

IoT Based Covid-19 Patient Health Monitoring System Using Wi-Fi

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ABSTRACT

Healthcare is given the extreme importance now a- days by each country with the advent of the novel corona virus. So in this aspect, an IoT based health monitoring system is the best solution for such an epidemic. With an improvement in technology and miniaturization of sensors, there have been attempts to utilize the new technology in various areas to improve the quality of human life. As a result, this project is an attempt to solve a health care problem currently society is facing COVID-19. The main objective of the project was to design for to reduce the corona virus, reduce the components and man power. The framework can be utilized to constantly screen the well being parameters of a patient. The body temperature, heart rate and spo2 can be measured from anyplace on the globe utilizing IoT (Internet of Things). IoT monitoring of health helps in preventing the spread of disease as well as to get a proper diagnosis of the state of health, even if the doctor is at far distance. It proposed a nonstop checking and control instrument to screen the patient condition and store the patient information's in server utilizing Wi-Fi Module based remote correspondence. Hence the proposed architecture collects the sensor data through ESP32 micro controller and relays it to the Wi-Fi where it is processed and analyzed for remote viewing

Keywords—Patient, temperature, Heart rate, Internet of Things.

INTRODUCTION

Health is always a major concern in every growth the human race is advancing in terms of technology. Like the recent corona virus attack that has ruined the economy of China to an extent is an example how health care has become of major importance. In such areas where the epidemic is spread, it is always a better idea to monitor these patients using remote health monitoring technology. So Internet of Things (IoT) based health monitoring system is the current solution for it [1]. Remote Patient Monitoring arrangement empowers observation of patients outside of customary clinical settings (e.g. at home), which expands access to human services offices at bring down expenses [2]. The core objective of this project is the design and implementation of a smart patient health tracking system that uses Sensors to track patient health and uses internet to inform their loved ones in case of any issues. The objective of developing monitoring systems is to reduce health care costs by reducing physician office visits, hospitalizations, and diagnostic testing procedure [3]. Each of our bodies utilizes temperature and also pulse acknowledging to peruse understanding wellbeing. The sensors are linked to a microcontroller to track the status which is thus interfaced to a LCD screen and additionally remote association with have the capacity to exchange alarms. If framework finds any sudden changes in understanding heart beat or body temperature, the framework consequently alarms the client about the patients status over IOT and

further more indicates subtle elements of pulse and temperature of patient live in the web. In this manner IOT set up tolerant wellbeing following framework viably utilizes web to screen quiet wellbeing measurements and spare persists time. There is a significant capability between SMS based patient flourishing viewing and IOT based patient checking framework. In IOT based framework, subtle parts of the patient flourishing can be seen by different clients [4]. The explanation behind this is the information should be checked by passing by a site or URL. While, in GSM based patient viewing, the flourishing parameters are sent utilizing GSM by strategies for SMS. In most of the rural areas, the medical facility would not be in a hand reach distance for the natives [5]. So normally the people neglect any kind of minor health issues which is shown in early stages by variation of vital elements like body temperature, heartbeat rate etc. Once the health issue has been increased to a critical stage and the life of the person is endangered, then they take medical assistance, which can cause an unnecessary waste of their earnings. This also comes into account especially when certain epidemic is spread in an area where the reach of doctors is impossible. So to avoid the spread of disease, if a smart sensor is given to patients, who can be monitored from a distance would be a practical solution to save many lives [6]. In this paper section II describes about the proposed system, section III describes about the experimental setup including the circuit and section IV about the algorithm used in the implementation. The paper discusses the experimental results in section V.

PROPOSED SYSTEM

The core objective of this project is the design and implementation of a smart patient health tracking system. Fig.1 shows the overview of the proposed system. The sensors are embedded on the patient body to sense the temperature and heartbeat of the patient. Two more sensors are placed at home to sense the humidity and the temperature of the room where the patient is staying. These sensors are connected to a control unit, which calculates the values of all the four sensors. These calculated values are then transmitted through a IoT cloud to the base station. From the base station the values are then accessed by the doctor at any other location. Thus based on the temperature and heart beat values and the room sensor values, the doctor can decide the state of the patient and appropriate measures can be taken.

