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HealthCare Monitoring and Alerting System Using Cloud Computing

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***Abstract*—** Now-a-days healthcare industry is growing enormously due to the increase in elderly population and decline in birthrate. A healthcare becomes a big issue due to lack of availability of expert doctors. Due to this issue there is a paradigm shift from need based health monitoring to preventive health monitoring service. Keeping in view this scenario we are proposing a health care system which will be integrated with cloud computing. That will make system capable of generating EMR i.e. Electronic Medical Records of patients which will play a beneficial role for patient's diagnostic and rapid improvement process as well as for medical practicing doctors who need vast medical cases for their own study purpose. This system will keep track of patient's health in a timely manner and generate a alert when the patient's vital parameters crosses the normal value. The major data will be transferred to the cloud storage that can be accessed by registered expert doctors and patients via Android App.

Keywords*-Cloud computing,EMR , Android App*

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I. INTRODUCTION

Cloud Computing is a commercial extension of computing resources which provides scalable resources and economic benefits to its users over the internet. It acts as software and provides data access and storage services which don't need the knowledge of the end users physical location and the systems configuration that provides the computing resources. In Cloud Computing, the users use the web browsers as an interface, while the software and data are stored on the remote servers and hence it is device independent.

In recent years, many healthcare organizations have started using wireless senor networks to remotely monitor patient health. Many healthcare organizations and insurance companies have also started using the electronic medical record (EMR) system by which the medical records are maintained in a centralized database in the form of an electronic record and the records are stored in the cloud. The paper proposes an approach where the health status of a patient is retrieved and delivers health-promoting messages in a non-interruptive fashion through a wireless body-area network; they can communicate with medical services[1]. Applications deployed on the cloud for manipulate electronic medical records. The general scope of our work is to propose an architecture to integrate the healthcare cloud with wireless sensor network technology through smart phones. The healthcare apps on smart phones monitor patients' health wirelessly providing real-time updates of the patients health condition to the doctors and other medical professionals via the cloud. State of the art review on cloud computing in healthcare[2].

The proposed architecture contains a filter system running on the smart phones, which takes the patient's health records from the smart phone apps and compares with a lookup table, which contains the normal readings of the different health parameters. If the incoming health readings to the filter are found to be abnormal, then an alert SMS is sent to the doctors with whom the patient is associated and a copy of the record is also sent to 3 the cloud running an EMR system maintained by the hospital. The patient may be in a real emergency situation and he may not be aware that he is in danger. The filter identifies that the patient may be in a serious emergency situation based on the historical and current values of the sensed data. If the filter determines the situation to be critical, a consolidated report is sent to the doctor through SMS, along with the location (address) of the patient, sensed through the GPS sensor running on the smart phone.

Since, the health records have to be confidential and secure. The Health Insurance Portability and Accountability is a set of rules on who has access to the patient's health records. In order to comply with the rules and regulations whenever there is an emergency alert, the alert SMS is sent only to the authorized and appropriate medical professionals who can access that patient's health data. The proposed key search algorithm helps to find the appropriate medical professionals for different health abnormalities and ensures that the patient's abnormal health data is sent only to the appropriate medical professionals. However, this algorithm works only when there is a single abnormal input to the filter system. Our work therefore also proposes a priority ranking algorithm, when multiple historical abnormal data have to be considered. Our system provides a secure framework whilst providing the benefits of the cloud.

II. LITERATURE REVIEW

In recent years we have witnessed the use of Internet for various health care related reasons from the perspective of end-users, especially patients. The users, who when being ill used to depend only on the doctor and his treatment, now want to actively influence and take control over their health and the healing process. The Web, with the different services it provides and novel mobile technologies, represents a suitable and reliable communication and collaboration channel.

Primary health care demands of users in the context of (their) health are: to get as much information as one can from different aspects about a specific disease; to take more active role in curing the disease; to use the applications and electronic services with which one can simplify the process of

healing, etc. These e-services in collaboration with health care institutions, their services and information systems, combined with active role of all participants of health care system, are defined as e-health, which is a part of the global strategy of Health 2.0.

