.  
          2. System support in mobile phone platform. | 1. The system does not have functionality to store patient medical record. |
| This system can design and optimize based on user requirement. It used to monitor and record simultaneous health care signals. This system detect cardiac arrest signal and notify alarm via short message system via mobile phone. | | |
1.4 Terminology

1. Emergency Medical Communication Respond (E.M.C.R)

E.M.C.R is the system that improves the communication between paramedic and medical officer in order to achieve 3 objectives: safe life, safe time, and safe from complaint.

Paramedic communicates with medical officer and explains the detail and condition of patient while patient is send to hospital. After understand the situation of patient, Intensive Care Unit (ICU) start the care plan to make the preparation before patient send to hospital. At the same time, medical officer who receive the call write down the information of patient in the E.M.C.R record book.

2. Emergency Medical Service Mobile Application
Emergency Medical Service Mobile Application is the mobile application use by doctor who is in Emergency Department, Radiographer and Medical Laboratory Technician. Doctor uses the system to request medical order to other departments and transfer patient’s details such as Radiology Department and Pathology Department. This project developed to help Hospital Pekan to achieve the objective of E.M.C.R which is safe life, safe time, and safe from compliant.

1.5 Scope of the project

This project is about medical order mobile application using by doctor, radiographer, and medical laboratory technician. There are 3 mobile applications designed differently for Emergency Department, Radiology Department, and Pathology Department. Patient record was registered before sent to hospital by paramedic. Doctor can view the patient record and edit the patient record once the patient record is registered. After doctor performs diagnosis procedure and obtains the information of the patient’s symptoms or condition, he has to decide which medical service he need, either radiology, pathology or both by using emergency medical service mobile application. Radiographer and medical laboratory technician can receive medical order sent by doctor via mobile application.

1.6 Outline of material

This thesis is divided into 3 parts and each part is devoted to discuss different issues in the project. Below is an outline for each part:

i. Part 1 – Introduction

   Part 1 shows the purpose of the project include project’s problem, objective and scopes. This part also discusses the existing system and its limitations.

ii. Part 2 – Report Body

   User requirement, design description, development plan and testing plan is conducted and discussed.

iii. Part 3 – Conclusion

   Summary of the whole project is presented in this part.
PART 2

REPORT BODY

2.0 Report Body

2.1 User Requirements

The User Requirements is a document usually used in software engineering that describes the requirements the user expects from the system. There are several requirements gathering techniques for examples conduct a brainstorming session, interview users, send questionnaires, work in the target environment, study analogous system and etc. but interview users is more suitable technique to gather requirement for this system. [5] So, doctor mobile application can be created through the individual interviewing.

Interview users are include medical assistant, radiographer, and medical laboratory technician. Due to their opinions, the advantages of doctor mobile application will increase efficiency of Radiology Department and give a clear image patient injured part, so that Radiographer can prepare equipment early before patient send to hospital. He belief doctor mobile application give more accurate information which part of patient injured and the level of danger because image is give a better description compare with audio - GIRN which is previous system they used. Once radiographer or medical laboratory technician login to the doctor mobile system, they can stand by anytime even their lunch time, it is more convenient and they get the updates of any emergency case that happen immediately.

Developer need to spend a lot of time in order to gathering the requirement during the development phase. Users have to try doctor mobile application and give
feedback to improve and enhance the system. The meeting minutes and photo is prove of a discussion between stakeholders is attached in Appendix A.

2.2 Technic/theory/modeling/flow chart/storyboard/all relevant diagram

2.2.1 System Overview

Figure 2.2.1 shows the system overview of emergency medical service mobile application. As figure 2.2.1, there are 3 systems which are Smart Mobile Emergency System, Expert Decision Support System, and Emergency Medical Service Mobile Application. Smart Mobile Emergency System will start the 1st process by upload picture or video with description to Expert Decision Support System. Next, Expert Decision Support System suggests doctor available and passes information to Emergency Medical Service Mobile Application. Emergency department requests medical service from Pathology Department and Radiology Department through Emergency Medical Service Mobile Application. Expert Decision Support System suggests an available doctor and the information were transferred to Emergency Medical Service Mobile Application (EMSMA). Emergency Department request medical requested medical order from Radiology Department or Pathology Department via EMSMA, if Radiology Department receives the x-ray order request; Radiology Department sends the x-ray result is done notification back to EMSMA. If Pathology Department receives the medical laboratory test order, Pathology Department sends the medical laboratory result is done notification back to EMSMA. Lastly, Emergency Department receives either one medical order notification or both from Radiology Department and Pathology Department.

<table>
<thead>
<tr>
<th>Smart Mobile Emergency System (SMES)</th>
<th>Upload picture/video with description</th>
<th>Expert Decision Support System (EDSS)</th>
<th>Suggested doctor</th>
<th>Doctor On Duty</th>
<th>Information Transferred</th>
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![System Overview Diagram](image)

Figure 2.2.1 System Overview
2.2.2 Flowchart

Figure 2.2.2 shows flowchart of Emergency Medical Service Mobile Application. Figure 2.2.2 shows there are 2 situations need to handle by medical office according to 2 departments which are Pathology Department and Radiology Department.
2.2.3 UML Use Case Diagram

UML use case diagram is a simple diagram that defines functionality of the system. It used to determine the system requirements and relationship between users and system. Figure 2.2.3 shows interaction between doctor on duty, medical laboratory assistant, radiographer and system. Responsibility of doctor on duty is included manage doctor id, request medical order for Pathology Department and Radiology Department. Use cases medical order for Pathology Department and medical order for Radiology Department have included relationship with the use case select patient information. Use case medical order for Pathology Department includes select type of pathology while use case medical order for Radiology Department includes select type of radiology. Manage doctor id is a point at which the use case attach patient injured picture is included. Medical laboratory and radiographer following the same process of manage staff id and receive medical order.

Figure 2.2.3 Use Case Diagram

2.2.4 Data Flow Diagram (level 0)

Figure 2.2.4 shows the entire data flow diagram designed. From process 14 until process 18 present the data flow of EMSMA.