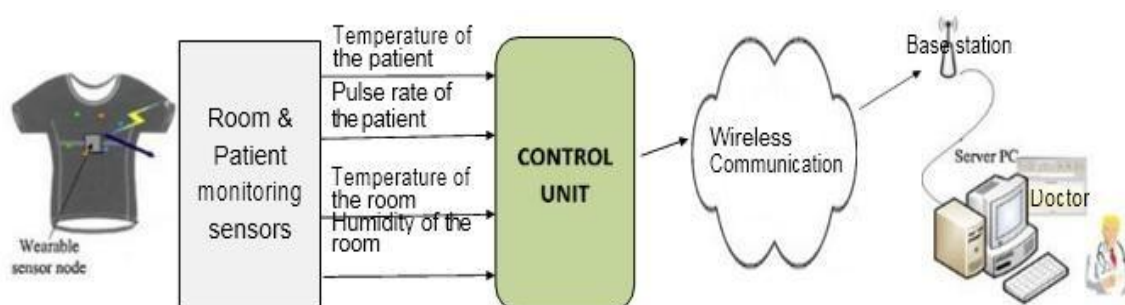


Fig. 1: Proposed System

Sensors

The temperature sensor connected to the analog pin of the arduino controller is converted into digital value with the help of ADC [10]. Using this digital data, the controller converts it into the actual temperature value in degree Celsius using the equation: $\text{temperature } (^{\circ}\text{C}) = [\text{raw ADC value} * 5 / 4095 - (400 / 1000)] * (19.5 / 1000)$ The heartbeat sensor is based on the principle of photo plethysmography. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (a vascular region) [7]. The digital pulses are given to a microcontroller for calculating the heart beat rate, given by the formula: $\text{BPM (Beats per minute)} = 60 * f$, where f is the pulse frequency A humidity sensor (or hygrometer) senses, measures and reports both moisture and air temperature. Humidity sensors work by detecting changes that alter electrical currents or temperature in the air. The relative humidity is calculated as given below:
 $\text{Voltage} = (\text{ADC Value} / 1023.0) * 5.0$; $\text{Percent relative humidity} = (\text{Voltage} - 0.958) / 0.0307$;

IoT Server

At whatever point the patient goes to the healing center premises, sensors sense the physiological signs and these signs are changed over to electrical signs [8]. Then simple electrical flag is changed over to advanced flag (computerized information) which is put away in RFID. The put way computerized information is transmitted through Zigbee Protocol to the neighborhood server Zigbee is appropriate convention for this framework. It comprises of greatest number of cell hubs. It is more favored for gadgets which are littler in measure and expend less vitality. From nearby server the information is exchanged to the therapeutic server through WLAN. Medicinal server comprises of substantial database as given in Table I. At the point when the information is exchanged to the therapeutic server, it checks whether the patient has any past medicinal record then the server adds the new information to that record and exchanges to the specialist. In the event that patient does not have any past therapeutic record then the server makes new ID and stores the information in its database [9]. This information is exchanged to the specialist for diagnosis.

EXPERIMENTAL SETUP

The body temperature, humidity and pulse rate sensors are monitored and initially displayed on LCD . The values from the sensors especially the body temperature sensor and the pulse rate sensor is stored in the database. Similarly, to determine the health state of the patient, different range of pulse rate reading is also considered Based on these different range values, the rules for diagnosing the disease of the patient is performed. The output health state is diagnosed with the following membership function: Healthy, Unwell, Hypothermia, Fever and Needs a detailed health checkup. These rules for diagnosis can be summarized by considering all the combinations of membership functions of the body temperature and the pulse rate as given below

- If the pulse rate and body temperature are (Low & Low) OR (Low & High) OR (High & Low) OR (High & High)
- Then the patient has to immediately go for a detailed Health Checkup.
- If the pulse rate and body temperature are (Low & normal) OR (High & Normal), then the patient is considered to be unwell.
- If the pulse rate and body temperature are (Normal & Low) then the patient is considered to be in a

hypothermiastate.

- If the pulse rate and body temperature are (Normal & High) then the patient is considered to be having fever.
- If the pulse rate and body temperature are (Normal & Normal) then the patient is considered to be healthy

EXPERIMENTAL RESULTS

The body temperature sensor, pulse rate sensor, room temperature and humidity sensor values are calibrated using the microcontroller. The complete prototype of the health monitoring system with the sensors, where it shows the output values of the sensors calculated and displayed in a LCD display, so that these values are visible even to the patient. These sensor values are then sent to the database server. These data can be accessed from cloud by the authorized users using the IoT application platform. The sensor values of the patient is displayed in the application. Based on these values received, the disease of the patient is diagnosed by applying the rules. The diagnosis of the health state performed by the medical practitioner. The medications can be prescribed and appropriate action can be suggested by the doctor even from a distance. When the pulse rate value was taken as 82.8 BPM (Normal) and the body temperature as 37°C (Normal), then the output value of health state is 91.4, which comes in the membership function Healthy. So for all combinations of the input sensors, the output health state can be simulated and diagnosed using the Matlab simulation.

CONCLUSION

The Internet of Things is considered now as one of the feasible solutions for any remote value tracking especially in the field of health monitoring. It facilitates that the individual prosperity parameter data is secured inside the cloud, stays in the hospital are reduced for conventional routine examinations and most important that the health can be monitored and disease diagnosed by any doctor at any distance. In this paper, an IoT based health monitoring system was developed. The system monitored body temperature, pulse rate and room humidity and temperature using sensors, which are also displayed on a LCD. These sensor values are then sent to a medical server using wireless communication. These data are then received in an authorized personal's smart phone with IoT platform. With the values received the doctor then diagnoses the disease and the state of health of the patient.

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