A Novel Method for Patients Identification in Emergency Cases using RFID based RADIO Technology

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Abstract—**Medical records provide an important role in the process of providing health care in hospitals and in various types of medical institutions. Medical records play a vital role in maintaining the information of the entire patients which includes the basic information, medical information, history of operation and medication etc. These medical records have been produced for the purpose of identifying a patient. In this paper, a novel method for identification of patients using the Radio Frequency Identification (RFID) technology is proposed. This paper explains the concept of electronic medical record and explains how to use RFID based technology in order to create an electronic medical-card for patients. The proposed methodology also aims to identify patients quickly in the case of emergencies using the magnetic card reader device, which provides detailed medical information for the patient file. It also helps the doctors who are present in the ambulance of patient. The proposed methodology is importance in some emergency cases where patients cannot provide their information to the hospital because they didn't know their identity and medical history.**

Keywords—*Medical records; radio frequency identification; magnetic card reader; patient; emergency; electronic health record; laboratory*

I. INTRODUCTION

Information technology is the basis for providing the quality of service in hospitals. It is effective in solving the problems of data loss and loss of time. It is also observed that the main aim of this information technology is to increase the efficiency and also the performance of staff who are working there, accuracy and utilization of the data available to the hospital in order to obtain the desired results. It also aims to improve the accuracy of how to train the people who have access to the system. The Electronic Health Record (EHR) [2] is a systematic collection of health information of patients which are electronically in nature and stored in digital format. These records can be shared across different healthcare institutions. These Records are shared through network or enterprise-wide information systems or other information networks for exchanging the data. E-health records may include a set of data, including demographics, medical history, medications, allergies, immunization status, laboratory test results, radiographs, vital signs and personal statistics such as age, weight, and billing information etc. [3, 5].

Hospitals are facing various problems nowadays, despite the use of electronic records [8]. These include the difficulty in identifying patients in the case of emergency, in the case of a traffic accident or fainting etc. In these cases, it is difficult for the doctors to identify the person or his medical record whether he has any chronic diseases, his medical history since they don't have the enough information about the previous treatments done. This leads to the loss of time in treating the patient. Identifying the medical history without contacting the patient provides high flexibility in many emergency cases so that it will be easier to provide the electronic medical record of the patients. This can be achieved by an RFID-RADIO based technology in which the patient can be identified by radio waves through the smart chip which is implanted in the patient's body by the Ministry of Health.

RFID chips are smart chips which send and receive the digital signals in the form of radio waves. The scanner present in the hospital captures the digital data which were encoded in the smart chip and labels attached to the patient's body. It locates the point of issue, read the data present in it and stores it in the reader. As soon as the patient enters the hospital (emergency department), the nurse uses an RFID reader for capturing the signals from the smart chip present in the patient's body via radio waves. All the information collected from the chip is transmitted through the communication interface to the computer system connected to the reader. Thus, the patient's identity, personal data and medical records were identified quickly and the information about whether he or she suffers from any chronic diseases or permanent treatment can also be found.

The physical components of a RFID system is shown in Fig. 1. The smart chip present in the RFID controller contains an encrypted integrated circuit. It does not have any battery. All the data are entered into the smart chip via a computer, which is directly connected to a machine. Doctors can store data and then it is inserted in the patient's body. The RFID reader captures digital signals from these smart chips by radio waves and then stores the information on the computer which is connected to it. The computer is programmed with an electronic system which is compatible with the RFID based technology.
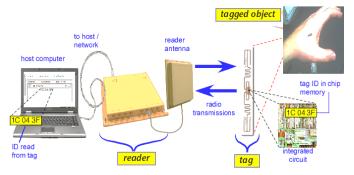
Fig. 1.   Physical Components of the RFID System.

RFID smart label tag   RFID RADIO   COMPUTER

Fig. 2.   RFID, Its Tag and the Computer Connected to it.

