SMART MOBILE EMERGENCY SYSTEM FOR PARAMEDIC USER

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ABSTRACT

Today, computerized systems are needed in every organizations and business sector. It can minimize the human's workload and the organization might need just one worker for one each system. Furthermore, technology helps people to reduce their time by using electronic systems instead of recording data manually. For that reason, ambulance emergency systems are built in health sector to make process and treatment that can be made in a more appropriate and faster way.

Ambulance Emergency System is a paperless electronic application that is designed with high flexibility and ease of usage, implemented for health sector to handle treatment with patient in more efficient way. There are many kinds of ambulance emergency system that exist nowadays. This system is generally built to receive the patient's details correctly in faster way.

SMES is developed as portable medical device that allows in tele-consultation, also in mobile healthcare. This system is used for paramedic user (ambulance site), where expert assistance is needed for patients to give directly treatment on site and send the information to the emergency department and the doctor. The information will be given in picture and video form for the preparation before patient arrival. The emergency department and the doctor will receive the information from the paramedic (ambulance site). With this system, they are ready for the next action and do the preparation before the patient arrival. It can reduce the time taken for patient treatment.

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LIST OF ABBREVIATION

SMES : Smart Mobile Emergency System

GIRN : Government Integrated Radio Network

TETRA : Terrestrial Trunk Radio

TAS : Ambulance Tasmania Radio Service

AREC : Amateur Radio Emergency Communication

SDLC : System Development Life Cycle

RAD : Rapid Application Development

CD : Context Diagram

DFD : Data Flow Diagram

ERD : Entity-Relationship Diagram

DBMS : Data Base Management System

SQL : Structured Query Language

LAMP : Linux, Apache, MySQL, php

HTML : Hypertext Markup Language

PHP : HyperText Preprocessor

In reality, the healthcare sector using mobile phone already implemented in Brigham Young University, Provo, Utah, United State of America (USA). They develop the Electronic Patients Devices (EPD) that connects to Patients Information Database (PID), Patient Application Software and etc. The based on a number of handheld computing platforms including smart cards, PDAs, or cellular telephones. EPDs include a database for electronically storing a patient's medical information, system and application software, and one or more wireless transport mechanisms for exchanging data. (David K.Vawdrey)

In Hospital Pekan, the registration process and the emergency calls run manually. Therefore, the smart mobile emergency system (SMES) is developed to reduce the difficulties in registration and preparation for patients. Thus, SMES provide hospitals with new opportunities for improvement in healthcare processes using integrated information, which go beyond advanced medical equipment, paper-free strategies or information centralization/ sharing.

1.1 Problem Statement

1. No Preparation in emergency department

Every information related to ambulance cases, especially for emergency event that happens after office hour or during weekend and public holiday need to be disperse accordingly to all medical personal (medical officer, medical technologist, lab assistants) who is on-calls. Differential diagnosis, vital sign status, requirement on x-ray and other medical resources as well as other lab investigation and proposed action on life threatening circumstances need to be notified and enlightened before the ambulance arrive to the hospital. This is to ensure all medical personal are aware and ready mentally and physically on the condition of emergency cases they will receive and all resources needed (such as patient trolley, emergency trolley and etc.) are in place. Unfortunately, in reality this work procedure does not happen hence resulted in most emergency cases being delayed and as a consequent jeopardize the life of patients.

2. **Receive the patient's details without know the actual condition. No formal procedure in transmitting information from ambulance personnel to emergency department' team normally leads to miscommunication and human-error.**

Hospital Pekan in ambulance unit were supplied with audio equipment, called Government Integrated Radio Network (GIRN). From emergency center, they give instructions to the paramedics to provide treatment for victims in the scene on the spot. This equipment is certainly easier for paramedics, but not for an emergency center, who does not receive the patient's details in visual form.