In recent years in the context of global e-health activities, many different applications and services have been developed which serve users in improving their health or getting the information they need. The services can be roughly divided into three groups which enable 1) acquiring information, 2) social inclusion and networking, and 3) information and automation of different user scenarios with health care institutions.

Even though Internet offers a great potential in developing services in the area of e-health, huge amounts of data and different fragmented services cause trouble for the users. They have trouble identifying suitable and verified services from the aspect of reliability, safe use and data confidentiality. Due to fragmentation of information, users have to utilize several different applications and services at the same time, which takes more time, especially because of disconnection of some services, which can clearly be associated. Because of the dimension of the Internet, users are not even aware of the existence of some services. A potential solution for these troubles lies in the development of a larger collaboration system that will logically connect different services and applications and consequently enable access through one entering point. This is at the same time one of the goals of the project in the context of e-health.

Modern technological solutions have not always been successfully accepted among the healthcare providers and users due to unreliability of the systems and additional bureaucracy. One of the key aspects for successful adoption of a new information system by health care professionals is in helping them to become more effective and obtain control over all dependent sub-systems, which are crucial for providing good quality services (and content that is being served). Hence the quality of the cloud service is necessary for the involvement of professionals and for the existence of the user community.

Because of the sensitivity of the field it is necessary to pay special attention to data acquisition, data security, data storage, collection and processing. It is necessary to ensure the results will be in accordance with all current regulations in Slovenia which concern personal data: Personal Data Protection Act, Electronic Communications Act, Patient's Rights Act, Decision – Surveillance of the Location and Health State of the Patients, Decision – Global Positioning System (GPS) surveillance, etc. With the review of online health service market, we can conclude that a lot of applications exist to facilitate the planning of a healthy lifestyle and help diagnose and cure diseases, though most of these tools are intended for foreign markets. Particularly, for the Slovenian market there is little quality interactive content dealing with health issues of type Web 2.0. Based on the list of applications a plan was made to implement several applications to help patients with treatment of their health problems.

Much work is being performed to integrate services of WSN and. But this work is only in initial stages and facing challenges of the real world[3].

III. METHODOLOGY

The systems architecture will be broken up into 4 parts. While each of these parts can be seen as separate systems, each part does form part of the healthcare monitoring system.

A. HealthCare Sensing

The measuring of a patient's health information would be done in the rural village of the patient where there is no access to medical professionals and vitals measuring equipment. The measuring of these vital parameters would have to be done by the patient using the system.

The system would have to accommodate for the computer skills of the people using it. The data for this section of the project would all be "faked" at this point. Time constraints prevent us from getting ethical clearance for doing the actual monitoring ourselves. An investigation is still underway to determine if we can link with other researchers in who might be undertaking the task of monitoring and recording patient data.

B. Security and Privacy

Since the nature of the data is medical we suggest that all communications within the system should be over encrypted network channels. This will ensure protection against integrity attacks and communication interception. The communications between the wireless smart boards (ALIX boards) and the data store/database will also be encrypted. Access to the database of medical data should also be by only authorized medical personnel and the ALIX boards, which requires us to set up a security policy on database access and transactions.

C. Middleware and Database

Dissemination would occur at multiple entry points. This could be either via public IP access meaning devices with internet connectivity can be connected directly possibly giving live updates of data. This entry point can also be used to connect to remote grids that only have periodic internet access or to extend the grid to new sites that have permanent internet connectivity.

This public access however requires security controls to ensure data being sent is from authorized systems and that new systems wishing to join are clearly identified as being uncompromised and trustworthy nodes, as such nodes could insert data which could negatively impact the analysis of data in decision making processes.

D. Front End application

The front end application will serve as a dashboard for medical professionals to check up reports on their patients. It will also serve as a notification centre for medical professionals to monitor critical patients

