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IoT Based Smart Health Monitoring System

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ABSTRACT: Health management is one of the major concern when considering a mass population among the earth irrespective of various nations. Our paper focuses on the development and implementation of an effective healthcare monitoring system through IoT by acquiring the vital health parameters and transmitting the data by wireless communication to a personal cloud storage. Method of acquiring and monitoring data in system is implemented using LabVIEW interconnected with myRio. The data can be accessed any time of the current status of the patient. In case any abnormal behavior in the signals is detected, the caretaker and doctors are notified immediately through a message service (SMS) via GSM module. Cloud computing and password protected account provides privacy and security of patient details by allowing restricted access to the database thus providing quality healthcare to all.

KEYWORDS: IoT, LabVIEW, Healthcare, LM-35, MAX-30100.

I. INTRODUCTION

Nowadays most of the people suffer only because of the carelessness of their health. This is because they do not have time to care for their own health being too. The reason behind the development of this project is the inefficiency of the people to monitor their health status about their health management. As we all know that internet of things makes our life easier, we have decided to make an IoT based Smart Healthcare Monitoring Kit. For applications like communication, monitoring, recording, storage and display, the IoT performs an amazing work with its efficiency. When monitored on a continual basis, an effectively analyzed information with IoT can bring about a bigger change in the field of healthcare. The current food habit and sedentary lifestyle increases chronic diseases such as Cardio Vascular disease (CVD), hypertension, stroke and diabetes. The rising cost of healthcare services has increased the pressure for providing effective and efficient healthcare to the patients in most of the developing countries. Internet of Things (IoT) works as one of the emerging technology, which allows us to interconnect anywhere and anytime. The scope of IoT is not only constrained to connect things, it allows devices to interact and exchange their data associated with users and merges telecommunication and information technology for providing better medical services. By means of IoT, medical information or data are transmitted from one location to another location to diagnose the diseases and arrange for proper medications to improve the patients' health conditions even at rural locations. This technology enables to deliver healthcare services over a long distance and minimizes the cost of healthcare services by managing the chronic diseases with less hospital stays, less travel time and shared clinicians and professionals.

II. LITERATURE REVIEW

Jaiswal et al[1], Internet of things (IoT) and cloud computing plays a vital role in today's tele-monitoring health system. This system keeps track of patient's physiological parameters through collection of body sensor's data using myRio. The doctor's healthcare is developed and displayed on a webpage where doctors and patients can access and communicate each other without physical presence.

Pramila et el[2], As it is a long-range wireless technology, unexpected situation of the patient's health is quickly detected and timely intervention leads to save the life of the patient. Due to costlier healthcare and higher waiting time in hospitals, the in-

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home patient monitoring system concept have been emerging in the recent years. This system collects data of various body parameters through biosensors, wearable devices and smart textiles and it transmits data to the central node server securely through Cipher Text Policy Attribute Based Encryption method. In turn, the server shares the collected data to the hospitals for further treatment. The server rings alarm to the ambulance during emergency. It is very beneficial for elders and chronic patients who require continuous monitoring.

M. S. S. P et al[3] The main challenge that this paper has overcome is to make elders equipped with for growing new International Journal of Pure and Applied Mathematics Special Issue 250 technologies and to become familiarity towards Smartphone, computer, etc. IoT based Smart healthcare with the help of smart devices and objects improves the healthcare monitoring system effectively, thus by reducing the inefficiencies of existing healthcare system. Smart devices with new and upgraded technologies enhances the data accuracy to be collected, real-time accessibility of patient's condition, intelligent integration of data collected, maintaining the integrated data smartly through cloud service, etc.

Gómez et al[4] IoT along with smart devices reduce complexity and complications in the healthcare system. The involvement of mobile technologies and smart devices over healthcare system have caused a huge impact on the world. The full-fledged utilization of M-health and E-health applications in today's world makes people aware for improving and maintaining the good quality of life. Apart from regular monitoring of patient's condition through M-health system, the main objective is to educate them through the recommendations of healthy eating habits and effective fitness routines for improving their quality of healthy life.