1.2 Motivation

Conventionally, emergency unit received call from patient. They need to dispatch the patient using ambulance services. In Hospital Pekan, the ambulance services used Government Radio Integrated Network (GIRN) as their platform with emergency unit. Instruction is given through this equipment. Even though this procedure can save times, but the emergency unit cannot figure out the real condition and situation of the patient is. Consequently, developing a system or program that is easier and faster to use by paramedic, emergency unit and doctors was considered thought to facilitate communication among them.

Developing this application looks challenging. It needs self-determining on it. Thus, it helps in enhancement in joining previous knowledge with recent ones

1.3 Objective

1. To design and to develop Smart Mobile Emergency Systems (SMES) that can work in real-time. The system should interact with existing hospital information systems, run on mobile computing devices.

2. To send report and graphical information (e.g. Picture or video) through mobile phone.

3. To apply the synchronization technique in this application.

1.4 Indication of Scope

This project is developed by using mobile application. The target users are:

- Ambulance Unit/ Paramedic :
    1. Paramedic can send the information about the patient's condition through mobile applications.
    2. Paramedic can send the evident about the patient through picture and video.

- System functionality / Emergency department :
    1. Collect patient's details such as, the picture about patient's condition, the level of emergency happened and some patient's background history.
    2. Process, verify and send the message to the doctor and emergency center before the patient arrived .They will make the decision whether the patient need to hospitalized, surgery or general medical examination.

- Doctor :
    1. Receive the patient's details from paramedic.
    2. Arrange the patient's priority followed by their cases.
    3. Send the information and instructions to department/unit related to patient's condition to do preparation. (e.g. X-ray department, Laboratory, Trauma center, Operation Theater)

- System Data:
    1. The Smart Mobile Emergency System data (SMES)

CHAPTER 2

LITERATURE REVIEW

2.0 Overview

In this chapter, it will briefly discuss about the literature review of emergency system for Smart Mobile Emergency System (SMES) For Paramedic User. There are several main parts in this chapter. First part of this section is the introduction of the literature review. Then, the next section discussed on the concepts existing in the project development. The following section deliberates on the technology used and applied technologies within the project. After that, the manual of the system for the project will be discussed. The last part concerns on the review of the existing systems and followed by methodologies used throughout the system development.

2.1 The concept of the project

Today, computerized systems are needed in every organizations and business sector. It can minimize the human's workload and the organization might need just one worker for one each system. Furthermore, technology helps people to reduce their time by using electronic systems instead of recording data manually. For that reason, ambulance emergency systems are built in health sector to make process and treatment that can be made in a more appropriate and faster way.

Ambulance Emergency System is a paperless electronic application that is designed with high flexibility and ease of usage, implemented for health sector to handle treatment with patient in more efficient way. There are many kinds of ambulance

emergency system that exist nowadays. This system is generally built to receive the patient's details correctly in faster way.

2.2 The concept of Smart Mobile Emergency System (SMES) for Paramedic

SMES is developed as portable medical device that allows in tele-consultation, also in mobile healthcare. This system is used for paramedic user (ambulance site), where expert assistance is needed for patients to give directly treatment on site and send the information to the emergency department and the doctor. The information will be given in picture and video form for the preparation before patient arrival. The emergency department and the doctor will receive the information from the paramedic (ambulance site). With this system, they are ready for the next action and do the preparation before the patient arrival. It can reduce the time taken for patient treatment.

SMES applied the synchronization application as the technique that will be used to make sure that the system always updates in real-time. In technology, this project use mobile phone as the main device of the project. It is because paramedics need a handful device, light and easy to carry everywhere. Lastly, this project also involves in data visualization and it is related to visualization and graphics information.

SMES is a mobile application for paramedic user to send the patient's details in visual form. After the paramedic received the information about the patients, they need to go to the location, and give the immediately treatment. Then, the paramedic will capture the photos or videos and send them to the emergency unit and doctor to their immediately action. The doctor and emergency unit will know the patient's condition and they will do preparation before the patient's arrival.

