

A Mechanism to Access the Medical Information and a Modeling Approach For Medical Hazards

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Abstract—The considerable revolution of information technology (IT) and its demands, and uses in the various parts of the human lives, such as education sectors, industrial sectors, agriculture sectors, communication sectors and others, there has also been high demands of IT in medical sectors which use to process, track and monitor the patient's information. To facilitate the medical sectors, the uses of propose study is twofold, and categorized in two phases. In first phase, the patient's real time information is carried via radio frequency identification (RFID) sensors tags and is transmitted and monitored through the uses of mobile phone, as an authorized user of monitoring system. In the second phase, the propose work is novel and is more based on the conceptual modeling, which provides the real time medical services for those patients that will have sudden illness (i.e., less major or major), and they may located at the distance placed from the main medical service station, may the distance will be in several, meters, kilometers, or a whole city. Therefore, to achieve this, a formal model will be designed which result the medical service that required by, and delivered to the remote located patients.

Keywords- Radio frequency identification, Remote sensing, Medical Tags, Short message service, Multimedia messaging service, Location finder, General packet radio service, Intelligent controller.

I. INTRODUCTION

The medical services are essential for human lives; in the recent years, notable enhancements have been made in medical sectors by employing of Information technology (IT). In past, medical services were limited in-term of medical treatments that caused a large number of death ratio for human; due to the shortage of available medical equipments and manually management of medical services, a large delay was accounted (during medical services managements and in patients treatments. The medical facilities were also limited to overwhelm the disasters that may take placed locally, or at the remote sites; that are because of technology limitations [1, 2]. Uses of advance IT infrastructure, wireless sensors based platform was created in-which a cost-effective Tag called “miTag (medical information tag) is designed which could helpful during the disaster location tracking, monitoring and its recovery. This deployed platform (via miTag) is efficient for monitoring the information from remote sensors based medical equipments, such as “pulse oximetry, blood pressure, temperature, electrocardiogram (ECG) and others, and is scalable, and manageable over the various networks (and

technologies) [1, 3]. The design to miTag could has taken around three years effort, throughout this, several medical groups and disaster recovery groups were involved and based upon their issues and challenges, a feasibility report was created that resulted the miTag. This miTag is highly scalable sensor based technology that able to incorporate with various networks and with different vendors' based medical sensors (and equipments) [1, 3, 4]. The communication module was designed to support two-directional wireless communication, which could be monitored through the main control center. Moreover, an interface called sensor interface was also added which is used for integration with other vendors' equipments and their test to miTag sensing networks and used for the purposes of information management. For disaster monitoring, two types of wireless networks were supported: 1) Short-range network, in which the patient body is measured and monitored within the short range, 2) Long-range network, in which the patient body is measured and monitored through several networked repeated over the long range or distance. However, the network configuration was dynamic in both cases; the patient body information is measured first via miTag (which is supported for various sensors, such as wireless ECG device, wireless blood pressure device, wireless pulse-oximeter device, and wireless LCD device), is accumulated, and transmitted back to the main control center over mesh network [1]. Figure 1 shows the general architecture of real-time patient information sharing while the disaster happens.

Wireless medical sensor networks (WMSNs) and Radio frequency identification (RFID) have been extensively used in medical and healthcare domains. The implementations of WMSNs are very extensive and effective in the medical and healthcare domains. Patients can use wearable sensors which can monitor the situations about Patient bodies (e.g., to detect the glucose level or heart rate level, and others) by using wireless network in medical centers. The RFID technology is used in hospitals and home-based healthcare services. A radio-frequency identification system monitors the situation of patient by use of labels or tags which directly contacted to the body of patient. RFID readers will send an encoded radio signal to read the label, and then the RFID label receives information and response identification and other medical measurement. [5, 6]. This study mainly deals with the study of WMSN and RFID, based upon u-Healthcare system. The study demonstrates an effective framework of u-Healthcare system formed by using of WMSN and RFID technologies. The implemented system can use RFID sensor on the patient

