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Smart Health-care Monitoring System Using IOT

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ABSTRACT

Smart Health-care Monitoring System is based on IOT Architecture. It helps Doctor's to monitor patients live data using IOT sensors and helps them to provide live assistance in medical conditions. IOT in healthcare is the key player in providing better medical facilities to the patients and facilitates the doctors and hospitals as well. The proposed system here consists of various medical devices such as sensors and web based or mobile based applications which communicate via network connected devices and helps to monitor and record patients' health data and medical information. The proposed outcome of the paper is to build a system to provide world-class medical aid to the patients even in the remotest areas with no hospitals in their areas by connecting over the internet and grasping information through about their health status via the wearable devices provided in the kit using a Arduino micro-controller which would be able to record the patient's heart rate, blood pressure. The system would be smart to intimate the patient's family members and their doctor about the patient's current health status and full medical information in case any medical emergency arises. The collected information can be used to analyze and predict chronic disorders or other diseases such as heart attacks in preliminary stage itself using the data mining techniques that will also provide the approach advantageous for decision making.

Keywords: Internet of Things, IOT in Healthcare, Patient Monitoring, Arduino, Smart Health Monitoring.

I. INTRODUCTION

Smart Health Care monitoring System is a system designed to help doctors to reach each patients and help them to monitor his data without using any physical sources. Smart Health Care System uses IOT sensors to execute its functionality, Users must have to connect with given environment to access its live data and have to create its profile on given sources. After the user created and grant permission to send data the system will create a database of a user. The doctor must have to select its patent in-order to access its live personal data.

After successful connectivity in between doctor and patient, doctor have freedom to monitor patient data & give treatment according to patient health. Smart Health Care System will be able to differentiate between contagious virus and Non-contagious virus so doctor can provide better assistance.The Internet of things is the inter-connection of devices, apps, sensors and network connectivity that enhances these entities to gather and exchange data. The distinguishing characteristic of Internet of Things in the healthcare system is the constant monitoring a patient through checking various parameters and also infers a good result from the history of such constant monitoring. Many such devices equipped with medical sensors are present in the ICUs now-a-days. There could be instances where the doctor couldn't be alerted in time when there is an emergency, despite of 24 hours of monitoring. Also there might be hurdles in sharing the data and information with the specialist doctors and the concerned family members and relatives. The technology that enhances these features is already available but is not accessible and affordable by most of the people in developing countries such as India. Hence these solutions to these problems can be just a simple extension to the current devices which don't have these facilities.

2 Related Work

A number of researchers have proposed various models for IoT in Healthcare and the prediction of various types of diseases using various techniques. This part focuses on the work done in the same area.

Ahn et al. [1] implemented a system for measuring the physiological signals in sitting position such as ECG and
BCG by using a smart chair that senses the non-constrained bio-signals and can be monitored using a monitoring system such as the one they had developed providing a classic example of the application of iot in healthcare.

Almotiri et al. [2] proposed a system of m-health that uses mobile devices to collect real-time data from patients in and store it on network servers connected to internet enabling access only to a certain specific clients. This data can be used for the medical diagnosis of patients and is achieved by using a number of wearable devices and body sensor network.

Barger et al. [3] made a smart house facility using a sensor network to monitor and track the movements of the patient in hoke and a prototype of the same is also being tested. The primary objective of their work is to check if their system is capable to outsmart the behavioral patterns and have discussed about the same in their work.

Chiuchisan et al. [4] proposed a framework to prevent the threats to patient in smart ICUs. The proposed system intimates the patient's relatives and doctors about any inconsistency in their health status or their body movements and also about the atmosphere of the room so that the necessary precautionary measures can be taken.

