

MAX30100 Based Heart Rate and SPO2 Monitoring using IoT

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Abstract: Percentage of Oxygen in blood plays a vital role as a parameter in determining one's health condition. This paper focuses on the effective monitoring of a person's oxygen concentration in blood thereby acquiring and transmitting the data by wireless communication to a personal cloud storage through IoT. Method of acquiring and monitoring data in system is implemented using LabVIEW interconnected with myRio. The data can be accessed any time in order to observe the current status of the patient. In case of abnormal behavior in the detected signals, the caretaker and doctors are notified immediately through a Short 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.

Keywords: IoT, LabVIEW, Healthcare, Health Monitoring, Max-30100.

I. INTRODUCTION

Oxygen, being one of the compounds in the earth's environment plays a vital role in the lives of every single organisms known. The importance of oxygen generally is of much greater value. When considering lives of humans, oxygen serves as the fuel for each cell on the body performing their respective functions for the better function of the human body. So the concentration of oxygen in blood serves as an important parameter in the efficient working of body. The measurement of concentration of oxygen in the blood determines the health condition of the patient. Now the rise in cost of healthcare services increased the pressure of middle class & poor people in obtaining the effective and efficient healthcare along with the cost of day to day expenses in most of the developing countries. As one of the emerging technologies, Internet of Things (IoT) allows us to interconnect anywhere and anytime through network. The scope for Internet of Things is not only constrained to connect things but also to allow various devices interacting and exchanging the data associated with users and combines the concept of telecommunication and information technology for providing better medical services. By means of IoT, information or data transmission is performed from one location to another location to diagnose the diseases and arrange proper medications and equipment to provide for the improvement of patient's health conditions even at rural locations. This technology enables for the people distributed among over a wide area range to acquire healthcare services over a long distance and to minimize its cost by managing the chronic diseases with less hospital stays(i.e. crowding in hospitals), less travel time and shared clinicians and professionals.

II. LITERATURE REVIEW

Chiuchisan et al[1] 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 patient's treatment.

Pramila et al[2], Being a long-range wireless technology, various conditions of the patient's health is detected quickly and timed interventions as per the collected data leads to save the life of the patient. Due to costly healthcare and higher waiting time in hospitals, the in-home patient monitoring system concept have emerged in the recent years. This system acquires data of body parameters through biosensors, wearable devices and smart textiles and transmits it to the central node server securely with the use of Cipher Text Policy Attribute Based Encryption method. In turn, the collected data is shared to the hospitals via the respected server for further treatment. Various alarming systems are used to alert the

ambulance during emergency. This method 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 for growing new International Journal of Pure and Applied Mathematics Special Issue 250 technologies and to increase familiarity towards Smartphone, computer, etc. IoT based Smart healthcare with the help of smart devices improves the healthcare monitoring effectively by reducing the inefficiency of existing healthcare system. Smart devices with new and upgraded technologies enhances accuracy of the data for collection, real-time accessibility of patient's condition, integration of collected data intelligently by maintaining the integrated data smartly through cloud service, etc.

Jaiswal et al[4], IoT and cloud computing plays a vital role in present tele-monitoring health system. This system keeps track physiological parameters of patient through collection of data from body sensors using myRio. The doctor's healthcare is improved and displayed on a webpage where doctors and patients are able to access and communicate each other without physical presence.

Gómez et al[5], Internet of Things with smart devices reduce complexity and complications in the health monitoring system. The involvement of mobile technologies and smart devices in health monitoring system have caused a huge impact on the world. The full-fledged utilization of M-health and E-health applications in the present world makes people aware in improving and maintaining the good quality of life. Apart from regular monitoring of patient's condition through M-health systems, the main objective is to educate them about health by recommendations of healthy eating habits and effective fitness routines for improving their quality of healthy life.

III. BLOCK DIAGRAM OF HEALTH MONITORING SYSTEM

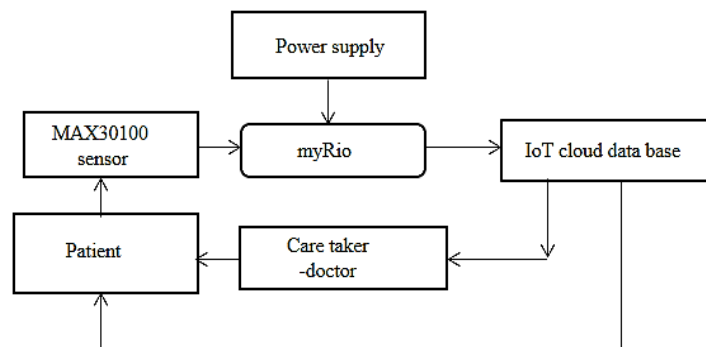


Fig. 1 Design of the Health Monitoring System

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 oxygen saturation of blood and heartbeat. A sensor named MAX30100 is used to acquire the data for the amount of oxygen saturated in 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

The entire methodology of the system based on the body sensor network mainly consisting of the wearable sensor namely MAX30100 sensor. The input terminals act as data collecting units, that collect the signals from the body of the patient. These collected data are viewed through LabVIEW. The measured body parameters are fed to MyRio. A MyRio is a device which can be programmed by LabVIEW. It acquires the data from the sensors and processes them according to LabVIEW program.