body and retrieved information will transmit to the central database server before transmitting the medical information to the local workstation to monitor the patient's medical status. The patient in the emergency situation could receive alerts through the wearable device or will receive the message via Mobile phones. At the same time, the medical staff of the local workstation will also receive information about the current conditions of the patient to warning that patient need to be noticed for urgent medical care. As consequence, the patient medical service that depends on the status of the patient will be stipulated or applied by the patient. With the patient's status, WMSN node's status will be patterned with the Mobile IPv6's based functionalities [5, 7].

A study by Cheng Wen et al.[8], proposed an ECG (electrocardiogram) based telemonitoring system which monitors the status of cardiology patents heart beats through the uses of cellular communication or mobile technology. This system is helpful to monitor the real time abnormal statuses of heat patient which located in medical award through MMS (multimedia messaging service) over GPRS (General packet radio service) technology and GPS (global positioning system) is employed which locate the patients during the emergency cases[3,8]. For further identifications and classifications, a

new ECG algorithm is deployed that measure the abnormal heart beats of individual patients, the required information is monitored via ECG and stored in the system that may located in the medical ward [8, 9, 10].

Another study by Cristian Rotariu et al.[11], a realization system is designed that monitor the cardiac arrhythmia within wireless sensor networks (WSN). The existing heart devices (i.e., ECG and others) are used to monitor the normal and abnormal heart beats of patients, the monitored information is transmitted to main control center which could be designated to analyze the retrieved information from the monitoring devices, over wireless sensor networks. Based on the information examined by main controller, the status will updated, and alarms will be generated in-cases of measurement, low or high heart rates. For monitoring, a user based application was deployed that in-functional to get the real time heart rates of patient; moreover, a user-defined interface was also designed and employed, in-which retrieved information is gathered to display [4,11,12]. As consequence, the current proposed study reviews the merits and demerits of existing developments that made in medical sectors and then proposes new approaches that will be significant for the medical information access, and monitoring, respectively.

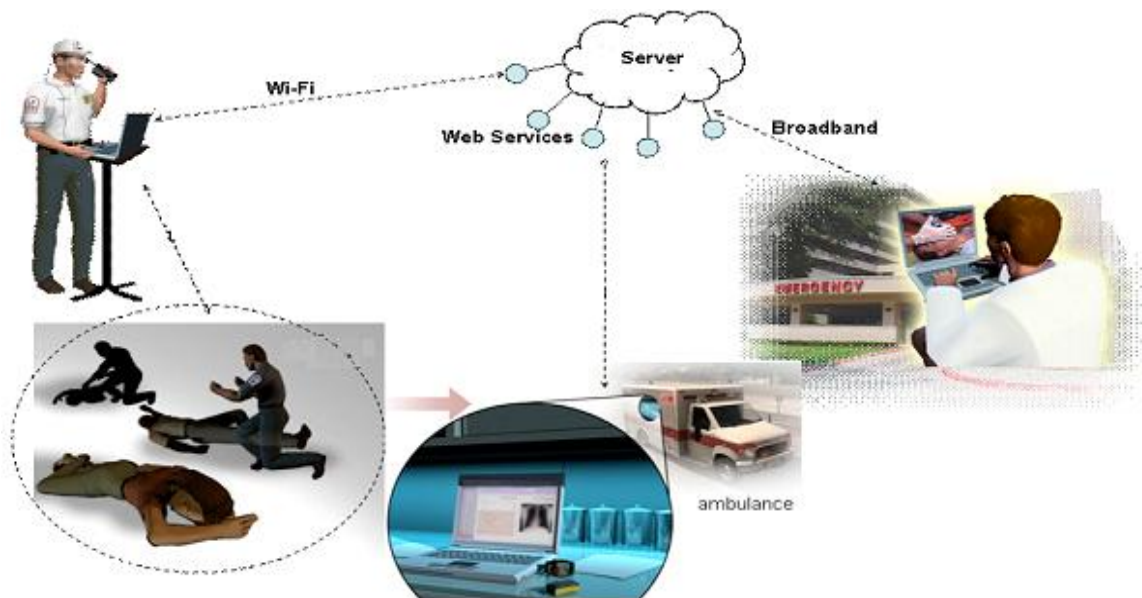


Figure 1: Real-Time Patient Information Sharing while the Disaster Happens [1]

