

IOT Based Remote Health Monitoring System

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Abstract—With the prevailing pandemic conditions all over the world, healthcare is given a higher priority each day. A remote health monitoring system is the best solution for prevailing epidemic situation. The Internet of Things (IoT) is a new Internet revolution particularly in the field of health. By the introduction of wearable sensors and smart phones the remote health care monitoring has emerged at such a pace. IoT health monitoring helps prevent the spread of the disease and obtain proper diagnosis, even if the doctor is far away. The paper focuses on a portable physical monitoring framework which can regularly monitor a patient's heart rate, temperature, and other basic parameters. An IoT remote health monitoring system is proposed where an authorized medical expert can access this stored data using any IoT platform and can be utilized to diagnose the health conditions of the patient.

Keywords— IoT, Remote monitoring, Sensors, Cloud, Data Analysis, Alerts.

I. INTRODUCTION

The Internet of things, or IoT refers to the thousands of devices communicating among themselves via the internet, where all of them can accumulate and share the data. IoT is truly a platform where in embedded devices are connected to the net, so that they can accumulate and exchange information with each other. Connecting a majority of these specific gadgets and including sensors to them adds a stage of digital intelligence to potentially dumb gadgets, enabling them to communicate with actual-time records without much human interference. These set of factors makes the world around us smarter and greater responsive, combining virtual and bodily unity.

The main goal of this work is to develop a smart monitoring gadget for a patient. The sensors capture the various parameters of the patient. Consequently, based on the status of the captured parameters the doctor can determine the patient's health condition and suggest appropriate medication.

A. Problem Statement

In this paper the patient's heart rate, body temperature and body movement can be monitored. Details can also be sent to the cloud for further analysis and recording. The concept of IoT, Arduino UNO and sensors were used to develop the system. Since real-time data is constantly being monitored,

doctors can be alerted if any abnormality is indicated. Reliability can be further improved by the use of Raspberry Pi. The paper is organized as follows: Section I provides an introduction to the topic, Section II deals with Literature Review, Proposed Methodology is discussed in Section III which discusses in details about the proposed block diagram and flow diagram, Section IV discusses about the Results and Section V includes the conclusion and future work.

II. LITERATURE REVIEW

The body temperature of the patient can be constantly monitored by a fitness care system as in [1]. The real time monitoring is enabled by Zig Bee Trap protocol. Sanitarium data is stored in the cloud. Synchronous IoT gadgets predict first-rate tracking with simple tracking and statistics collection and measure comparable maintenance and analysis costs.

[2] Proposes the machine and use of emergency medical offerings in according with the IoT health monitoring gadget. This machine reduced the problems related to the affected person's health and the fee of health care. Collecting, recording, and analyzing the data by the technology and providing remote health assistance alleviates a patient's problem of regular visits to hospitals.

The unusual body movements and unexpected falls can be identified by the real-time fitness tracking machine as in [3]. Biosensors connected to the microcontroller will display the crucial health of the patient. If any of the pre-determined limits are exceeded, the sensor readings will be dispatched to the physician and patient's assistant by using textual message.

[4] Discusses the wearable generation of the remote fitness care device. The paper describes the implementation of tele-health packages for the aged and diverse continual diseases and their significance.

The improvement of contemporary medicinal drug, the effective and secure use of health care technology was discussed in [5] which are critical for any health care system. The concerns regarding the shortage of scientific equipments for health care were raised. The paper emphasized the need of development of biomedical equipments and shielding measures that helps to enhance the health care.

A gadget was proposed in [6] that ensures high quality service with price. The system based on GSM and GPS can be used to remotely monitor the health condition and communicate with a medical expert.

The developed device in [7] introduced the layout of an intelligent IoT fitness care gadget using micro-controllers. In this case, sensors along with micro-controllers are used to capture and analyze the health parameters. The communication can be established by Wi-Fi technology. The details can also be displayed via LCD. Specialists can log in to obtain the facts at the page's html web site. An evaluation framework is being developed to assess the physical well being of the patient.

The developed system as in [8] introduces health programs based on Wi-Fi nerve networks. The benefits the system includes the early detection based on the analysis of the obtained parameters with reference to the data base. The remote system enables health care in a completely unique, real-time and green way as discussed in [9-12].