2.3 Technology Approach

2.3.1 Mobile Collaboration Technology

Technology-based process of communicating using electronic assets and additional software designed for use in remote locations using Mobile collaboration. Today generation hand-held electronic devices feature video and audio capabilities broadcast over secure networks. It is enabling several people, groups or organizations conferencing in real time.

Telemedicine technology has been in practice for a number of years in the healthcare sector nowadays. To use of hand-held devices such as a remote public, mobile collaboration technology spreads these abilities to locations now accessible through, with a patient's home or long-term care facility. Healthcare professionals in several locations can together discuss, view, and consider patient issues. To improve the quality and access to healthcare, the use of mobile collaboration technology within the healthcare sector has the potential, making its delivery more cost-effective.

2.4 EXISTING SYSTEM ON AMBULANCE EMERGENCY SYSTEM

2.4.1 GOVERNMENT RADIO INTEGRATED NETWORK (GIRN)

Figure 2.0 Terrestrial Trunk Radio used for Government Integrated Radio Network (GIRN)

The Government Integrated Radio Network (GIRN) enabling faster communication links and improving operations. Terrestrial Trunk Radio (TETRA) network currently used by more than ten Malaysian government agencies, the secure nationwide. It was used for security, public safety and emergency to first responders and law enforcement organizations and it is developed by Sapura.

TETRA system supports several types of data communication .For example; status messages and short data services (SDS) are provided over the system's main control channel (Tetra Systems). It is used while packet-switched data or circuit-switched data communication was specifically assigned the channels. TETRA also provides for terminal's authentication towards infrastructure and vice versa. The air interface encryption and end-to-end encryption is available for protection against eavesdropping.

2.4.2 Ambulance's Tasmania Radio System (TAS)

Ambulance's Tasmania Radio System, known as TAS used radio because it has exclusive use of the system. With this system, it can send broadcast messages, always available, and immediate. TAS is an analog communication. But, this radio networks are not private or secure. There has 4 main component using TAS. First, mobile (vehicle) radios. Next is the handheld radio. Third, the base radio network, and lastly, the Comms Centre. The radio system has 12 channels or networks. The Comms Centre are linked of each of these has two or more base radio sites by land lines or radio links. Plus, the area of the State covers by each channel, and some of the adjacent channels usually overlap.