Dwivedi et al. [5] developed a framework in order to secure the clinical information that has to be transmitted over the internet for Electronic Patient Record (EPR) systems in which they propose a multi-layered healthcare information system framework which is a combination of Public Key Infrastructure, Smartcard and Biometrics technologies

3 System Architecture

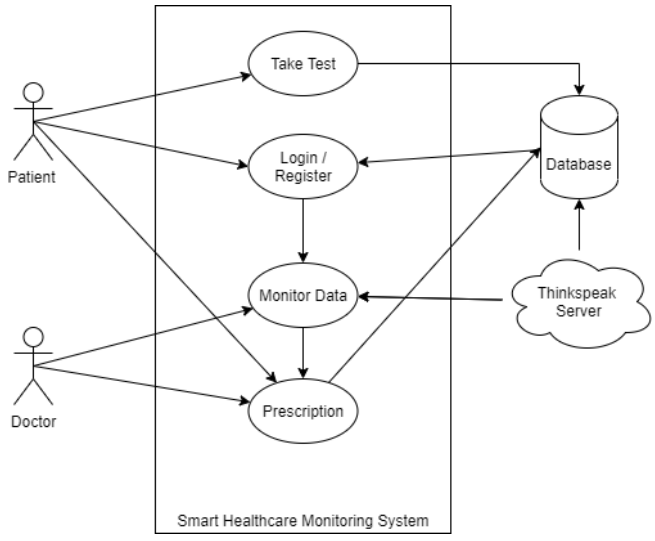

Figure-1 System Architecture

In This Architecture there are two users who are going to access the system 1) Patient, 2) Doctor.

1. Patient: Patient is going to take a test which will be conducted at the time of new regeneration so that system can categorize patient into different category 1.Contagious 2.Non-contagious. This will help doctor to monitor different patient according to the environment.
2. Doctor: Doctor can do the new registration or he / she can login to access the database. This database contains patients live data.

Doctor simply can monitor live data and according to it create the prescription.

For the better understanding of patient our system going to categorized patient into 2 category

A contagious disease (or communicable disease) is a disease that readily spread (that is, communicated) by transmission of a pathogen from an infected person to another person. Contagious diseases vary in how readily they are communicated. For example, COVID-19, which spreads by transmission of the SARS-CoV-2 coronavirus from one person to another, is extremely contagious, as evidenced by the global pandemic it caused. Conversely, a non-contagious disease either cannot be transmitted from one person to another or the probability of transmitting the disease to another person is low. A disease is often known to be contagious before medical science discovers its causative agent. Koch's postulates, which were published at the end of the 19th century, were the standard for the next 100 years or more, especially with diseases caused by bacteria. Microbial pathogenesis attempts to account for diseases caused by a virus.

A non-communicable disease (NCD) is a disease that is not transmissible directly from one person to another. NCDs include Parkinson's disease, autoimmune diseases, strokes, most heart diseases, most cancers, diabetes, chronic kidney disease, osteoarthritis, osteoporosis, Alzheimer's disease, cataracts, and others. NCDs may be chronic or acute. Most are non-infectious, although there are some non-communicable infectious diseases, such as parasitic diseases in which the parasite's life cycle does not include direct host-to-host transmission. NCDs are the leading cause of death globally. In 2012, they caused 68% of all deaths (38 million) up from 60% in 2000. About half were under age 70 and half were women. Risk factors such as a person's background, lifestyle and environment increase the likelihood of certain NCDs. Every year, at least 5 million people die because of tobacco use and about 2.8 million die from being overweight. High cholesterol accounts for roughly 2.6 million deaths and 7.5 million die because of high blood pressure.