II. PROPOSED DESIGN AND IMPLEMENTATION

In medical sector, the tremendous enhancements have been accounted due to the used of Information technology (IT), a patient can be operator by many medical advisors (at same time) which may present locally in the hospital or in medical centers or/and present remotely to provide the required medical treatments for the assigned patients. With the uses of IT and its developments for Web (chat) forums, the medical advisors from all over the World can able to communicate in a group, discussion for any type of diseases that will result the better solution to diagnosis the dangerous and critical diseases.

1. An Mechanism to Access the Medical Information

In study first phase, the cardiology patients are monitored in the real time senses with employs of Radio-frequency

identification (RFID) tag, within the setup and configuration of wireless environment. The employed RFID tag called uni-directional tag (Uni-tag) has designed which tracks the patient normal and abnormal statuses of heart rates, and according to the heart pumping (conditions), the information will be updated and viewed through the use of integrated local system called local controller (LC) [3]. However, the employed RFID tag is designed as uni-directional to transmits the information; incase, more than one, or several patients will have located in the same medical room or medical ward, then the intelligent RFID tags controller is used and networked which get the information from the medical tags, keeps and analyzes the information and transmits them back to the designated local controller. During information retrieving and examining, the alarming facility is also available that can be in-function, if the abnormal points or behavior will be analyzed from the

individual tags. The retrieved information will further transmit and store in database, as a part of local controller, and retrieved information also can be displayed on multimedia display (screen) that embedded in medical ward. A simulation based medical system setup and configuration is shown in figure 2.

As consequence, several medical wards can be configured and networked together, and managed through centralized sever (CS); the information which retrieved from the Uni-tag to intelligent RIFD tags controller, can also be accessed by the designated medical advisors, and the guardian of patient(s). This type of access is provided for the authorized users (i.e., medical advisors and the guardian) that view the information of their belonging patients while logging to centralize sever. The CS provides a secure patients medical status access via cryptography mechanism to the users to locally access or

access within medical networked center [13,14]. However, designated medical advisors will also view the information from any remote location via internet access, through the installation and access of secure copyright software. This software provides the secure access channels for the medical advisors which can monitor their patients as remote user of the system and provides text based advises to the in-charge of the local controller via centralized sever. Moreover, a group chat facility is also provided in-which the local or remote located medical advisors can communicate on the medical issues, the individual patient medical issues and on other critical diseases, which resulted to diagnosis and overcome the several dangerous diseases of nowadays, as a part of proposed medical system. Figure 3 shows the transmission flows while the random sized packets are transmitted from main server to external devices (e.g., mobile and laptops).