III. PROPOSED METHODOLOGY

The objective of the paper is to develop a system to monitor the health parameters of patients and to continuously record it. The information can be conveyed over Internet to the concerned doctor and the medical assistant. In this paper the patient's heart rate, body temperature and body movement are measured. The details can be send to cloud for further analysis and recording. A system can also be introduced to alert the doctor or medical assistant. Remote Health monitoring system can be developed to collect the data which can be analyzed by the doctors so as to aid remote health monitoring through the Internet. An alert system can also be introduced to notify the concerned persons. Another highlight of the proposed system is the provision of sending SMS/Email alert using PHP APPLICATION, if any of the health parameters crosses the threshold value.

A. Proposed System Block Diagram

The proposed system consists of various sensors attached to the body of the patient which transmits the acquired information to the processing unit. In this paper, RaspberryPi will be used as the data processor. The patient's smartphone / computer and the doctor's computer are used as monitoring systems.

The proposed remote health monitoring system is used to obtain vital parameters of the patient which in turn is converted into signals. The RaspberryPi provides the processing, which constitutes the IoT phase. The above details can be send to the doctor and the medical assistant. The information can be displayed and also be send to the cloud as shown in Fig.1. The doctor can access this information via a smart device.

In this paper multiple sensors can be used to capture the health parameters and can be displayed on the monitor. The captured data can be stored in the cloud for future use and analysis as shown in Fig.1. If any parameter exceeds the permissible limit the warning email is automatically sent to the patient to contact a physician for further treatment. Fig.2 represents the Circuit Configuration of the proposed system. Fig.3 represents the flow of the proposed word.