1. User / Patient Login

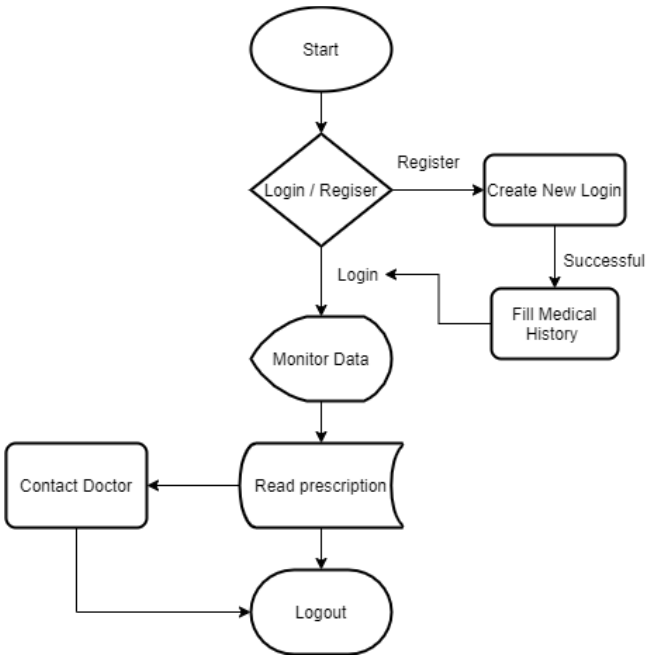

Figure-2 Patient Login

Above flow diagram gives the architecture of how patient can able to access system

1. Register / Login: The new user/patient must have to register in order to create profile and access doctor. Already registered patient have to fill medical history.

2. Monitor Data: The Patient after login can easily access and monitor data. This information helps patient to know about his medical condition.

3. Read Prescription: In this field the user can download or read prescription from doctor. Using this prescription patient can order medicine.

2. Doctor Login

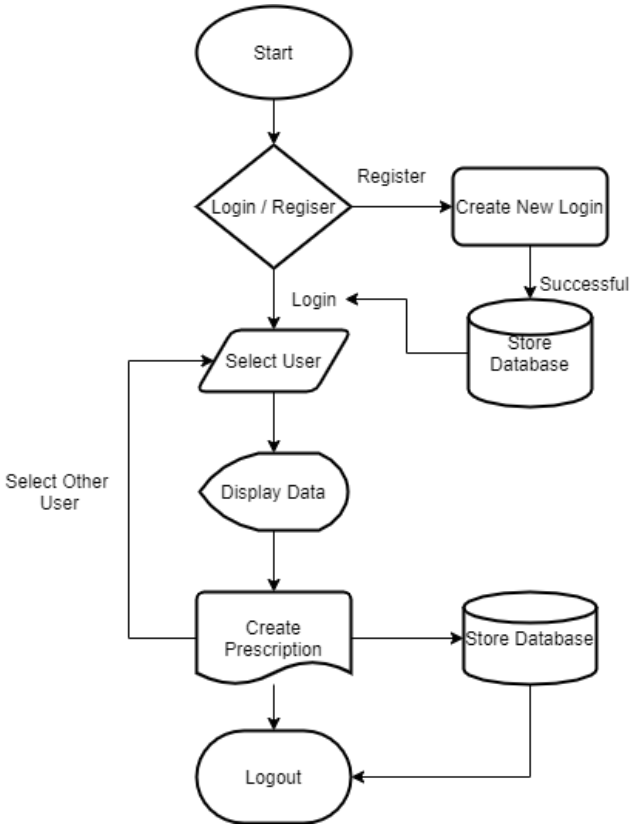

Figure-3 Doctor Login

Above flow diagram gives the architecture of how Doctor can able to access system

1. Register / Login: The new Doctor must have to register in order to create profile and access Patient data. Those doctors, who already registered, need to fill details of clinic.

2. Select User: After successful login doctor have to select patient in order to monitor his / her data.

3. Monitor Data: The Doctor after selecting patient can easily access and monitor data. This information helps doctor to know about patient medical condition.

4. Create Prescription: In this field the doctor can write or upload prescription of particular patient.

4 Implementation

In this paper, we have proposed a system in which patient's body temperature, heart rate, body movements and blood pressure reading results that are being monitored by the system. The various sensors are placed on the patient's body and they take the readings and send the corresponding signal to the Arduino. The Arduino is a credit card-sized single-board computer that operates on Linux OS. Here, various sensors are used to measure the patient's body temperature, heart rate, Blood Pressure and their respective results are sent to the database via Arduino and can be monitored from anywhere worldwide through the internet
facilitated via GSM module

