A Smart E-Health System using RFID Module and Secured Cloud Storage

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***Abstract*— Health care is an important sector for the growth of emergent countries. The efficiency and liability of medical sector depends on the quality of service and ease of maintenance. Health records provide patient's detailed history and the data related to it is unstable and it turns out to be complicated to develop. The proposed system using RFID module provides accurate, current, and detailed information at the point of care and emergencies by integrating various medical entities. This automates the maintenance of health records by having a paperless system and has a secured medical database using cloud storage.**

Keywords—RFID, cloud storage, VS2010, MySQLyog.

I. INTRODUCTION

Nowadays Information and Communication Technology (ICT) is an indispensable part of developing country as it offers great opportunities and have a gross effect on nation's economy and internationally competitive in the medical sector. Assessing the welfare of the nation depends on the advancement level of the medical industry. The implementation of e-Health system in emergent nations is a confrontation collaborated by United Nations agencies and medical sectors at the global, internal and regional levels.

The medical systems demand advancement in the quality, competence and attainability of medical care services, in addition to incorporating of new approaches for the better health of citizens universally. A decade in the medical system application in urbanized countries has exposed immense economic and medical development for investing in information technology. Consequently, the execution of information and communication technology can lead to the enhancement of people wellbeing and reduction of expensesin medical sector has essentially transformed health care in urbanized nations, leading for improved quality and efficiency of medical facilities.

The advantages of ICT applied to medical system is improved health services to the society and help medical professionals have advanced quality, secured, and more judicious and enhanced medical care. Information and communication technology are fundamentals for the advancement of a medical record system. Since India has a significant existence in information technology, the coherent medical system has assisted all share-holders, by contributing roughly eight percent to gross domestic product.

Printed documents involve more interest to hold and manage printed records as well as to systematize finite number of records. Health care practices pile paper medical records in large warehouses. These paper records require more space and are prone to environmental disasters, paper records also tend to deteriorate over time. Inclusively printed documents are endangered from break in, getting it misplaced from a worker. Several health care professionals maintain only single photocopy of a paper health document, if a particular documentation is lost it is irretrievable**.** The doctor who resides the medical records in a stockroom, they require them to be mailed or scanned or faxed which is a prolonged process.

Following are the most common problems like rising death rate, increasing expenses, suffering from different diseases, misuse of drugs.As medical data continues to expand at 48 per cent per year (source: EMC-IDC report), medical organizations are exposed to new opportunities of digital world. People expect speedy full range access to the quality medical services, personalized understanding and connectivity 24/7. To accomplish this need, institutions has implemented cumbersome edge IT infrastructure nearby to give immediate access to applications and data. But the drawback of this distributed model is, it lowers the branch employee efficiency since the application performance troubles with greater data backups, disaster recovery, and other fundamental upgradation requires more time.

II. LITERATURESURVEY

Mohammadariful Basher and Palash Chandra Roy[1] it aims to recommend a PDA based e-Health card system where a smart card for patient recognition which improves global medical system. It also explains how ICT services can advance the medical sector via e-Health card in rustic areas of Bangladesh. Accordingly, this electronic card can save patients medical history and decline the bribery of medical sector. This paper identifies key issues of medical system in urban and rustic areas. Conducting methodical study to bring awareness about how to use e-Health card can assist them and evaluating with e-medical system in urbanized and emergent countries with various case studies. A model and framework of an successful PDA based e-Health card system is secured and highly proficient to afford quality

medical service. Current e health solutions are mobile phone health Service, Telemedicine, Patient Health Records, m-Health. PDA is a handy minicomputer which is transportable. This gives an integrated platform for e- health system.

Gunjan V.Ukalkar and Prasad S.Halgaonkar[2] has implemented enhanced encapsulation security channel using RSA algorithm to ensure the security of data in NFC health card and cloud environment which maintains the quality of service in health domain. NFC tags are tapped with NFC enabled mobile phones that display all the information of patient stocked in NFC tags maintained with e-health card. The patient is provided with a unique identification number which keeps track of all the credential information. NFC allows data exchange between two devices and is a higher frequency wireless technology with a limited range. MIFARE classic NFC tags are used which offers 1MB of data storage, spilt into 16 sectors. The workflow of the system is as follows: the doctor scans the id of the patient using a mobile application which links to the server. RSA is a cipher block in which each message is mapped to an integer which includes key generation, encryption and decryption. System analysis includes time complexity and space complexity.