Chiuchisan et al[5] Secondly, the major challenge is of the accuracy, validity and integrity of measurement data with other devices. Thirdly, the usability and the experiences of the user with the device and its friendly supporting software play vital role in continuing regular and long period use of wearable tracking devices. The use of Internet of Things (IoT) and its e-Health applications in the Tele-medicine health system leads to seamless flow of information between doctors and patients, thus making healthcare cost effective and improving the quality of patients' treatment

III. BLOCK DIAGRAM OF HEALTH MONITORING SYSTEM

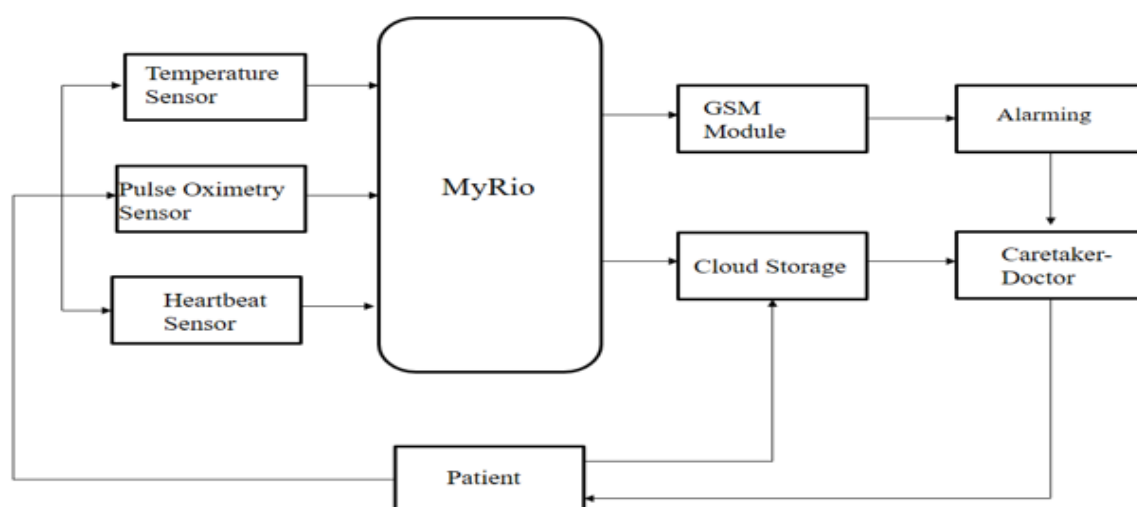


Figure 1 Design of the Health Monitoring System

The diagram basically gives us about the working of health monitoring system. The data that had to be managed for health management is acquired for various parameters namely temperature, oxygen saturation of blood and pulse rate measurement. The sensor used for temperature measurement is named as LM-35. The LM35 series are precision



