REMOTE HEALTH MONITORING IOT

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Abstract

Internet of Things (IoT) concepts have been widely used to interconnect the available medical resources and offer smart, reliable, and effective healthcare service to the patients. Health monitoring for active and assisted living is one of the paradigms that can use the IoT advantages to improve the patient's lifestyle. In this paper, presented an IoT architecture customized for healthcare applications. The aim of the research was to come up with a Remote Health Monitoring System that can be made with locally available sensors with a view to making it affordable if it were to be mass produced.

Index Terms: Electrocardiogram (ECG, Intensive care unit (ICU),), Internet of Things (IoT), Self-Monitoring Device (SMD),

I. INTRODUCTION

Remote patient monitoring is one of the application areas of the Internet of Things. Patients are monitored for their vital signs such as blood pressure and pulse rate. The remote patient monitoring system offers convenience by automatically uploading monitoring data. This data can be viewed by doctors without needing to be physically present near the patient. Along with that the patient's symptoms can be analysed for prediction of respective disease. It also shows trends in the statistics and can help doctors in their diagnosis. The system is modular, i.e. sensors can be added to the gateway to expand the monitoring capabilities.

Remote health monitoring can provide useful physiological information in the home. This monitoring is useful for elderly or chronically ill patients who would like to avoid a long hospital stay. Wireless sensors are used to collect and transmit signals of interest and a processor is programmed to receive and automatically analyze the sensor signals. In this paper, you are to choose appropriate sensors according to what you would like to detect and design algorithms to realize your detection.

Using a single parameter monitoring system an approach to a remote health monitoring system was designed that extends healthcare from the traditional clinic or hospital setting to the patient's home. The Disease prediction system will predict the disease based on the symptoms provided. The system was to collect a heartbeat detection system data, data about symptoms analyzed and few other parameters. The data from the single parameter monitoring systems was then availed for remote detection.

To build a remote patient monitoring system and an accompanying software interface for use by doctors to monitor patients in real time and to view trends in the statistics and an interface for prediction of the disease based on symptoms. The system must be low cost and modular. It must be extensible and have the capability to support additional sensors as needed.

II. LITERATURE SURVEY

In the existing system, continuous monitoring of patient vitals is done only in ICUs. In most hospitals in India this data is not captured and stored digitally. The patient reports contain a few readings and not the complete history of readings. Recovering patients have to make frequent visits to the doctor where their readings are taken. In patient wards, patients are provided with some buttons which they can press to call for aid.

In an IoT based system for Remote Patient Monitoring, the IoT based system for patient monitoring proposed by Archip et al. [1] make use of sensors equipped with IEEE 802.15.4 radio modules that report to a RasberryPi to capture patient data. The captured data is made available through a RESTful web interface which is platform agnostic and thus, supports different clients (phone or web application). Their goal is to carry out ward monitoring to prevent patient relapse.

In a custom IoT health care system, Maksimović et al. propose a do-it-yourself (DIY) self-monitoring device (SMD) using a RasberryPi and the e-Health sensor shield v2.0. A lightweight http server (Apache tomcat) running a RasberryPi serves the data to users. Various security and privacy concerns are discussed by the authors.

The e-Health sensor shield is quite expensive and the high cost is barrier to adaption in India. A custom built solution would be more practical.

In internet of things, Remote patient monitoring using web services and cloud computing**,** An android platform based mobile application for health care using the IoT and cloud computing emphasizes the software architecture and design. An ECG android application is presented, with the goal of minimizing hospital visits and reducing the cost of personal and administrative operations. Cloud computing is presented as a solution to cope with the large amount of data produced.

III. SYSTEM DESIGN

The proposed system is an application of the Internet of Things to carry out patient monitoring. A group of sensors connected to an Arduino board are used to constantly monitor physiological parameters such as oxygen saturation and heartrate. The monitored data is captured and stored in a private cloud to be viewed remotely through a Python Interface. With this system, patient monitoring is not restricted only to hospital wards. It can be used in small clinics and patient homes. The patients can also detect the possible illness based on symptoms provided to the prediction system in a scale of risk factor. Along with that the details of the doctor to be visited is suggested. Doctors can check the status of their patients remotely. The benefit of continuous monitoring is that a lot of data is available rather than a few readings.