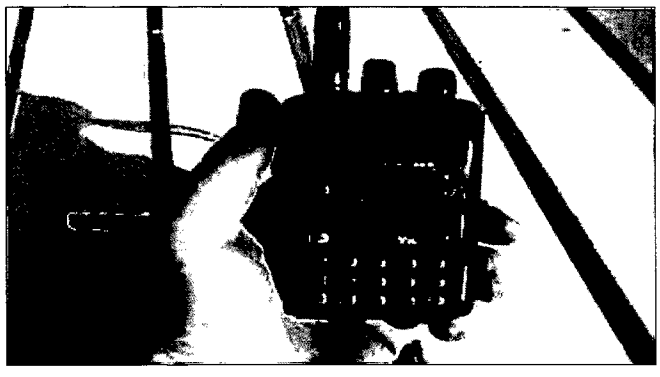

Figure 2.1 : TAS handheld Radio

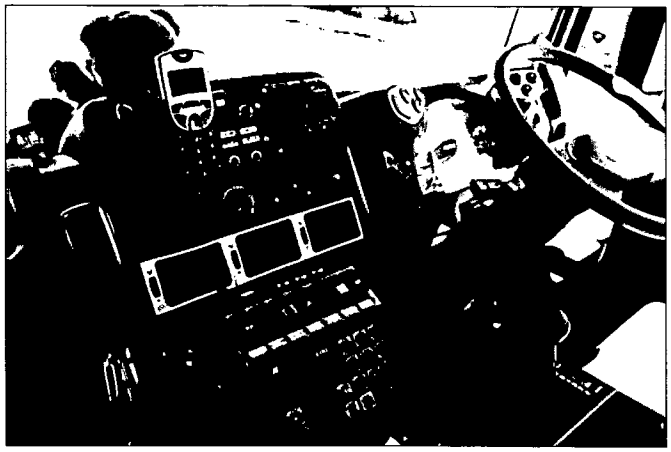

Figure 2.2: TAS Mobile Radio

2.4.3 Amateur radio emergency communications (AREC)

Amateur radio is often used in an emergency communication when wire line, cell phones and other conventional means of communications fail especially when crisis and natural disasters happened. Some of ambulance services in the world certainly used this system too.

Unlike marketable systems like GIRN and TAS, Amateur radio is not as hooked on terrestrial facilities. Sometimes, terrestrial facilities may fail. Amateur radio operators are proficient in improvising power sources and antennas. By the automobile battery, most of equipment today can be powered of. Thus, these systems are a dependable, rugged and the best solution and protected for data communications and convenient long-distance High Frequencies voice.

Figure 2.3: The AREC emergency system.

2.5 COMPARISON THE EXISTING SYSTEMS AND ITS LIMITATION.

2.5.1 GOVERNMENT RADIO INTEGRATED NETWORK (GRIN)

GRIN is real-time equipment that can deliver faster in audio form. It was connected to the emergency center, so that the emergency department can give the instruction and know the patient's details directly.

Compare to SMES, its can deliver the patient's details accurately on the spot in the visual form. So the emergency department knows the patient's condition directly. Plus, with this smart system, the doctor will be notifying about the patient's condition too. So the doctor can gives instruction and prepare for the action before the patient arrived.

2.5.2 AMBULANCE TASMANIA'S RADIO SYSTEM

Like GRIN, Ambulance Tasmania's use radio system and give the information in audio form. Ambulance Tasmania's radio network has 12 channels (or networks). Unfortunately, there is some of the adjacent channels usually overlap and not secure. Compare to SMES, since this system is stand alone and it is a mobile application, it is use only in ambulance unit, directly connected to emergency department and Doctor. Hence, SMES will send the details in pictures or video and send it to the both department. So, both departments can be more prepare before the patient arrived.

2.5.3 AMATEUR RADIO EMERGENCY COMMUNICATIONS (AREC)

In communications volunteers, AREC usually active with local public safety organizations. Using analog communication technology, it can be fastest and secure device in most emergency cases. But, still the emergency unit and the doctor cannot figure out the real situation is.

Compare to SMES, this system can send the details in visual form with some details, it can save times. The doctor who is on call can receive the information from paramedic directly and do some preparation. The doctor also can manage and gives instruction to laboratory department, radiographer, Pathology department and so on. It can saves time.

	GRIN	TAS	AREC
FEATURE	It is analog communication that doesn't need the need for the direct involvement of a control room operator/dispatcher. So it enables users to have a one-to-one trunked 'radio' link	It is analog communication that doesn't need the need for the direct involvement of a control room operator/dispatcher. So it enables users to have a one-to-one trunked 'radio' link	It is analog communication that proficient in improvising power sources and antennas, powered by the automobile battery.

	between sets.	between sets.	
ADVANTAGE	1. The communications are not interrupted when moving to another network site. 2.Faster in information delivery.	1. Can send broadcast message. 2. Faster in information delivery	1. More secure than TAS. 2. Long distance-High Frequency voice and data communication.
DISADVANTAGE	1. Emergency department and the doctor cannot figure out the real situation is.	1. There is no private and secure in information. 2.some of the adjacent channels usually overlap	1. The emergency unit and the doctor cannot figure out the real situation is.

Table 2.0: The comparison between The Existing Systems.

