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Rural Healthcare Smart Diagnosis System

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Abstract: The applicability of an E-Solution that improves healthcare delivery settings in the rural parts of the developing world and discusses a proposed patient-centric E-Solution that suits the rural setting is the main objective of his project. The main benefit of implementing such an E-Solution is that it ensures the availability of the Specialist across a distance at many E-Clinics within the shortest possible time frame. Some of the important features supported by this solution are: prediction of disease that might be required for diagnostic decision making by doctors, seamless work without much technical dependency (without maintenance); affordable, adequate and accessible solution for Patient care management system.

Keywords: E-Solution; Electronic Medical Records; E-Clinic, E-Consultation, E-Clinic Management Centre

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1. Introduction

Patients in rural areas incur heavy expenditure in travelling long distances spending a lot of time to consult Specialists in cities due to the lack of Specialists in their areas. This issue can be addressed by an e-Solution that makes appropriate use of Electronic Medical Records (EMR) and Telemedicine technologies which enables the patient to consult a Specialist through e-Consultation.

Healthcare delivery setting in rural parts today exposes limited access to highly specialized consultancies. Patients in rural areas have to travel long distances to consult a Specialist in an urban area. This entails a huge amount of cost, time and inconvenience especially in the elderly, post-operative and re-convalescing patients who have received specialized treatments. In rural areas patient's medical records are stored in the record rooms of the hospitals where they are ordered and managed manually. When a patient visits the clinic it is necessary to go through all the records to find the relevant record which imposes delay to the process.

The patient records are piled up for searching a particular record when a clinic is about to start. This problem could be addressed by connecting the Patient and the Consultant through a web-based Electronic Medical Record (EMR) system. The use of electronic medical records would also help manage patient's medical records more efficiently.

2. Literature Survey

According to survey [1], this paper aims to fulfil the requirement of a survey paper that analyses both with-contact and contactless, image-based remote health monitoring systems from very recent literature i.e. developed/proposed between 2012 and 2016. In this paper, the authors Thierry Oscar Edoh,Pravin Amrut Pawar, Bernd Brügge,Gunnar Teege[2] describe a case study of the poor access to healthcare in the developing world, case of Benin, a West African developing country. The authors identify problems and the existing obstacles for applying standard Telemedicine and eHealth solutions. The authors particularly describe an adapted multidisciplinary remote care delivery system approach for improving and increasing the use of existing health services as well as the access to healthcare by overcoming some cultural, social, financial, and at least linguistic barriers.

S. Vijava Shetty, G. A. Karthik and M. Ashwin, "Symptom Based Health Prediction using Data Mining,"[3] Taking certain prominent symptoms and their diseases to build a Machine learning model to predict common diseases based on real symptoms is the objective of this research. With the dataset of the most commonly exhibited diseases, the authors built a relation to predicting the possible disease based on the input of symptoms. The proposed model utilizes the capability of different Machine learning algorithms combined with text processing to achieve accurate prediction.

G. G. Warsi, K. Hans and S. K. Khatri, "IOT Based Remote Patient Health Monitoring System,"[4] Remote patient health monitoring system is an IoT device which could be used with patients or elderly at our homes whose real time health readings such as temperature, blood pressure and electro-cardiogram could be monitored remotely on a hand held device. This IoT device will automatically send an alert to the users in case of an emergency which in this case would be fluctuation of the readings of the sensors beyond the normal range. This device is built using a thermometer, electro-cardiogram sensor and sphygmomanometer attached to an arduino which transfer its data to servers using a wifi-module. The servers then compute the data which can be displayed on handheld devices. In case the values received from the sensors are outside the normal range then an alert will be sent to the user from the server.

Authors Madhu J. and Narasimha Rao[5] in this project have attempted to solve a healthcare problem currently society is facing. The main objective of the project was to design a remote healthcare system. It comprises three main parts. The first part being, detection of patient's vitals using sensors, second for sending data to cloud storage and the last part was providing the detected data for remote viewing. Remote viewing of the data enables a doctor or guardian to monitor a patient's health progress away from hospital premises.