This paper discusses the proposal of development and working of a system with the application of the RFID based technology in hospital. When a patient was bought to the hospital in case of an emergency, the employee present in reception use the RFID Radio Reader to read the data in the chips which it present in the body of patient. The reader collects the data and it searches the database in order to identify the information about the patient and it retrieves his record. This information helps the doctors and nurses to treat the patient at once. RFID, its tag and the computer connected to it is shown in Fig. 2. This proposed approach can save the time of treatment because the time taken to search the patients information in some emergency cases is more and also, in the case of an emergency, the patient need quick action to save his life. This paper is organized as follows: Section 2 depicts the literature review focusing on various methods proposed by earlier researchers. Section 3 depicts the Components of an RFID system, discusses the proposed methodology, its phased and the modules, etc. Section 4 depicts the result and discussion section, conclusion and future works are shown in Section 5.

II.   LITERATURE REVIEW

The RFID is a technology which uses radio waves to transfer data from an electronic tag, called RFID tag which is attached to a person. The data is accessed through a reader for the purpose of identifying and tracking the information about the person. The RFID based technology has been already used by various researchers [1-3] to track and trace the victims in a situation of disaster. Data which were collected in real time in the case of an emergency is saved time in the RFID chip. Various applications such as crisis management teams, hospitals and emergency personnel, have access to data through a computer database present inside the RFID chip [3].

The RFID was the first explored in the 1940s as a method to identify allied airplanes [4]. Nowadays, the RFID system have been applied successfully to various applications in the manufacturing, supply chain management, agricultural applications, transportation, healthcare, etc. [5]. Various errors in medical field can be prevented by building a safer healthcare based system. Recently, the RFID has been applied in hospital management [16]. The RFID is valuable for quickly retrieving patient information and monitoring patient locations in the hospital [6, 7]. There have been few previous by reports researchers based on on-site experiments shows that the RFID is suited best for the application in hospital [8]. Resources from various organizations and technical structures such as hardware and software are the most essential requirements in the re-design of electronic projects [9].

Chao et al, proposed a novel methodology for improving the safety of patient with the combination of RFID and mobile based technology. In general, medical errors can be classified into five categories such as the poor decision making, poor communication, inadequate monitoring of the patient, misidentification of the patient, inability to respond rapidly and poor patient tracking, etc. Adopting information technologies based methodologies in enhancing these deficiencies are the main goals of current trend in enhancing patient safety [10]. The result showed that the RFID adoption though assigned with low level of awareness; adoption capital recompense and infrastructural challenges in the health sector also has high and great tendencies to thrive. As a result of the second research, question revealed that the health care service delivery can harness the benefits of the information technology solution system to function in its servicing in forms like authentication and identification of personnel, patients' data and blood verification; drug dispensary among others [11].

Barriers and critical success factors towards Radio-frequency identification technology adoption [12] in South-East Asian healthcare industry showed that most respondents think the reason of that barrier from the budget and less information, and there is difficulty to use the technology and systems.

The respondents also think the success factor are the integration of collected data, collaboration between units, supporting from top management, and finally they can create a small Radio-frequency identification project [13].

Yao et al proposed that the RFID technology offers healthcare practitioners various advantages to improve safety of patient, time saving, and costs reduction but. It also causes critical issues for successful implementation of the RFID based technology. In order to increase the acceptance and wide use of RFID in healthcare, more customized the RFID systems, more institutional support, and integration with existing HIS, and various regulations to protect privacy are needed [14].

III.   COMPONENTS OF AN RFID SYSTEM

The proposed Radio-frequency identification system in this paper consists of different Component which are integrated in a system and shown in Section 4. The integration

of the Radio-frequency identification components enables the implementation of an Radio-frequency identification solution [15]. Components of the Radio-frequency identification system is as follows:

- Transponder (tag that it can attached to human).

- RFID Antenna (To detect the transponder).

- RFID Reader (use to receive the data from transponder).

- Connections (enable Transponder, Antenna, and Reader to work together by using information technology infrastructure).