Fig.1 System Setup

A complete device setup is shown in the above image which includes Arduino Micro Controller board with power supply attached to it. Micro Controller is connected to a pulse sensor which sends the sensor data to the server. Finally, when the device is connected to the network, it displays all the patient's information on it along with any irregularities of patient's vitals.

IV. RESULT AND DISCUSSION

A. Login page

Here, the doctor or caretaker enters the patient's unique credentials. Once the credentials are verified, login page will be navigated to Patient's vital monitoring page where doctor or caretaker can view current vital readings of the patient. Here, patient's unique credentials must be kept confidential by the doctor and caretaker to protect privacy of the patient data.

Fig.2 Login User Interface

B. Patients vital monitoring page

After the doctor or caretaker logs in successfully, either one can be able to view live patient's vital information which includes heartbeat, symptoms details from the disease prediction system etc.

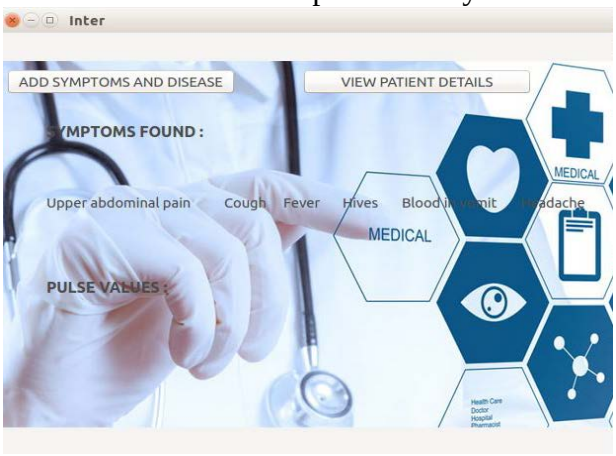


Fig.3 Patient Monitoring User Interface

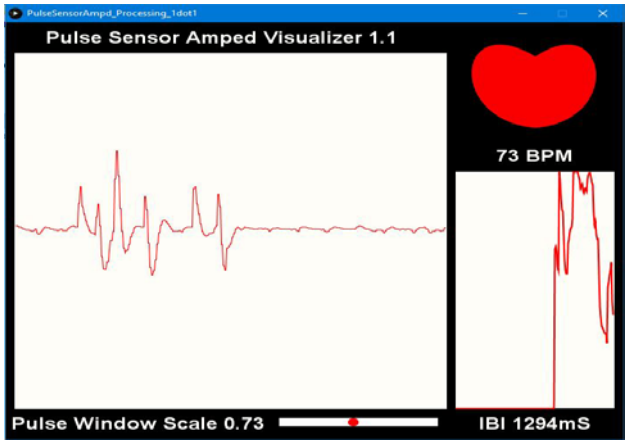


Fig.4 Real Time Heart Beat Monitoring Page

C. Patients' disease prediction page

After the patient has successfully logged in, he/she can get his disease details based on the symptoms provided. The software recommends the adamant doctor to be contacted based on the type of the disease. It also provides a portal for uploading previous medical reports.

