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IoT based Real Time Health Monitoring

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Abstract: **conventional sensor based diagnosis in medial field requires more number of sensors and human efforts if it is processed in a large scale. It is a difficult task due to the shortage of medical professionals and system setup. To overcome this issue an IoT based health care application is proposed in the research work. The proposed system consists of the web and mobile application based on continuous wireless monitoring of patients. The objective is paper is to implement a low-cost system and transmit the patient vital signs in emergency situations. Sensors are being used for measuring the patient vital signs by using the wireless network. The sensors data are collected and transmitted to the cloud for storage via Wi-Fi module connected with the controller. The data is processed in the cloud and feedback steps are taken on the analysed data which can be further analysed by a doctor remotely. Remote viewing reduces burden to doctors and provides the exact health status of patients. If the patient needs urgent attention then a message is sent to the doctor.**

Keywords— Arduino, Health, monitoring, patient, IoT, sensor, wireless

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I INTRODUCTION

In the ever-increasing world population, people are suffering from chronic diseases at a high rate. The main reason behind this is daily usage of tobacco, alcohol consumption, over stress, no physical activity etc. According to the world health organization (WHO), millions of people die due to increased cholesterol levels, overweight, high etc. The person who is affected by chronic disease must handle his life properly with at most care and should be treated and monitored by a doctor all the time. The important parameters for the chronic diseases are the heart rate, body temperature, amount of oxygen in the blood etc. The patient monitoring system allows doctors to supervise many patients at a time. The heart rate indicates the soundness of the heart. Heart rate for adult males [1] on an average is 70bpm and for adult females on an average is 75bpm. With the help of these values, the heart condition can be tracked. The body temperature tells the body condition. The normal [2] human body temperature is 98.6 ° F ± 0.7°F. Any variation in the values of body temperature can risk improper human health. The amount of oxygen in the blood is calculated by the Spo2 sensor which is a very vital parameter for human health. The normal oxygen levels [3] in the blood varies between 75 to 100mm of mercury. The amount of oxygen below 60mm of Hg is considered as low. It is also an important parameter for human health. The regular monitoring of these vital parameters is very important for better health and great health. For the measurement of these vital parameters, an automated system must be designed for continuous monitoring. In this paper, an Arduino based automated monitoring system for patents is designed and implemented. This can monitor the physical condition easily at a lower cost. Rest of the paper explains the existing approaches in section II, the proposed design and implementation of the work in section III, result and discussion of the implemented system in section IV and the conclusion and future scope is presented in section V and VI respectively.

II. LITERATURE REVIEW

There are many approaches for measuring the vital parameters for health monitoring. Alexsis Bell et al. [4] developed a prototype for a wireless patient monitoring system. This system was measuring oxygen concentration in blood, pulse and temperature by interfacing with sensors. The drawback of the design was thermistor positioning, the blood oxygen concentration was not calibrated; the hardware requirement was more and lead to the high cost of the prototype. Sagar R Patil et al. [5] designed patient monitoring using wireless technology. It used sensors for measuring the vital signs of patients. The drawback was the readings were not proper and showing glitches while showing the output. Sohail Shaikh et al. designed [6] a system for monitoring patients using IoT. The main target was just the data transmission from patients to the doctors. The drawback was the non-inclusion of MAC protocols for still efficient data transmission. T K Ramesh et al. developed [7] a wireless network protocol for monitoring the patients. The comparison of wireless network protocols is done. The drawback was the communication in rural areas was not efficient. Dr. Bharath Kumar G J proposed a design [8] for monitoring the patient's vegetative state using cloud computing and IoT. It shows to the family members the patient condition remotely. The main drawback is it's applicable for patients only in a vegetative state. Sushan M et al proposed a design [9] for improving the safety of patient and surveillance monitoring. The drawback of the system was complex in clinical settings. The sensors data measurement was not appropriate. Pratiksha W D et al. proposed a method [10] from which health monitoring of patients is done. The patient's only temperature and heart rate with the saline level

were measured. The drawback was that the measurement of vital parameters was not measured. S Nubenthan et al. designed a system [11] for continuous monitoring for dengue with the wireless monitor. The drawback was that the sensor data was not transmitted using GSM modules and the mobile based application was included. Sachi marathe et al. designed a system [12] for patient monitoring with vital parameter measuring sensors. The design stored the data from sensors on to the cloud. The drawback was the results deviated by a factor of ± 3. Kathikamani R et al. designed [13] monitoring system for patients using wireless technology. The data collected are stored on the cloud and are analyzed. The drawback was not using web service application peripheral interface, it was on localhost. Using the above literature papers as a base, a design is proposed which fulfills the drawbacks of all the systems and was implemented.