- Web-Based System (Database / User interfaces).

IV. PROPOSED METHODOLOGY

Various methods have been proposed in literature for the RFID based patient authentication. In this paper, a system based on the incremental model is proposed which has the development stage, requirements and then design stage until it reaches the final stage. It is shown in Fig. 3. Design stage is the phase of testing and implementation [17]. Main objective of this paper is to identify the patient's in emergency cases when he was bought to the hospital using the radio-frequency identification technology. This also provides an interface to manage the follow-up of patients. In the proposed system, the programmer designs, implements and tests all the components of the system. To apply this proposed methodology, we have to develop a system which is work with the RFID technology.

A. Use Case Diagram

Fig. 4 shows the use case diagram of the proposed system. In Fig. 4, first actor represents the system administrator. He has the authority to access the entire system and manage the medical record by adding new patient and update and delete the patients. He also has the authority to add doctor, he can identify the patients using RFID Reader to identify the patient, and he can also show the EHR of patients. The second actor represents a doctor. He can write a report, insert the medicine, and also, he can send data to the lab.
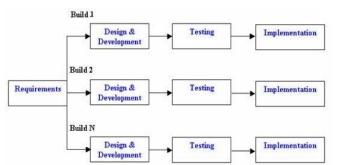

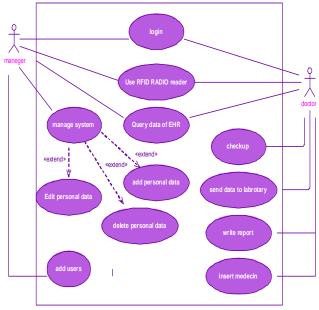Fig. 3. Schematic Representation of an Incremental Model.

Fig. 4. Use Case Diagram for the Proposed System.

B. Findings and Discussion

Fig. 5 shows the Main interface for the Administrator which will allows him to enter the personal data of the patient for the process of saving it in the chips. By this screen, he can read the data from the chips using reader to query about patients in the cases of emergency. He can view the reports and show the electronic health record which belongs to the patients.

Main interface for the doctor is shown in the Fig. 6. It also shows how to quickly the query of a patient's data can be retrieved through tag smart reader is also shown. Inquiry about the full medical record of the patient, i.e. tests and previous medicines are also shown. Two buttons are there for the purpose of sending the data towards the laboratory tests and radiology.

Fig. 5. Main Interface for the Administrator.
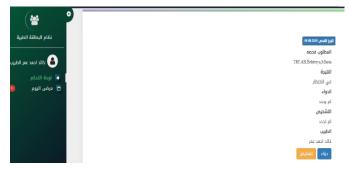
Fig. 6. Main Interface for the Doctor.

Fig. 7. Interface for Diagnosis.

Fig. 7 shows the interface for previous diagnosis of the patient and the type of examination required by the doctor and dispatched laboratory medical laboratories. The interface screen also contains a form in which the doctor can fill the report and enter the type of medicine for the purpose of sending it to the pharmacy.

V. CONCLUSION AND FUTURE ENHANCEMENTS

Radio-frequency identification systems have been successfully applied in various areas of manufacturing, Production, agriculture, Logistic services and healthcare services. In the healthcare industry, there are other advantages for example; increase accuracy tasks, reduce human errors, improve safety, and patient satisfaction. In the coming years there is no doubt for using the RFID in the healthcare industry and it will become a primary requirement. Although, the complete usage of RFID will not be able meet expectation of health care organizations. In this paper, a novel methodology for identifying the person's information using the RFID chip in case of an emergency is proposed. The RFID reader present in the hospital is used to read the data or previous information about the patient in case of any emergency is done. If the proposed methodology is used alone, health care organizations

and many patients will be faced with numerous advantages. Integrating the proposed methodology with Hospital Information Systems (HIS), electronic health records (EHRs) and also with the Clinical Decision Support Systems (CDSS) could be the feature enhancements.

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