Authors A. Abayomi-Alli, A.J. Ikuomola, O.A. Aliyu & O. Abayomi-Alli[6], In this paper the design and implementation of a mobile remote health monitoring system (MRHMS) based on wireless technology is presented. MRHMS was able to integrate three level networks namely Body Area Network (BAN), the Personal Area Network (PAN) and the Wide Area Network (WAN). The sensors for monitoring a

patient's bio-signals like blood pressure, body temperature, pulse and breathing were in the BAN. The PAN consists of the BAN as it connects the supervisor's agent andthe mobile base unit (MBU) through Bluetooth technology while the WAN was able to combine the PAN, mobile response unit(MRU) and hospital site (HS) through GPRS and Internet technology. The system is largely mobile agent based hence it is fast and responsive in real time making it ideal for proper remote health monitoring. HTTPS, SSL and TLS protocol were all employed to secure data transmission during user authentication, ensure confidentiality and data integrity. Using a GPRS based. Mobile phone or PDA and the system's mobile base unit (MBU), patients are able to send Short Message (SMS) to the paramedics or other medical staff. Real time medical attention could be given and where necessary physical consultation is done.

In this paper[7], a portable physiological checking framework is displayed, which can constantly screen the patient's heartbeat, temperature and other basic parameters of the room. We proposed a nonstop checking and control instrument to screen the patient condition and store the patient information in a server utilizing Wi-Fi Module based remote correspondence. A remote health monitoring system using IoT is proposed where the authorized personnel can access these data stored using any IoT platform and based on these values received, the diseases are diagnosed by the doctors from a distance.

Authors Fraser HS, Biondich P, Moodley D, Choi S, Mamlin BW, Szolovits P[8] discuss pilot projects demonstrating that such systems are possible and can expand to manage hundreds of thousands of patients. We also pass on the most important practical lessons in design and implementation from our experience in doing this work. Finally, we discuss the importance of collaboration between projects in the development of electronic medical record systems rather than reinventing systems in isolation, and the use of open standards and open source software.

According to survey[9], the components are the following: a hand worn device with Arduino board, an ECG (electrocardiogram) sensor, a waterproof temperature sensor, an accelerometer gyro sensor, a pulse rate sensor, a pressure sensor, a GPS module, Wi-Fi module, a buzzer and LCD (liquid crystal display). Wearable devices are the new trend. These devices collect data from the person wearing it (like pulse, location, ECG etc.) and send to the cloud for storage and analysis. This multi-sensor device assembles a system which is very helpful for monitoring wearers health. The real time indication of the wearer's health state and can be further analyzed for medical diagnosis.

Authors Laurinda B. Harman, Cathy A. Flite[10] state- The physician, practice, or organization is the owner of the physical medical record because it is its business record and property, and the patient owns the information in the record [1]. Although the record belongs to the facility or doctor, it is truly the patient's information; the Office of the National Coordinator for Health Information Technology refers to the health record as "not just a collection of data that you are guarding—it's a life" [2]. There are three major ethical priorities for electronic health records: privacy and confidentiality, security, and data integrity and availability.

In literature survey[11], Authors Castaneda C, Nalley K, Mannion C state that the challenge is not "How can we collect all of this data?" but "How can we integrate, secure, and utilize this large amount of data via CDSS to improve clinical outcomes?" Computer-based systems that can host all scientific and clinical data are critical to generating the end-point knowledge that is directly relevant to improved understanding and management of disease for each patient. As supercomputing, science, and medicine continue to converge, the conversion of data to knowledge, and sharing of such knowledge, has become a crucial component for achieving precision medicine and personalized patient care.