3. Arduino Micro controller

Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board

microcontrollers and microcontroller kits for building digital devices. Its hardware products are licensed under a CC-BY-SA license, while software is licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially from the official website or through authorized distributors

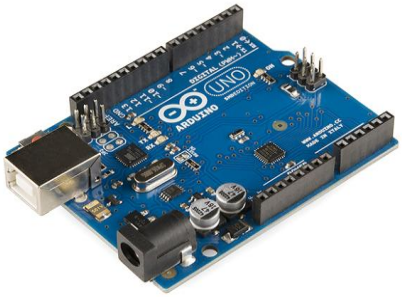

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Figure-4 Arduino

4. Temperature Sensor

For measuring the temperature LM35 sensor has been used which is an IC sensor used to measure the temperature with the help of the analog output proportional to the temperature.

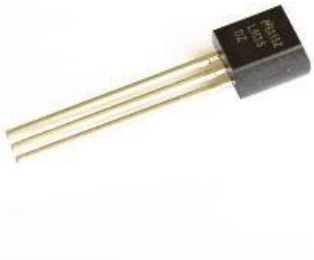

Figure 5 Temperature Sensor

The LM35 is an IC temperature sensor with an output voltage which is proportional to the Celsius temperature. The LM35 is better than linear temperature sensors which have calibration in Kelvin, because one doesn't need to remove a large constant voltage from the output value to obtain the Celsius reading. These salient features of the LM35 sensor make interfacing to any type of circuit extremely easy.

5. Heartbeat Sensor

The heart rate is measured using a pair of LED and LDR

, a micro-controller and it works on the fundamentals of optoelectronics. The infrared radiation is emitted by IR led and the infrared light is reflected by the surface. The intensity of radiation generated electron-hole pair which in turn produces leakage current. This current thus generated is sent through a resistor to obtain the proportional voltage. Thus, the greater is the intensity of the incident ray, the larger value of voltage flowing across resistor will be obtained.

Figure-6 Heartbeat Sensor

The heart rate is measured by placing the tip of forefinger upon the sensor. Once the circuit senses the pulse, an LED will start blinking along

with your pulse. The output is sent to a circuit or a micro-controller to measure the heart beat rate in BPM.

1. *BP Sensor*

For measuring the blood pressure, we have used here a manual blood pressure monitor instead of a digital one as it is cheaper. It is commonly known as a sphygmomanometer and the kit consists of an arm cuff, a squeeze bulb to inflate the cuff, stethoscope and a sensor to read the pressure. Blood pressure is measure using an air pressure sensor. The readings are in the form of electrical signals. These readings are also converted to digital form to be read by the Ardunio.

2. *GSM Module*

The GSM module used here in this paper is GPRS/GSM Quad band Module (SIM900) which offers GPRS connection to our system, and includes the SIM900 communication module from SIMCom. This module can accept any type of sim card having its own unique number. The same can be used to send messages, make calls or create sockets to provide internet connectivity. The data from the above sensors is constantly updated in MySQL database which is linked to the web UI using the python code. The patient can log in and monitor their health status at any time. The system is made smart to trigger a SMS/Email alert via the proper gateways which assure an efficient delivery of the message. Also, the values from these sensor in combination with various other symptoms which are asked from user based on initial diagnosis is used to predict the disease patient is suffering from, if any, using the data mining technique through our programming logic and is displayed as a result of analysis along with the details of a doctor for the disease in their area.

5 Result

As the title says, the result of Smart Health Monitoring system is of extreme use to patients and doctors as well. The patient can check their health status anytime from the comfort of their homes and visit hospitals only when they really need to. This can be done by using our system whose result are brought online and can be seen from anywhere around the world. Since it is a prototype model, our system shows the almost real time values of various health parameters and emulates how the same can be implemented in the real world. The doctors can also use the log of the patient body condition to study and determine the effect of medicine or other such things. The smart prediction module predicts the disease that the patient is suffering from by asking them for various symptoms they may have and the options are based on the previous symptom. The final conclusion is made after at least 3-4 symptoms are identified. The result is most accurate if more and more symptoms are identified.
References

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