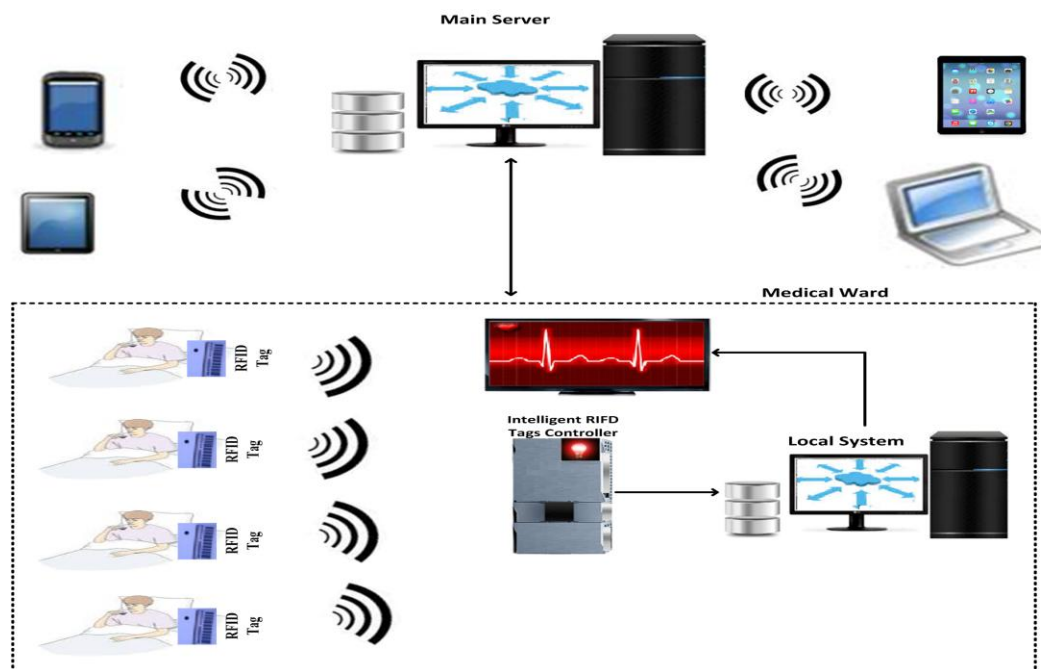


Figure 2: A Simulation Design for Medical System

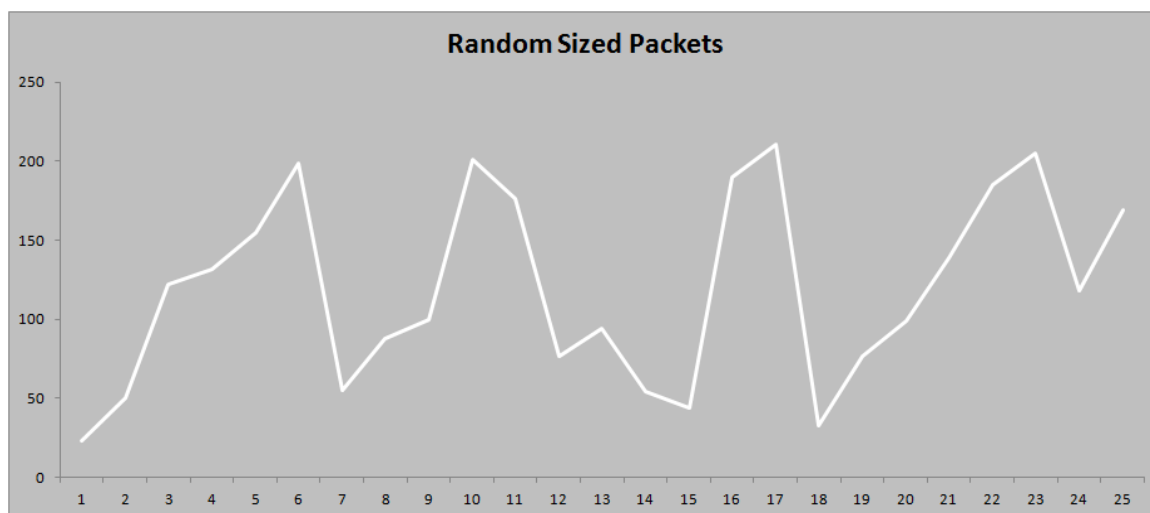


Figure 3: Transmission Flows for Random Sized Packets

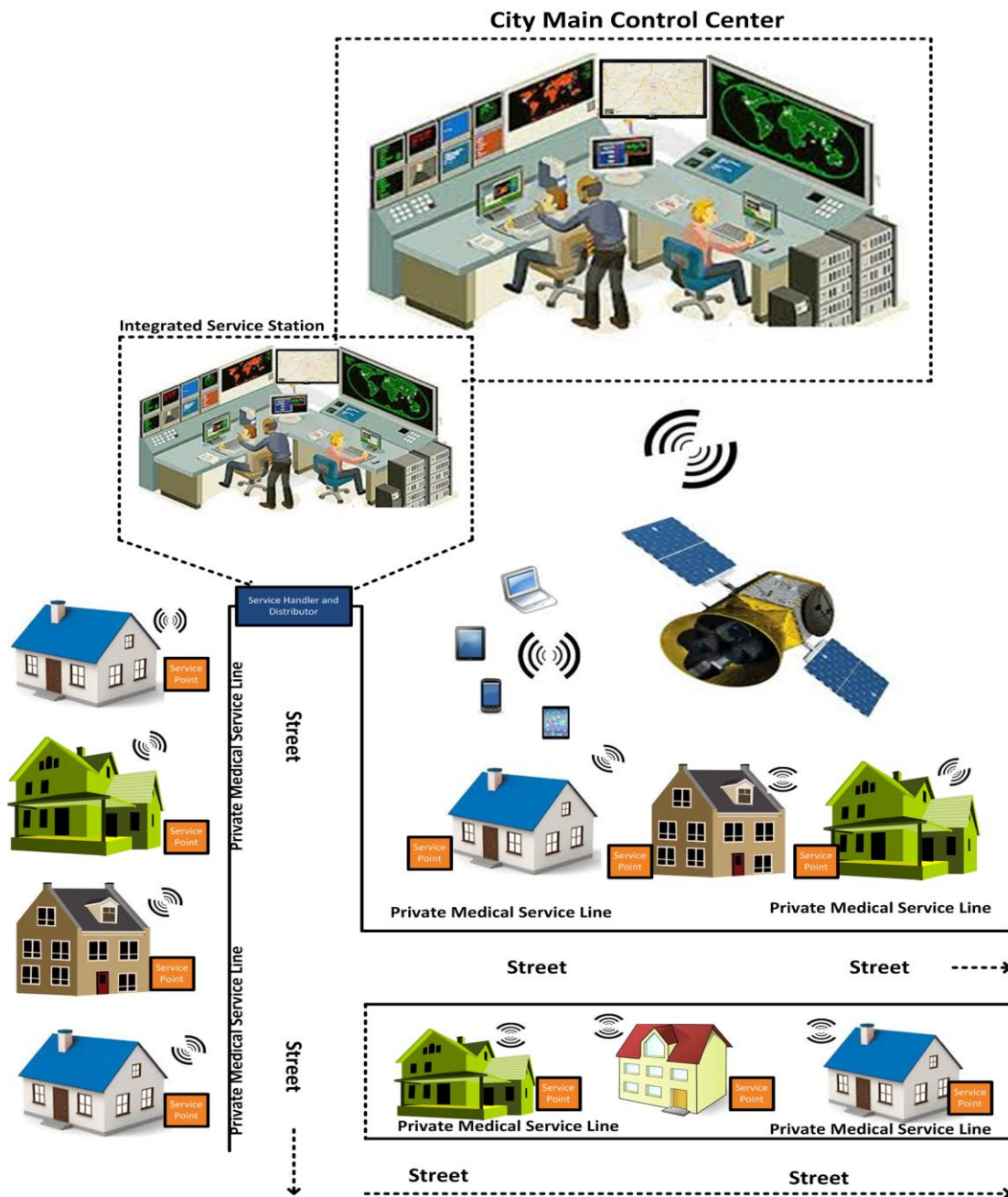


Figure 4: Modeling Design for Medical Service Monitoring and Management

2. Modeling Approach for Medical Hazards

In the second phase, a novel conceptual model is designed in which the medical services are provided to the remote locations, where required. The remote location or the delivered service location may be located far away from the medical service station or located anywhere in the whole city. In this proposed model, the desired and required medical service location is traced (or researched) through the uses of GPRS over cellular network. The whole city is monitored by GPRS service that will help to get the required service location(s).