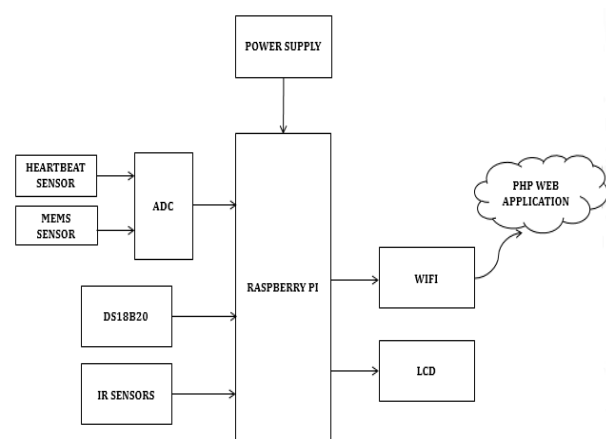


Fig.1. Block Diagram of the Proposed system

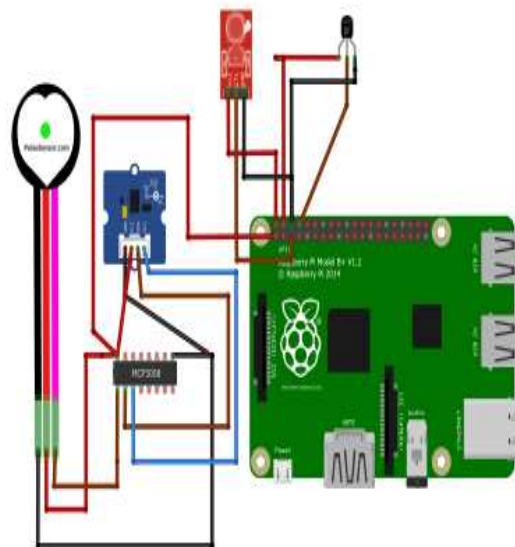


Fig.2. Circuit Configuration of the proposed system

B. Flow Diagram of the Proposed System

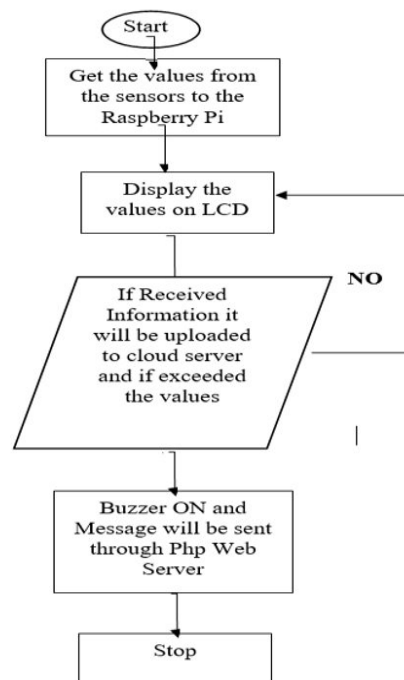


Fig.3. Flow Diagram

IV. RESULTS AND DISCUSSION

The virtual network computer system depends on the platform. This means that a client running on one type of application cannot connect to a VNC server running on a different type of application as shown in Fig.4. Body temperature sensor, pulse rate sensor, MEMS sensor, Heartbeat sensor, Saline level sensor and humidity sensor values are collected.

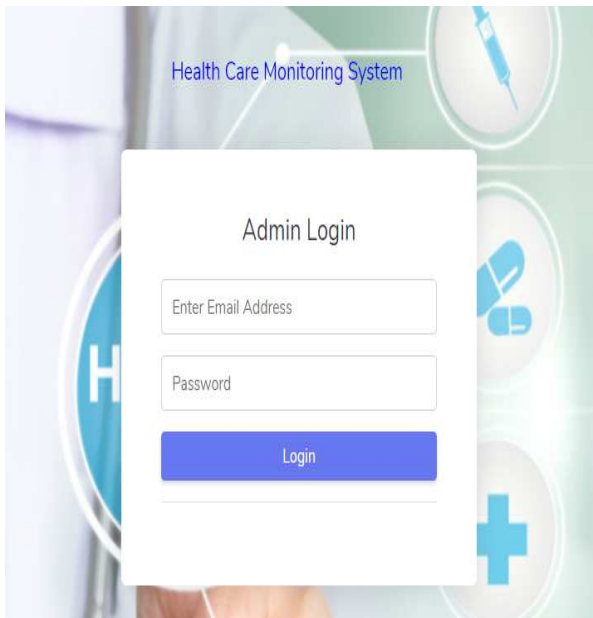


Fig.4. VNC Viewer Login

Real time sensor values are displayed on the LCD display as shown in Fig.5 which facilitates assessment of the health condition by the medical assistant. The captured sensor values are also transmitted to the data server. IoT application platform enables the authorized medical expert to can access this data from the cloud. Based on these results, the patient's health condition is diagnosed.

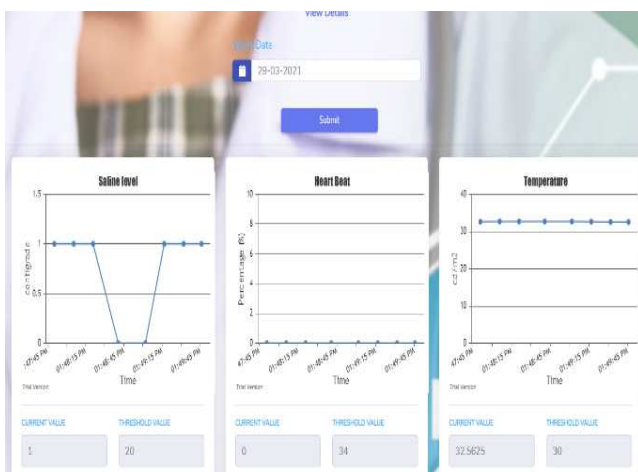


Fig.5. Display of the sensor outputs

The body movements of the patient can be obtained from the MEMS sensor which finds application in remotely monitoring a paralyzed person. Output of MEMS sensor is

shown in Fig.6. Body movements can be monitored remotely by a physician. Therefore, all the sensor inputs can be integrated and the data can be simulated and detection of physiological conditions can be made using NOOBS software.



Fig.6. Output of MEMS sensor

V. CONCLUSION

The Internet of Things provides one of the most accessible solutions especially in health monitoring. The remote health monitoring system based on IoT monitors body parameters using various sensors, which are also displayed on the LCD. The proposed scheme creates an environment conducive to the wellbeing needs of the patient. IoT health care is a potential area where opportunities are unlimited. The captured data are sent to a medical server using wireless technology. The data can be analyzed by an authorized medical expert by using the IoT platform. This unique system is also used for providing timely assistance and medication to patients. The data can be further analyzed using machine learning algorithms and predictions related to health conditions can be made which can provide assistance for the physician.

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