Naveen Malhotra [3] In accordance to this journal, the purpose of electronic medical record (EMR) is to prevent medical errors, increases patient security and enhanced quality procedures in healthcare. This in turn contributes to the country's economic stability. The programming structure make the electronic medical record a feasible systematic tool for tracking patient EMR between health care providers, medical statistics. In addition to this EMR is to develop uniform billing system. The disadvantages of paper record were documented for instance misplacement of important health information, partial documentation and costly preservation. According to the research by institute of medicine entitled "to err is human" specify medical errors, 98,000 individuals die each year in U.S. hospitals from avoidable errors. Government provides many incentives to allow adoption of EMR system with a main objective of optimized safety and quality of care. The core barrier for the adoption is standardization and inoperability. The future scope includes the interactive medications such as supervising blood pressure and heart rate that can decrease postponement in medication.

StehanieO.Zandiehet al., [4] This article differentiates the accomplishment methods among paper based and electronic health record system. The main requirements for EHR includes adequate facility and printers, a doctor information technology and workflow education to make sure a successful evolution to a paperless health record system, sufficient protection of patient privacy and a support staff with IT. A qualitative study of 12 academic ambulatory practices and 11 practice managers and 12 medical directors were interviewed. Minimum number had EHR systems for documentation. The rest had used paper records to document data but used electronic system to schedule and bill patients. Switching to a new EHR provides more stable EHR product with better IT support developed by a honest and economically secure company.

Kuo-Hui Yeh, N.W. Lo and Chieh Wang [5] This paper proposes a RFID based e-Health system which supports patient's security and enhances the competence of out-patient department in Taiwan's hospital environment. The main security fundamentals are privacy, reliability, accessibility, liability and non-repudiation of information. The patient services are divided into 8 parts. Part 1 – issuing RFID tag and connect it with card. Part 2 - Diagnosed by a physician via authentication. Part 3 - Extended tracking. Part 4–laboratory process via authentication. Part 5–Report examination. Part 6 - Lab process. Part 7 -Prescription supervision Part 8–medicine management. This system simultaneously provides the structure robustness, security and the process competence on the health sector.

III. PROPOSEDWORKS

The proposed system aims to have a paperless system besides automate and ease the process of maintaining the patient's medical details that provides the mechanism to collect, store and forward the data to the medical information system and have a secured database.The block diagram in figure 1 shows the proposed model for the system.

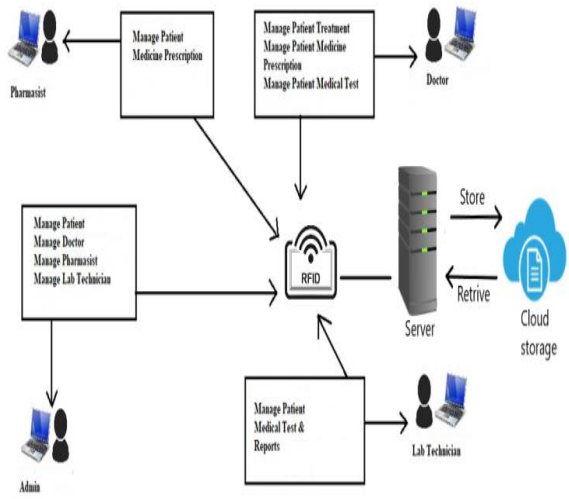

Figure 1: Block diagram for the proposed model

The RFID health card for a patient is issued by a hospital staff for his first visit. The details of hospitals, laboratories and pharmacies are updated by an admin. During consultation doctor can have an access to the patient medical history and can also update his current health status. The test prescribed by the doctor can be viewed via the health card and digital reports can be uploaded back to the same. The pharmacist can update his stock details after providing medicines and can keep track of his medical sales which reduce illegal usage of drugs. The figure 1 shows the functions performed by different entities of medical system where data can be accessed from cloud storage.

Process:

The RFID module is connected to the host via USB driver. The project creates a windows-based application using visual studio 2010 IDE platform. The data stored in a cloud server is retrieved from the connection established by MySQLyog. The ADO.NET connects the application and the database .The following section describes the activity performed by each entity and the flow of their act.

ADMIN

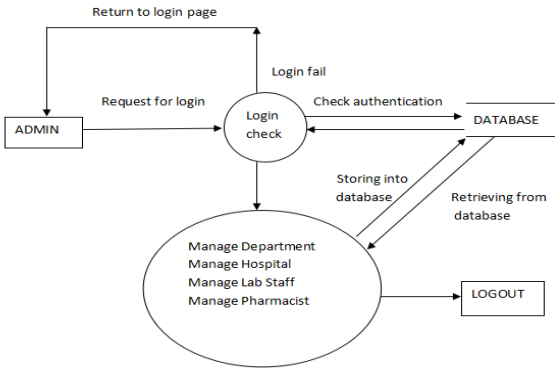

Figure2: Design flow diagram of admin

The first level is operated via admin, he is provided with the login credentials .The server checks for the correctness of the credentials if fails it requests for the login again. If the login is successful, he gets the access for database where he can store and retrieve the contents of database. Admin can perform following functions: he can add various medical department to diversify the doctors based on department, manage existing hospitals by providing authentication, add government certified laboratories and pharmacies and issue login credentials.