III. PROPOSED WORK

The system consists of the basic vital sensors interfacing with the cloud and mobile application as shown in figure 1. The data is captured by sensors are sent to the processor Arduino where the data is acquired and processed. The data acquired by the processor is compared with the threshold values of the desired sensors. If the sensor values move equal or above the threshold, then an emergency message or alert is passed to the doctors in the mobile application through a Wi-Fi module with the details of each sensor. This data is further passed to the cloud for details changes of the past few hours data. The past few hours can be accessed on the website and the data is stored in the cloud.

The proposed system uses the sensors like pulse sensor (for measuring the heart rate), Temperature sensor (for measuring the body temperature) and SpO2 sensor (for measuring the SpO2 intake) as shown in figure1. The system measures the parameters in real-time and displays on the LCD and in the cloud which enables monitoring of patient health when the doctor is with the patient or wireless monitoring for any place. The flowchart of the proposed system continuous monitoring of the patient is shown in figure 2. The sensors data is sent to the cloud via the Wi-Fi module, if the sensors data are not in acceptable range then an alert message is sent onto the mobile application. The doctor can take the action very soon for helping the patients.

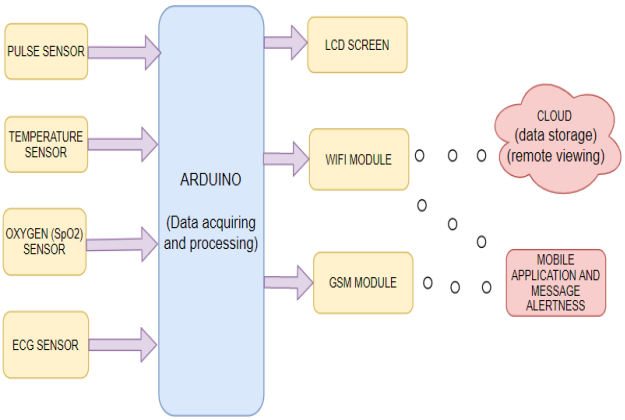


Fig1: Block diagram of the proposed system

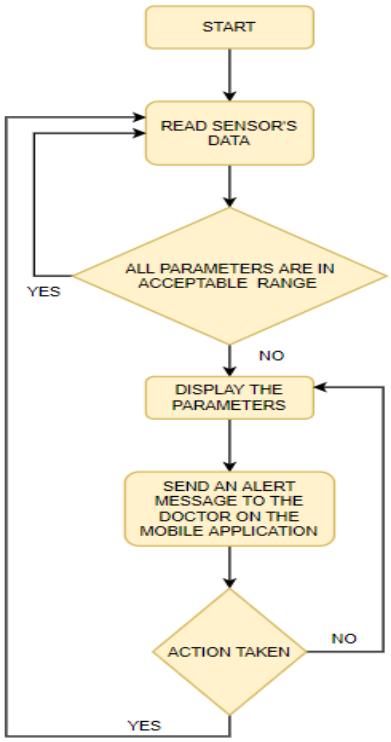


Fig2: flowchart of the process of the system

The basic hardware needed for the proposed model is pulse sensor, Temperature sensor, SpO2 sensor and Wi-Fi module and GSM module.

Pulse sensor: it measures the [14] heart rate. It has circuitry for noise cancellation. A finger is placed on the sensor; it calculates the amount of blood in the capillary tube based on the amount of light reflected. The difference in the amount of light transmission and reflection is the result of the sensor.

Temperature sensor: The sensor[15] measures the body temperature from -55 degree celsius to +150 degree Celsius. For every 10 degrees rise in temperature, the output changes by 10mv.

SpO2 sensor: This sensor [16] measures the oxygen content in the blood. A little beam of light passed through the blood

within a finger. It measures the amount of change in light absorption.

Wi-Fi module: This module [17] allows connectivity of the internet with the embedded applications. It uses the communication protocol. It transmits the values of sensors to the mobile application.

GSM module: It's a GSM modem with TTL output. It's a standard for [18] the mobile telephones. This module sends the message to the mobile if there is a sensor value crosses the threshold.