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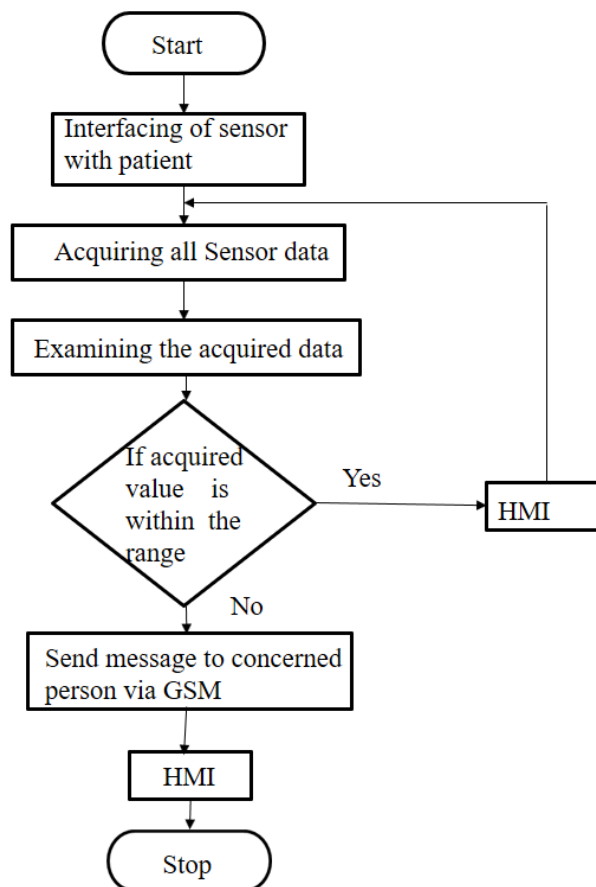
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integrated circuit temperature sensors, whose output voltage is linearly proportional to the Celsius. Heartbeat, considered as a parameter for health management is acquired using Pulse sensor. This sensor is used to monitor the amount of oxyhaemoglobin. It measures the heartbeat per time, conveyed in Bpm (bits per minute). A sensor named MAX30100 is used to acquire the data for the amount of oxygen saturated blood. MAX30100 is an integrated pulse oximetry and heart rate monitor sensor solution by combines two LEDs, a photodetector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate signals. It operates in supplies ranging from 1.8V and 3.3V power supplies. The data from these sensors are acquired and processed using myRio and LabVIEW programs. LabVIEW (Laboratory Virtual Instrument Engineering Workbench) is a system design platform and development for a visual programming language from national instruments and The LabVIEW programs designed to process specific data for each sensors have various condition for each parameters in order to evaluate the patient's health condition. The evaluated patient data is stored in a password protected Cloud storage account and is provided access to doctors and concerned caretakers.

IV. PROPOSED METHODOLOGY AND DISCUSSION



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Figure 2 overview of the working of smart health monitor kit.

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The entire methodology of the system depends upon the body sensor network mainly consisting of the wearable sensors (namely temperature sensor, MAX30100 sensor and the heartbeat sensor). They act as data collecting units, collecting the physiological signals from the patient's body. These collected data are viewed through LabVIEW. Then the data are transmitted to the base station or the gateway server (cloud). At the base station, the received data is stored in the form of files for further use. With correct access codes for the cloud storage one can access the account for the patient's data. The accomplishment of transmission and storage of data in cloud storage is achieved by the use of IoT platform. The last part of the architecture is used to store, analyze and present the received data in a graphical and text format. The GUI sends an SMS to the physician or the patient's family through the GSM Modem. The measured body parameters are fed to MyRio. A MyRio is a device which can be programmed by LabVIEW. MyRio acquires the data from the sensors and processes them according to LabVIEW program. Generally, the problem faced in processors are their processing speed but the advantage of using MyRio device is that its processing speed is ten times of the standard general micro-controllers and micro-processors. The measured parameters are transferred to the cloud database (IoT-IBM), by this way there will be a transparency between the medical organization and the patients. The MyRio device is then connected to the GSM module. In case the acquired data doesn't match the reference values denoting any abnormal conditions (like pulse rate exceeding 100 or 110 BPM) it will send a SMS to the caretakers via GSM module. The Cloud database is password protected, so it provides privacy and security of patient details by allowing restricted access to the database.

V. EXPERIMENTAL RESULT WITH TABLE AND DISCUSSIONS

This paper suggests a better and efficient way of health monitoring by continuously monitoring the vital body parameters and this way of approach greatly reduces the hospitalization and also comprising a smart way of providing data transparency by using IoT and Cloud storage. As per the tabulations the real time data has been provided from measuring parameters namely temperature, pulse rate, and oxygen saturation of blood.