HOSPITAL STAFF

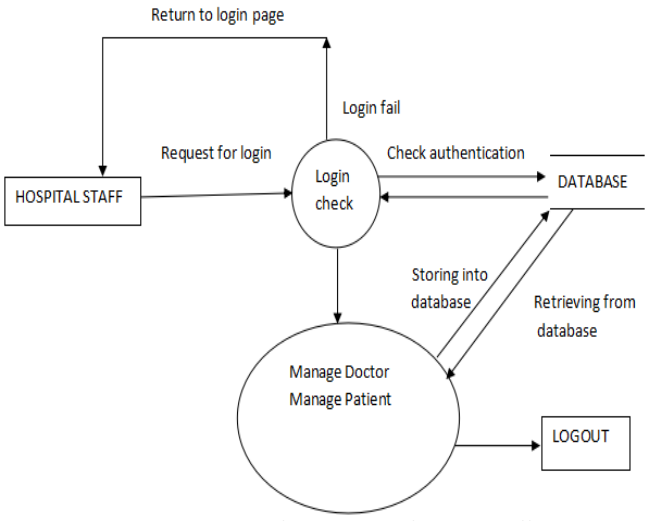

Figure3: Design flow diagram of hospital staff

When the patient is into the hospital for his first visit, hospital staff login with his credentials provided by the admin. If the login fails it requests for the login again. On successful login, hospital staff creates a database for a patient and add doctors with respect to their department in the hospital database which is kept tracked by admin.

DOCTOR

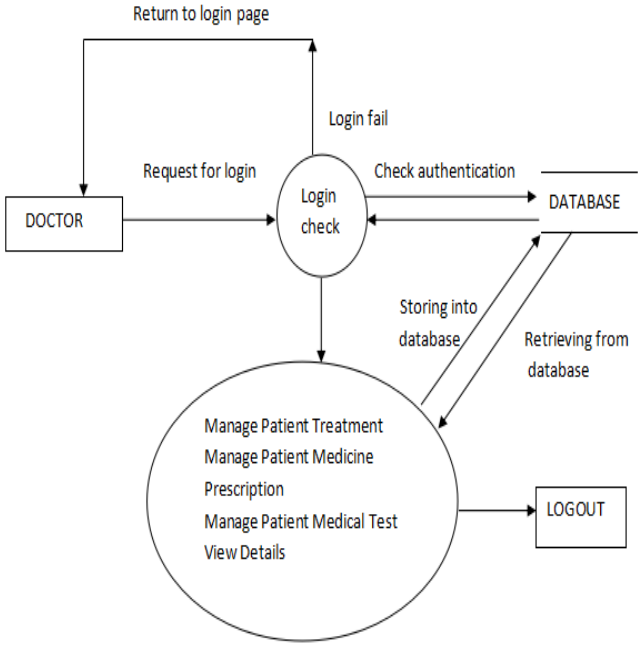

Figure4: Design flow diagram of doctor

When the patient consults a doctor, the doctor login with the credentials issued by the hospital staff if fails it requests for the login again. On successful login the doctor have an access to the patient database which includes the history of treatment, medicines prescribed and medical reports. The doctor can update prescription and treatment thus keeping track the medical status of the patient.

LAB TECHNICIAN

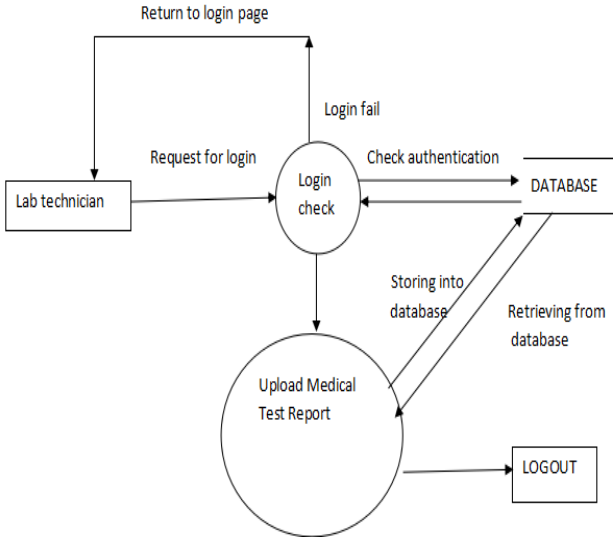

Figure5: Design flow diagram of lab technician

As per the prescription of the doctor the patient has to undergo laboratory test such as blood sugar level, x-ray, and MRI etc .Lab technician login with the credentials given by the admin, if the login fails requests to login again. On successful login, lab technician can view the test details of the patient and upload the test reports back into it.