IV. RESULT AND ANALYSIS

In the proposed model, the vital parameters for the patient are acquired by attaching on the patient's body. The data is sent to the cloud via the Wi-Fi module. The sensors are interfaced with the processor Arduino. The patient can move freely if the patient wants. A fingerprint sensor is used so that an authorised person can only access the data. The basic hardware connections of the system are shown in figure 3. The processor process the data acquired by sensors and processed data is transferred to the cloud through a Wi-Fi module. The processed data can be seen on the webpage using the computer or the mobile. The real-time vital parameters are measured every 30seconds. The system is implemented in such a way that if the parameter data exceeds the threshold values, then the doctor will receive an alert message.

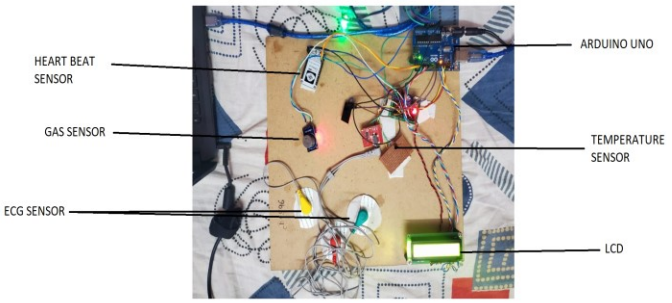
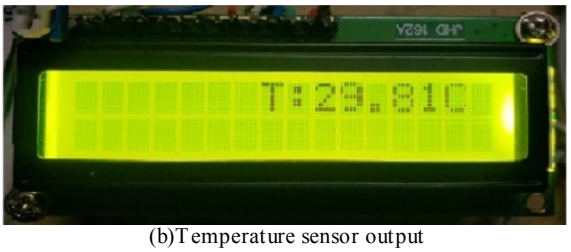


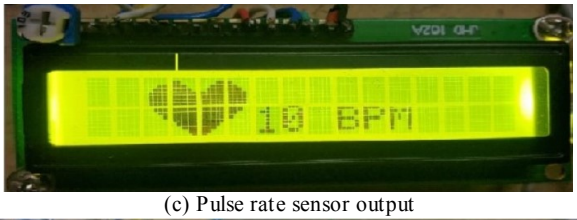
Fig3: hardware connections of the system

The hardware implementation of the proposed system is shown in figure3. The sensors are connected to a patient for testing. The readings of the sensors are displayed on the LCD. When its normal reading or within the permitted threshold then no message is sent to the doctor as shown in figure4.

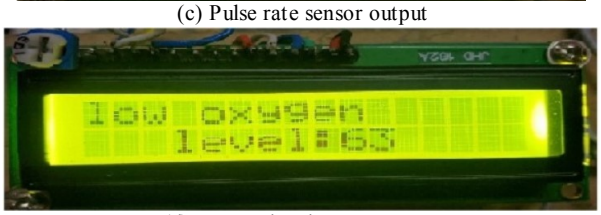
(a) ECG sensor output



(b)Temperature sensor output



(c) Pulse rate sensor output



(d) oxygen level sensor output

Fig 4: (a),(b), (c),(d) shows ouput of sensors on LCD

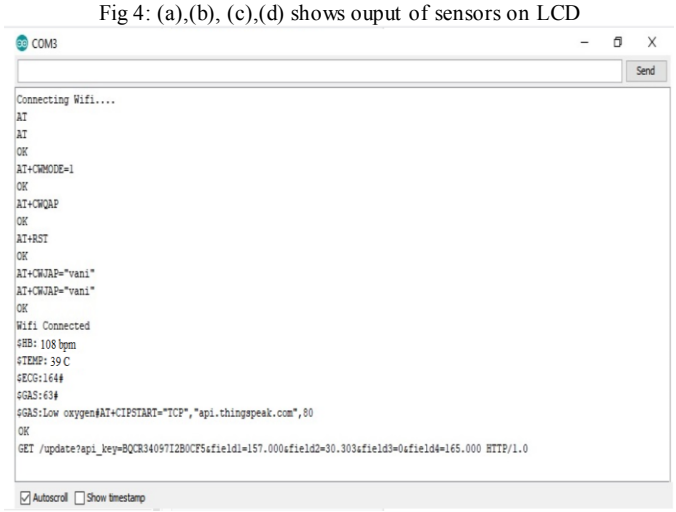


Fig 5: output on the serial monitor of Arduino

The output of sensors is displayed on LCD. The values of sensors are transmitted to the cloud and the mobile application as shown in figure 5. Figure 5 shows the output of the serial monitor of Arduino with all the sensor values. If the values of any of the sensor value cross threshold an alert message is sent to the doctor as shown in figure 6. The doctor receiving an alert message.