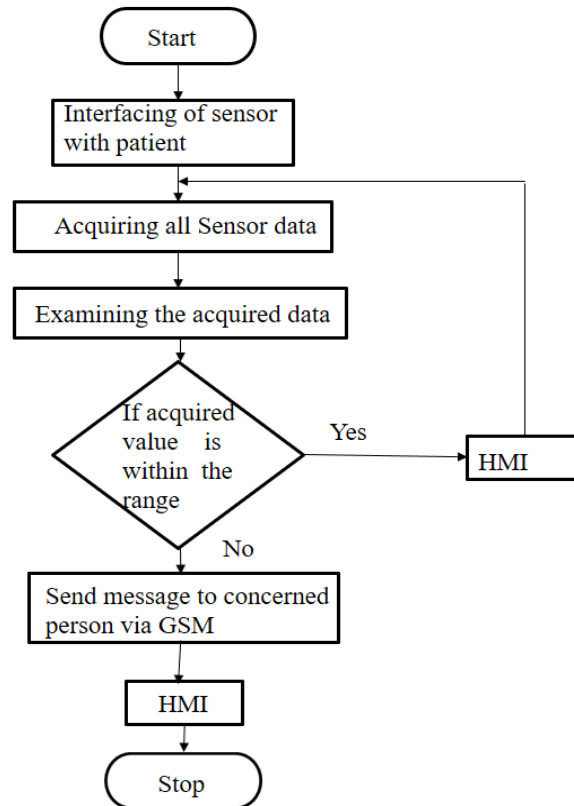


Fig. 2 Overview of the working of smart health monitor kit

Generally, the problem faced in processors are their processing speed but the advantage of using MyRio device is that it's processing speed is ten times of the standard general micro-controllers and micro-processors. The MyRio device is then connected to the GSM module. Now with the pathway between myRio and GSM module, the obtained parameters from the patient's body are then transmitted to the base station or the gateway server (cloud database IoT-IBM). The data received from the base station is stored in the form of files for further use. With correct access codes for the cloud storage, one can access the account to obtain a patient's data for various analyses. The transmission and storage of data in cloud storage is achieved by the use IoT platform. The last part of the architecture is used to store, analyze and present the received data in text and graphical format. The GUI sends SMS to the physician or the patient's family through the GSM Modem. By this way, the patient's family can be noted of various data regarding condition and the treatment undergoing by the patient. 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. A transparency between the medical organization and the patients will be obtained. 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 DISUSSIONS

This paper suggests an efficient and better way of health monitoring by continuous monitoring of vital body parameters (i.e. Heart beat, oxygen concentration in blood). This way reduces the hospitalization considerably comprising a smart way of providing data transparency by using IoT and Cloud storage. As per the tabulations, the real time data are obtained from measuring heart beat and oxygen saturation in blood.

For each parameter, various conditions are used to send alert messages to persons. For pulse rate measurement, these reference value ranges (60-100 bpm, <60bpm, >100bpm) are used for comparison in determining normal, high and low conditions. Considering oxygen saturation of blood, the quality is determined in percentages ranging from 94 to 100 for healthy human. When considering other organisms, the range differs according to each's species thereby can also be used when the range is changed according to the required reference range.

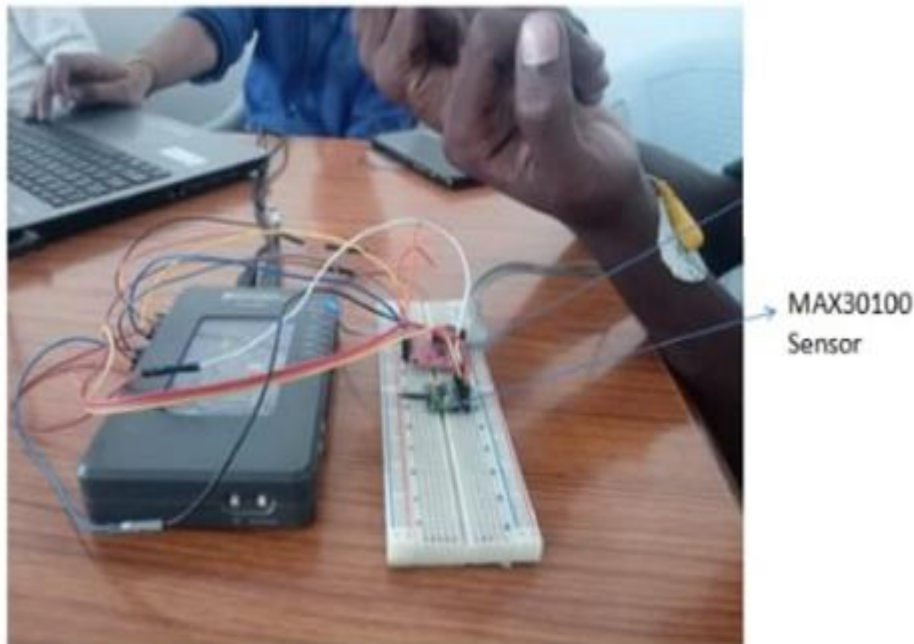


Figure. 3 Represents the hardware representation of the kit

TABLE I REAL TIME PATIENT DATA ANALYSIS

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

VI. CONCLUSION

The outcome of this project is that it provides a 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 are identified to determine a patient's health condition. LabVIEW programs for measurement of heart rate and oxygen concentration in blood by Max30100 is designed and the output for these parameters have been uploaded on IoT providing the access to patients as well as to respective medical centers. Now the message is sent using GSM module when the value does not meet the reference value and great reduction in hospitalization is the key advantage obtained by this method. The main advantage is that we have greatly reduced hospitalization.

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