According to survey [12], Wearable health-monitoring systems (WHMS) have drawn a lot of attention from the research community and the industry during the last decade as it is pointed out by the numerous and yearly increasing corresponding research and development efforts. As healthcare costs are increasing and the world population is ageing, there has been a need to monitor a patient's health status while he is out of the hospital in his personal environment. To address this demand, a variety of system prototypes and commercial products have been produced in the course of recent years, which aim at providing real-time feedback information about one's health condition, either to the user himself or to a medical centre or straight to a supervising professional physician, while being able to alert the individual in case of possible imminent health threatening conditions. In addition to that, WHMS constitute a new means to address the issues of managing and monitoring chronic diseases, elderly people, postoperative rehabilitation patients, and persons with special abilities.

Authors Manoj G., Divya P.S., Raj Barath S. , Justin Santhiyagu [13] designed the idea using IoT, so that the data can be sent to an inaccessible server from where it can be measured. The mathematical modelling of health management systems is done with predictive modelling which is better than other techniques, and the performance measure is evaluated. The significant challenge in implementing the system is the portability, low cost, and user-friendliness. The Internet has become the vital part of one's life; in order to take this to the next step, the Internet has been connected to medical kits. Using smart technologies, all devices are connected to one another to create a worldwide ubiquitous network.

Chapman, K.R.P. and Arunathilake S.M. K.D.,[14], in this paper investigate the issues and challenges faced by patients in Sri Lanka, a developing country, with regard to inequality of resource distribution and the existing eHealth infrastructure. In order to solve these issues, it introduces a simple patient centric three phased eHealthcare strategy using an evolutionary approach which builds on the existing infrastructure. In phase one, the main emphasis is on setting up of a eConsultation Clinic to link the specialist in a general hospital in a city with a patient in a peripheral setting. This will consist of an eCare Clinic in a peripheral hospital, a web-based eHealth record system, m-Communication system and an e-Consultation centre with a medical specialist.

Archip, Alexandru & Botezatu, Nicolae & Serban, Elena & Herghelegiu, Paul-Corneliu & Zala, Andrei[15] found Monitoring and Recording of various medical parameters of patients outside hospitals has become a Widespread phenomenon. The Reason behind this project is to design a system for monitoring the patient's body at any time using internet connectivity. The function of this system is to measuring some biological parameter of the patient's body like Temperature, Heartbeat, Blood pressure, by using sensors and the sensors will sense the body temperature, heartbeat and blood pressure of the patient and sends the values to IOT Cloud platform through WIFI-Module. All information about the patient's health will be stored on the cloud; it enables the doctors to monitor the patient's health, where the doctor can continuously monitor the patient's condition on his Smartphone. The results showed that this project can effectively use Wi-Fi technology to monitor patient health status. And the power consumption of the Wi-Fi module (ESP8266) can be reduced as much as possible. Thus, the designed system provides low complexity, low power consumptions and highly portable for healthcare monitoring of patients

Rajvardhini Katake, Bhagyashree Kute, Sharmili Ranjane, Shubham C. Jaiswal, in "Survey of Health Monitoring Management Using Internet of Things[16] state that - Since, we Are Dealing In The Advancement Of Internet Technologies, In The Advancement Of Internet Technologies On Machineries Are Interrelated. Technology Improvement Is Very Much Useful In Human Life For Making Things Simple And Highly Effective. In Our Day To Day Life We Find Internet Of Things (IOT) Beneficial In Several Places, Smart Such As Smart Home, Smart City, Smart Environment, Agricultural Fields And Medical Fields. Taking In Consideration Of Medical Field We Can Find The Internet Very Useful In The Application Of Monitoring Patients Heart Rate, Body Temperature, Respiration Rate And Body Movements Using Raspberry Pi. After Connecting Internet To The Raspberry Pi Board It Act As A Server S It Is Connected To The Internet, Server Automatically Sends Data To The Web Server. After This We Can Monitor These Parameters Using Web Page Anywhere In The World Using Laptops, Smart Phones, ETC. Medical History Stored Is Stored On Cloud For Easy Accessing.