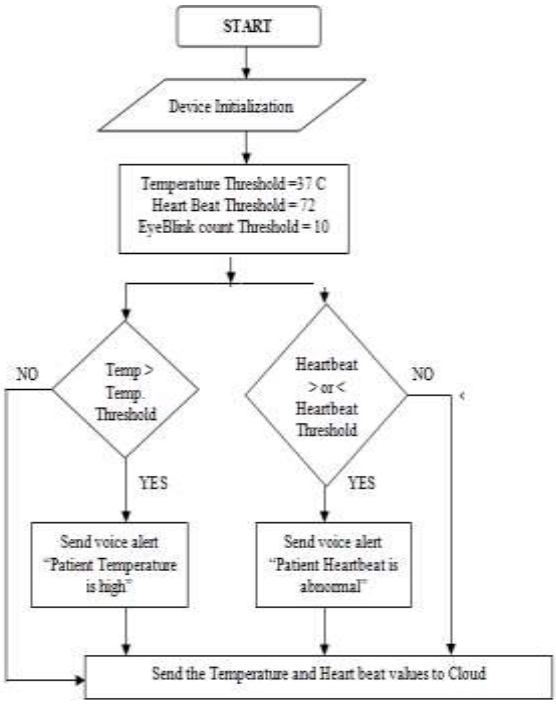

Fig 1: Flowchart showing the flow of events in the system

The proposed system focuses on collection of patient's vital health parameters and generates alert to care takers, doctors so that immediate action can be taken in case of emergencies. The data is then stored in Cloud so that data can be accessed via Internet from anywhere anytime. Cloud computing is the use of computing resources (hardware and software) that are delivered as a service over the network (mainly the Internet). Cloud has abundant processing power, large amount of storage which can be scaled according to application needs. Modern technology is being shifted to Cloud based platform as it is suited for long-term data storage.

IV. FUTURE SCOPE

A. *System Outcomes*

- Accurate measurements of environmental parameters
- User friendly interface for measuring/viewing of vitals parameters
- Efficient use of energy for remote site, mobile devices and vehicle based data courier unit
- Data Courier unit and remote site should be able to operate for long periods without maintenance.
- Data is effectively distributed across systems to prevent bottlenecks and resources hoarding.
- Resources are effectively allocated to devices with these allocations being dynamic based on output received from grid members.
- Able to correctly predict intervention based on sensor readings and historical data.
- System is able to learn from feedback received from usage and able to adjust its analysis of data.
- Robust security implementation on WSBs and Android IOIOs
- Simple web front end for medical professionals

B. *Expected Impact*

This project is mainly aimed at providing better healthcare for patients living in rural areas. There will be a definite impact on the quality of healthcare which these patients can receive. The South African Medical authorities are making pushes towards becoming a nation which stores patient history in a paperless way. Our system will show some key insight into how the storage of medical data could be conducted.

C. *Security Outcome*

There is of course a whole field of work dedicated to the systematic analysis and evaluation of a secure communications network, for the purposes of not over scoping, We will employ traditional step by step method of evaluating a secure network.

E-health will be the next step in the development of health services; however, the adoption will depend on the quality, availability and the user experience. In close relation with heath issues is also the impact of the environment pollution on the health of population. The research and resulting services of the project will present a step in the direction of e-health and e-environment by providing users more reliable health related information quickly and easily.

V. CONCLUSION

This paper proposes a framework for secure HealthCare Systems based on big data analytics in mobile cloud computing environment. The framework provides a high level of integration, interoperability, and sharing healthcare providers, patients and practitioners. The cloud permits a fast Internet access and sharing by authenticated users. Big data analytics helps analyze patient data to provide right intervention to the right patient at the right time. The proposed framework applies a set of security constraints and access control that guarantee integrity, confidentiality, and privacy of medical data. The ultimate goal of the proposed framework is to introduce a new generation of HealthCare system that are able to provide healthcare services of high quality and low cost to the patients using this combination of big data analytics, cloud computing and mobile computing technologies. In the future we plan to design and implement HealthCare system based on the proposed framework.

We observe research proposals for various application fields including emergency healthcare, home healthcare, assistive healthcare, and telemedicine, as well as storage, sharing and processing of large medical resources (e.g., images) in general. Gaining popularity among users, cloud computing is believed to improve accessibility of health data, ensure efficient management and usage of medical resources, facilitate collaboration among healthcare organizations, and open new possibilities for healthcare. However, security and privacy still remain the main concerns. Further research potential is observed in the security and privacy area, the proposals' development, simulation in the

real world settings and extension to mobile computing. The implementation of the work is under processed. This work is only in initial stages and facing challenges of the real world.

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