Fig.5 Disease Prediction Page

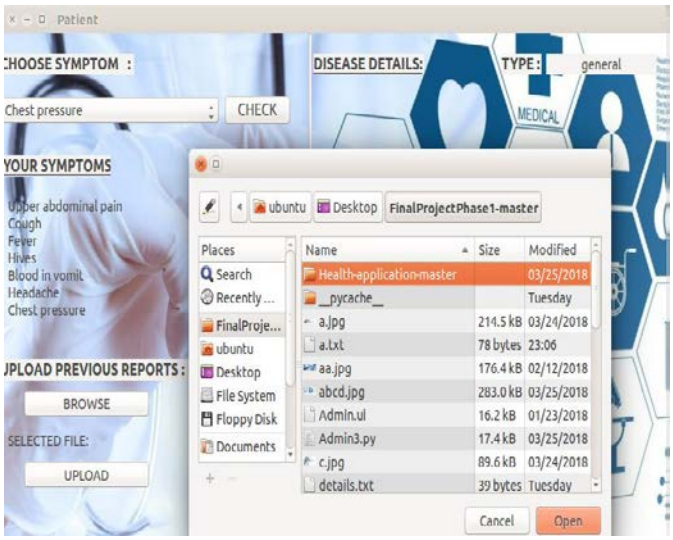


Fig.6 Documents Upload Page

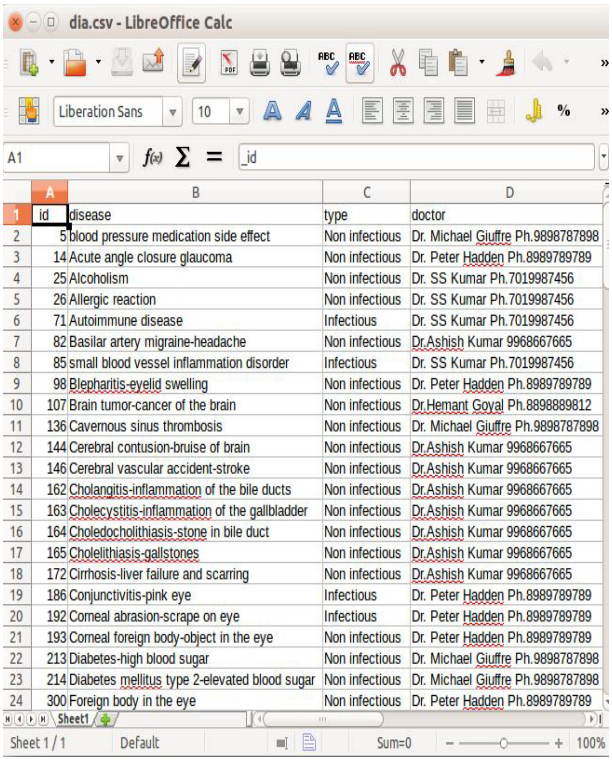
D. Add symptoms details page

After the doctor or caretaker logs in successfully, he can add symptoms and disease details to the stored dataset which is used by the prediction system for disease analysis.

Fig.7 Add Symptom Details Page

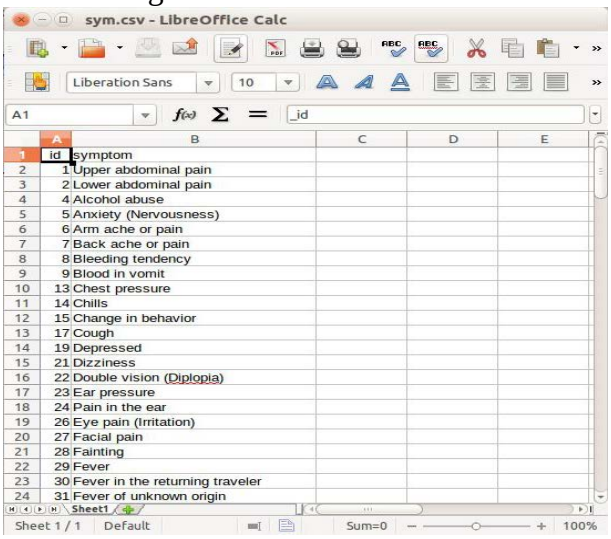
E. Datasets used

These are the datasets used by the prediction system for analysis it contains a disease csv file in which each row list of diseases, type of the disease and the recommended doctor.The symptoms csv file contains list of symptoms in which each symptom has a unique id. Finally the symptom_diseaese_matrix csv files contain data about the symptoms. where the disease and symptom are mapped if the disease has particular symptoms.