The proposed model is to be significant to provide the time critical based medical facility within the whole city, without usage of any vehicles which may caused more timing issues due to the traffic crowded. Means that, the proposed model does not use the vehicles (such as medical Vans or others) to

provide the medical services, but does use a virtual platform (which will be real in near future) to access the medical service needed locations and with desired medical facilities. This model is designed to provide an advance and less time consumed platform in-which medical services are provides to toward the hazard places or sudden accidental places.

In modeling, the designed and implemented platform is very unique and wholly controlled by the private organization, just like as the Internet Access Company, and TV Channels Broadcasting Company. Let's consider an example of Train system in-which each train can move and stop according to the scheduler stations over the train tracks, the proposed model would also seem as similar to the advance train management, monitoring and controlling system. The private lines (as shown in figure 4) are spread and networked, in each part and every street of, over the city. In each street or street line, the local medical service point or connection is created for each

house or for each building. The medical service connection will be established by the mutual agreement between the service provider company and the house owner. Means that, similar to Electric and Gas lines, the connection points are open, but will be free or paid depending on the medical service company policies, however, the fee charges will be made upon the medical service used by the individual (users). Moreover, at the time of connection and agreement, a little charge or registration fee will be paid by the customers.

In case of urgent or sudden medical service will require by the patient that may located remotely in the network of proposed medical system access, the medical services would be delivered within few seconds, without inferences of external environment. As known, the medical system is a private setup and networked over the whole city. The users simple use their mobile phones to inform the main medical service station, in-case of medical emergency, or use the emergency alert phones that were provided by service provider and setup in the connection holder place. In case of medical emergency or alert, the medical box will be delivered which contain all main medical facilities, such as the basic or required disease medicine, oxygen and oxygen masks, medical required injections, medical drips and others; an additional advance facility of video communication is also provided and accounted as a part of medical service. Through the uses of auto video option, the patient live status can be viewed and required guidelines will be provided remotely from the service center, as required by the patient conditions and treatment plan. Means that, there no needs to require any web cam or video cam facility at the emergency site, the video facility is provided from the service center and considered as a part of medical (virtual) box. The video cam automatically will in-process, a specialist advisor will also be connected via this camera which provide the important precautions for patient recovery, and also guideline to use the whole medical service box and its embedded parts. Figure 5 shows a general model for proposed medical system.

In-short, this study provides a advance facility to provide the medical services for those patients that are located remotely over the distance, in-cases of emergency, with faster and efficient services, without interference of traffic and other environment issues. However, this work has been under development stages and soon the extended simulation based version will be published over internet access.

III. CONCLUSION AND FUTURE WORK

The uses of information technology (IT) play crucial roles in our daily lives, especially, in medical sectors which may considered as the most important factor to the human lives. Notable enhancements are accounted in medical sectors that would be useful in medical treatments to recover the patients and to fight against the dangerous diseases. With the enhancements, another enhancement is made in this study which monitors the real information or status of cardiology patients through the use of radio frequency identification (RFID) tags and the retrieved information is accessed, stored and monitored in local controller, by the means of intelligent RFID tags controller which networked in-between the RFID tags and the local controller. Moreover, a novel conceptual model is designed and networked that provide the remote medical facility for patients during the cases of emergency. The model designed is very convenient and efficient, to provide the medical services in-cases of emergencies, or for

those patients that are located remotely and are far from medical centers.

In future, a simulation based environment will be designed that thoroughly model the whole structure of this study, moreover, the intelligent functions will be deployed that provide more reliable and efficient accesses to the remote located patients in-cases of emergency and also the further enhancements will be made to the existing study.

IV. ACKNOWLEDGMENT

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