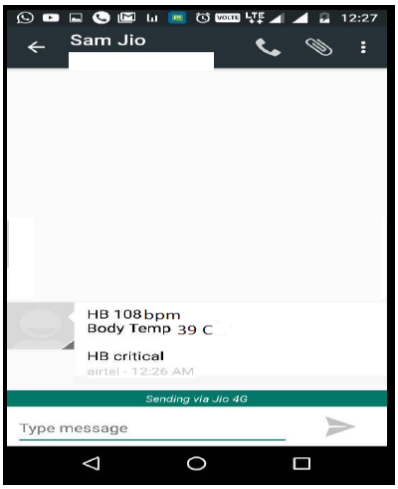


Fig 6: doctor receiving an alert message

If the doctor wants to see the sensor values, the doctor needs to enter the hospital name and the patient name as shown in figure 7. The values of all the sensors are displayed in the mobile application. The ECG output can also be seen onto the mobile. The doctors can go and visit the patient soon.

Fig 7: patient details in the application

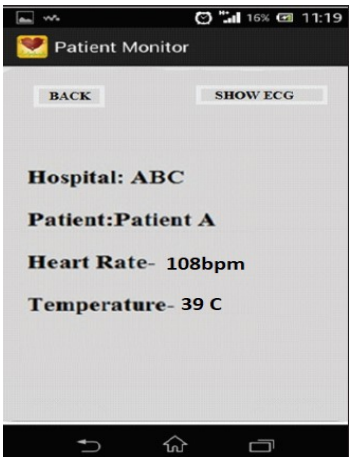


Fig 8: Details of the patient

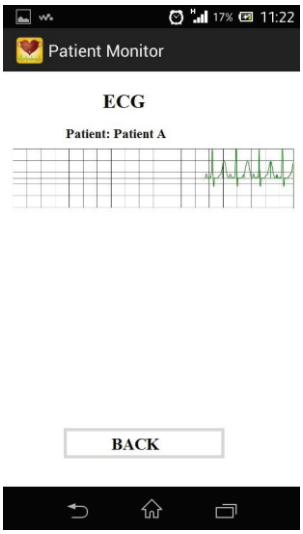


Fig9: ECG output of the patient

The doctor needs to enter the patient details like patient name and the hospital for getting the values of sensors. The patient sensor reading is shown in a mobile application. The ECG output can also be seen on mobile as shown in figure 8 and figure 9.

V. CONCLUSION

The proposed system is implemented for wireless health monitoring of the patients. The vital parameters are measured by the sensors such as pulse sensor, temperature sensor and SpO2 sensor. The proposed model allows the doctors to monitor patient health from anywhere. The proposed system helps people to consult the specialist all over the world. The system uses IoT and wireless sensor technology for efficient health monitoring. The data from sensors is taken every 30 seconds. The data is stored and can be visualized on the webserver. The system is implemented in such a way that if the sensor data exceeds the threshold values, a message is sent to the doctor. The main advantage is in case of emergency the intervention time between doctor and patient is reduced. The objective is achieved by proposing a low-cost system for saving human lives so that human lives will be comfortable. The limitations are the doctor's availability and the proposed model doesn't include the blood pressure monitoring system.

VI. FUTURE SCOPE

In the lockdown, the doctors can observe the patient condition without any difficulty. This system can also be applied to COVID-19 patients. The system could be modified to support regular check-up of patients from long distance as it reduces the travelling time. All the people's data can be linked with aadhar card for tracking the health of the country. The patient can be tracked with the location, in case the patient misses out in the hospital. The data acquired by sensors can be sent to the family members. Each patient must be mapped with the doctors treatment zone to alert the doctors. The proposed system can be integrated as a kit and can be supplied at low

cost to all people for the important parameters supervision. As a part of the future scope, the results should be verified for many patients and accuracy need to be calculated. The waiting time and displeasure [19] can be reduced for the patients if high-end sensors are being used. The data collection increases as the number of patients increase. To manage this[20]big data with cloud computing techniques can be used.

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BIOGRAPHIES

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