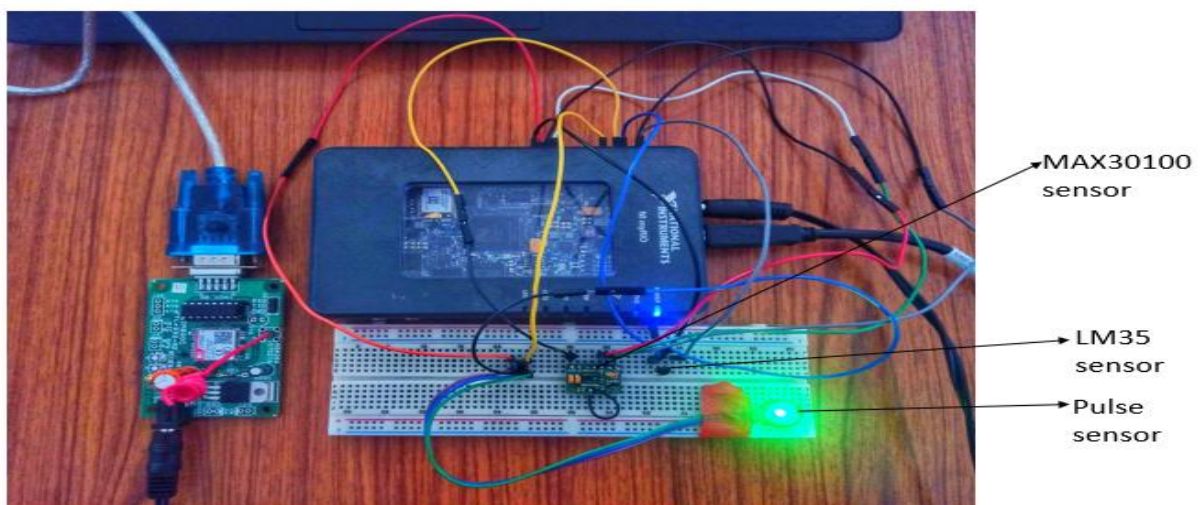


Figure 3 Represents the hardware representation of the kit



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S. No	Patient Name	DOB	Age	Email Id & Contact No	Patient Condition		
					Body temp (°C)	Pulse Rate (Bpm)	Oxygen Concentration in blood (%)
1	S. Alan Roddick	08.02.1999	21	alanjosh151@gmail.com 6383893281	36.6	74	98
2	G. Manoj Kumar	17.09.1998	21	manojvandayar@gmail.com 7339464145	36.9	89	98
3	R. Ragul	21.04.1999	20	rraghul9121@gmail.com 8754960494	36.6	78	98
4	M. Karthik	02.12.1998	21	mkarthikkarthik60@gmail.com 7667101034	36.8	84	96
5	R.S. Saran Kumar	01.11.1998	21	sarangreenz@gmail.com 74185214323	36.7	75	97

Figure 5 Tabulation provides the real-time patient data obtained from the smart health monitoring kit.

For each data, various conditions are used to send alert messages to concern persons. In temperature measurement, the obtained data is compared with three reference data ranges (36.5-37.5°C, 37.5-38.3°C, <35) for normal, fever and hypothermia. For pulse rate measurement, reference value ranges (60-100 bpm, <60bpm, >100bpm) are used for comparison of determining normal, high and low conditions. Considering oxygen saturation of blood, quality is determined in percentages ranging from 94 to 100 for healthy human. Considering animals and other organism, the range differs according to each's condition thereby can also be used when the range is changed according to the required range. Thus the accuracy and precision is increased thereby providing an efficient and dependent health monitoring system.

VI. CONCLUSION

The outcome of this project is that it provides an continuous monitoring of health and an open platform for patients to get to know their health using IoT (IBM). As discussed earlier, various health parameters have been identified to determine a patient's health condition. The Labview program for determining the body temperature, pulse rate, heart rate determination by ECG signal (PQRS wave) and Max30100 measures pulse rate and oxygen concentration in blood has been designed and the output for these parameters have been uploaded on IoT providing the access to patients as well as to respective medical centres. Now according to the values the message is sent using GSM module and the main advantage is that we have greatly reduced hospitalization.

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