	FEATURE	**ADVANTAGE**	**LIMITATION**
GRIN	It is analog communication that doesn't need the need for the direct involvement of a control room operator/dispatcher. So it enables users to have a one-to-one	1.The communications are not interrupted when moving to another network site. 2. Faster in information delivery	1.Emergency department and the doctor cannot figure out the real situation is.

	trunked 'radio' link between sets .		
TAS	It is analog communication that doesn't need the need for the direct involvement of a control room operator/dispatcher. So it enables users to have a one-to-one trunked 'radio' link between sets .	1.Can send broadcast message. 2. Faster in information delivery	1.There is no private and secure in information. 2.some of the adjacent channels usually overlap.
AREC	It is analog communication that proficient in improvising power sources and antennas, powered by the automobile battery.	1. More secure than ATRS. 2. Long distance-High Frequency voice and data communication.	1.The emergency unit and the doctor cannot figure out the real situation is.
SMES	It is 3G communication that capable to deliver information in details in real-time, faster and lower power consuming computing.	1. User-friendly. Easy to manage and deliver information in fastest way. 2. Receiver can review the data in details and do early preparation before patient's arrival.	1. Need internet connection to send the data. When the connection loss, it fail to send the information.

Table 2.1: The comparison between The Existing Systems and SMES.

2.6 Techniques Approach

2.6.1 Synchronous Transmission

In general, synchronous (from Greek *syn-*, meaning "with," and *15hromos*, meaning "time") is an adjective describing objects or events that are coordinated in

time. (Rouse, 2005) Sometimes, the term has several different customs in information technology.

Synchronous signals are those that occur at the standard clock rate in network telecommunication when all clocks are based on a static or single reference clock. Plus, synchronous communication requires that each end of an exchange of communication in one to one communication, and it will respond in turn without starting a new communication. A synchronous protocol usually used when files transmissions do from one location to. When the transmission is received, it wills response is returned showing success or not. If not, it can be resend back.

To achieve accurate and consistent data across operational and transactional systems, data synchronization is needed to enables any organization to improve in business performance. It can get a higher quality data through systems and publics since it is ensuring up-to-date data. Plus it will improve data security and integrity, compliance, and visibility across the any organizations and sector.

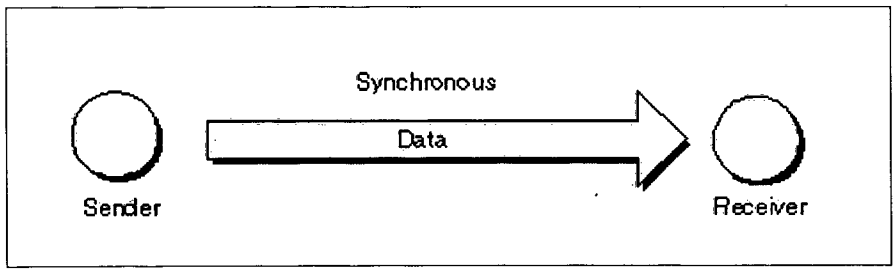

Figure 2.4: The synchronous architecture

2.6.2 Asynchronous Transmission

The term asynchronous is usually used to describe communications in which data can be transmitted intermittently rather than in a steady stream. For example, a telephone conversation is asynchronous because both parties can talk whenever they like. If the communication were synchronous, each party would be required to wait a specified interval before speaking.

Asynchronous transmission uses start and stop bits to signify the beginning and ending bits. The additional one at the start and end of a transmission alerts the receiver to the occurrence of the first character and last character. The asynchronous transmission method is deployed when data is sent as packets as opposed to in a solid stream. The start and stop bits have opposite polarity, allowing the receiver to understand when the second packet of information has been sent.

The difficulty with asynchronous communications is that the receiver must have a way to distinguish between valid data and noise. In computer communications, this is usually accomplished through a special start bit and stop bit at the beginning and end of each piece of data. For this reason, asynchronous communication is sometimes called start-stop transmission.

Most communications between computers and devices are asynchronous.

2.6.3 Data Compression