PHARMACIST

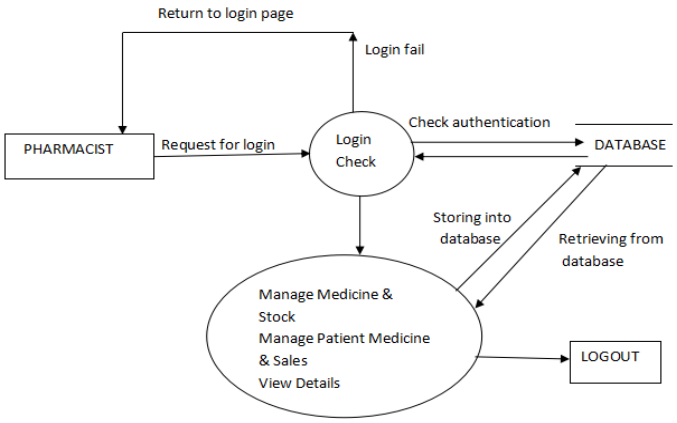

Figure 6: Design flow diagram of pharmacist

Pharmacist login via the credentials issued by an admin, if the login fails it request for the login again. On successful login he can view the prescription and provide medicines simultaneously medicine stock gets updated thus keeping track of medicine sale to avoid illegal usage of drugs.

IV. RESULTS

The figure 2 and figure 3 is the output obtained from VS2010. Figure 2 is the result webpage of e- health system. The admin is given with the login credentials where he generates random id and password (login credentials) for hospital staff, lab technician and pharmacist. Updated database is as shown in figure 3 which is obtained by updating the contents of medical database. This automates the maintenance of medical details for an integrated environment.

Figure 7: Web page of e-health system

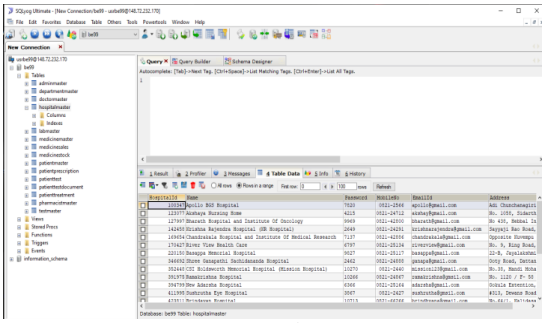

Figure 8:Database of e-health system

Figure 9: Login page of a doctor

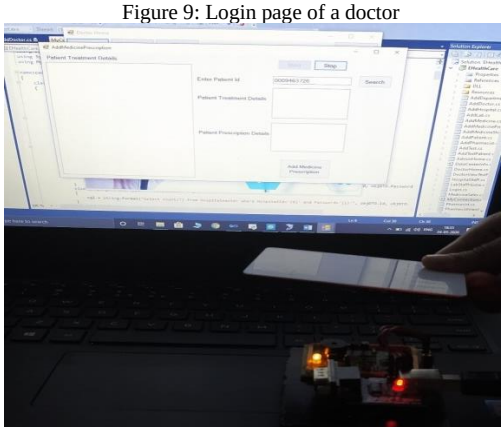

Figure 10: Interfacing of RFID module

Different Login page has been created for the entities with respective authentication. Fig.4. shows the login page of a doctor with his functionalities. Similarly, admin, lab technician and pharmacist have their login web pages that can be accessed via secured authentication.

Figure 10 shows the result of the RFID module interfaced with IDE. When the RFID card is brought near the reader, data sensed by the reader is transmitted to the controller in 12 ASCII characters. Among which 10 characters are unique id of the tag and the remaining 2 are XOR operation of pervious ten characters which can be trimmed in the program so 10-digit card number appears on the screen.

V.CONCLUSION

In this work, secured e-health system has been proposed. It facilitates to transform quality of health care sector. This would get better health flow in congested hospitals of emergent countries like India and urbanized nations. Health care associated data is unstable and it turn out to be complicated to administer and develop. Hence a smart health system has been proposed which can pile up bighealth data in protectedapproach. It safeguards the data from illegal users and also advances the safety by using encryption algorithm provided by the cloud database. Hence from the above results we can obtain a paperless system and automatic maintenance of patient medical details. This method effectively reduces death rate and illegal usage of drugs.

VI. ACKNOWLEDGEMENT

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