3. Proposed Architecture

The rural e-health system is a web app which can be helpful for people in rural areas, as they do not have access to good medical facilities. In this age of digitalization, this means is put to use and can save lives. For detection of disease data mining techniques are used. SVM algorithm is used.

In the system, the admin can add doctors including specialities view and delete doctors. He can add, view and delete arogya vibhag.

The Arogya Vibhag Jr. Doctors can add patients and their details like their symptoms. He can search for a specialist doctor and detect disease, view allocated doctors and chat with him and view the prescription.

The Senior Doctor will be in contact with the Arogya Vibhag Doctor. He can view the allocated patients, view their symptoms and system detected diseases. He can chat and submit the prescription to the Arogya Vibhag Doctor.

The patients of rural areas will be heavily benefited by the rural e-health system.

The rural e-health system is a web app which can be helpful for people in rural areas, as they do not have access to good medical facilities. In this age of digitalization, this means is put to use and can save lives. For detection of disease data mining techniques are used. Naïve Bayes algorithm is used

In the system, the admin can add doctors including specialities, view and delete doctors. He can add, view and delete arogya vibhag.

The Arogya Vibhag Jr. Doctors can add patients and their details like their symptoms. He can search for a specialist doctor and detect disease, view allocated doctors and chat with him and view the prescription. The Senior Doctor will be in contact with the Arogya Vibhag Doctor. He can view the allocated patients, view their symptoms and system detected diseases. He can chat and submit the prescription to the Arogya Vibhag Doctor

4. Architecture

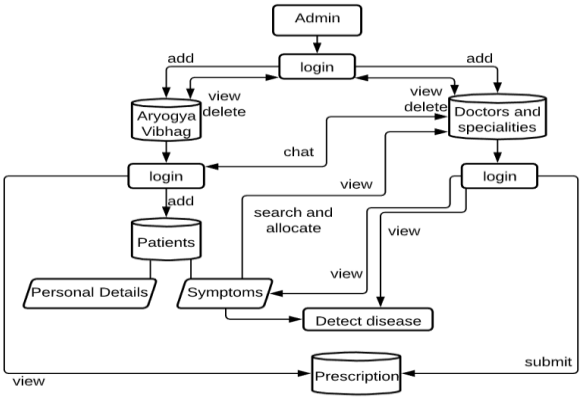

Figure. 1: System Architecture of Rural E-Health

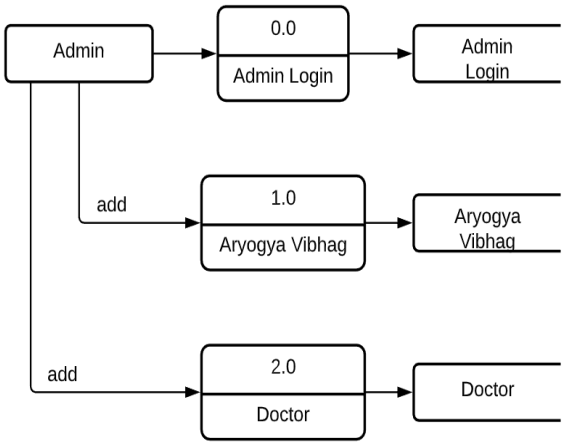

Figure.2: Initial phase of design

5. Conclusion

Remote Health Care Smart Diagnosis System is designed especially for rural people to consult specialists/doctors remotely and get proper solutions to their problems

on time. In order to achieve this, we have prototyped a system by integrating the existing simple applications where one patient with one sensor application for heart rate measurement can communicate to a remote specialist. We have used existing freeware applications to minimize the cost (cost is almost nil). As the system is working with a particular sensor, we can conclude that it will work well with integrated sensors as well. Also as the system is working with a few different plugins integrated together, we can conclude that the system will work well if many plugins are integrated together.

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