dia.csv - LibreOffice Calc

id	disease	type	doctor
5	blood pressure medication side effect	Non infectious	Dr. Michael Giuffre Ph.9898787898
14	Acute angle closure glaucoma	Non infectious	Dr. Peter Hadden Ph.8989789789
25	Alcoholism	Non infectious	Dr. SS Kumar Ph.7019987456
26	Allergic reaction	Non infectious	Dr. SS Kumar Ph.7019987456
71	Autoimmune disease	Infectious	Dr. SS Kumar Ph.7019987456
82	Basilar artery migraine-headache	Non infectious	Dr.Ashish Kumar 9968667665
85	small blood vessel inflammation disorder	Infectious	Dr. SS Kumar Ph.7019987456
98	Blepharitis-eyelid swelling	Non infectious	Dr. Peter Hadden Ph.8989789789
107	Brain tumor-cancer of the brain	Non infectious	Dr.Hemant Goyal Ph.8898889812
136	Cavernous sinus thrombosis	Non infectious	Dr. Michael Giuffre Ph.9898787898
144	Cerebral contusion-bruise of brain	Non infectious	Dr.Ashish Kumar 9968667665
146	Cerebral vascular accident-stroke	Non infectious	Dr.Ashish Kumar 9968667665
162	Cholangitis-inflammation of the bile ducts	Non infectious	Dr.Ashish Kumar 9968667665
163	Cholecystitis-inflammation of the gallbladder	Non infectious	Dr.Ashish Kumar 9968667665
164	Choledocholithiasis-stone in bile duct	Non infectious	Dr.Ashish Kumar 9968667665
165	Cholelithiasis-gallstones	Non infectious	Dr.Ashish Kumar 9968667665
172	Cirrhosis-liver failure and scarring	Non infectious	Dr.Ashish Kumar 9968667665
186	Conjunctivitis-pink eye	Infectious	Dr. Peter Hadden Ph.8989789789
192	Corneal abrasion-scrape on eye	Infectious	Dr. Peter Hadden Ph.8989789789
193	Corneal foreign body-object in the eye	Non infectious	Dr. Peter Hadden Ph.8989789789
213	Diabetes-high blood sugar	Non infectious	Dr. Michael Giuffre Ph.9898787898
214	Diabetes mellitus type 2-elevated blood sugar	Non infectious	Dr. Michael Giuffre Ph.9898787898
300	Foreign body in the eye	Non infectious	Dr. Peter Hadden Ph.8989789789

Fig.8 diseases list csv file


sym.csv - LibreOffice Calc

id	symptom
1	Upper abdominal pain
2	Lower abdominal pain
4	Alcohol abuse
5	Anxiety (Nervousness)
6	Arm ache or pain
7	Back ache or pain
8	Bleeding tendency
9	Blood in vomit
13	Chest pressure
14	Chills
15	Change in behavior
17	Cough
19	Depressed
21	Dizziness
22	Double vision (Diplopia)
23	Ear pressure
24	Pain in the ear
26	Eye pain (Irritation)
27	Facial pain
28	Fainting
29	Fever
30	Fever in the returning traveler
31	Fever of unknown origin

Fig.9 symptoms list csv file

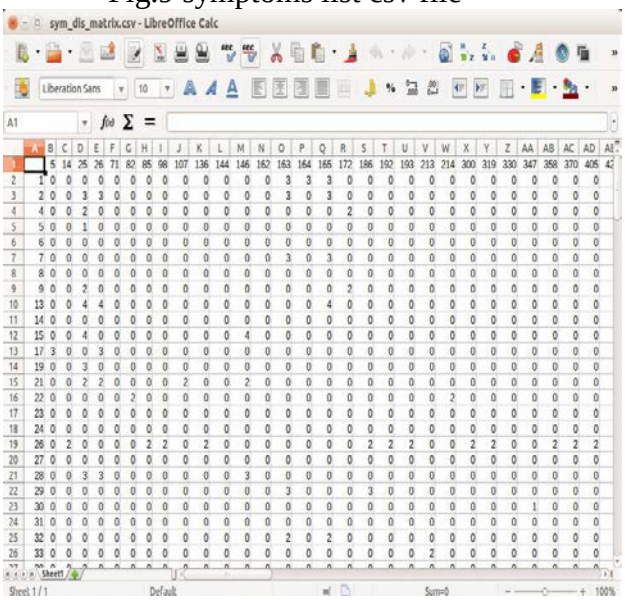

sym_dis_matrix.csv - LibreOffice Calc

Fig.10 symptoms and diseases mapped csv file

V. CONCLUSION

In this paper, we have proposed a system which will make use of a data set for health prediction. This system will prove useful in urgent cases where the patient is unable to reach the doctor, for emergency cases that do not have doctors in an area, during late night emergencies and also for preliminary examination of patients. This app has a large scope as it has the features such as automation of disease prediction, to save the environment by using paper free work, to increase the accuracy and efficiency so that patients can get direct help, management of disease related data.

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