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Advanced IoT Based Patient Health Monitoring System by Web-Server Technology

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ABSTRACT

An Internet of Things- (IoT-) based health monitoring systems are possibly enormously advantageous for patients. Here, we presents an IoT-based system that is a real-time health monitoring system utilizing the measured values of body temperature, pulse rate, and oxygen saturation of the patients, which are the most important measurements required for critical care. System consists of a liquid crystal display (LCD) that shows the measured temperature, pulse rate, and oxygen saturation level and can be easily synchronized with a mobile application for instant access. The proposed IoT-based method uses a Raspberry Pi -based system, and it was tested and verified for several human test subjects. The results obtained from the system were promising: the data ac- quired from the system are stored very quickly. The results obtained from the system were found to be accurate when compared to other commercially avail- able devices.

Keyword: Healthcare monitoring system, IoT; Raspberry Pi; Sensor interfacing

I. INTRODUCTION

Wellness encompasses not even just the avoidance of sickness, but also physical, mental, and social well-being. The desire for a better existence extends to physical well-being. Unfortunately, as a consequence of limited health care, significant differences between rural and urban regions, and physician and nurse shortages at critical periods, the global medical crisis has produced a contradiction.

IoT is a new technical development that connects stuff. IoT systems include intelligent condition monitoring [1, 2], intelligent parking [3, 4], intelligent homes [5, 6], intelligent cities [5, 6], and intelligent industrial sites [7, 8]. The IoT is most often used in healthcare management to track the health of patients and their surroundings. Utilizing sensors and networking, machines are linked to the internet [9, 10]. Those components might be employed in health-monitoring devices.

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M2M devices, which include computer peripherals, human-machine interfaces, portable devices, and smartphones, receive data from sensors [11]. Any health condition may benefit from this way of monitoring and enhancing treatment. A programmable user interface [12], assistive technology [13], and mental health management are all examples of modern systems.

Heart rate and body temperature are the two most important health markers. The pulse rate is the number of times the heart beats each minute. Increase the blood flow volume to calculate the palpitations. Regular people's emotional prices differ from 80 to 100 beats per minute. IoT has been used in much major medical re-search to track patient health. Males' resting heart rates are approximately 70 beats per minute, whereas females' resting heart rates are around 75 beats per minute [15]. Females aged 12 and above had a higher prevalence of cardiovascular disease than men. The total quantity of heat emitted by the body is calculated using scientific methods. A typical person's body temperature is affected by a number of variables, including ambient temperature, gender, and diet. In healthy people, it usually ranges between 97.8 and 99.2°F (36.5-37.2°C). Temperature changes may be caused by the flu, low- temperature hypothermia, or any other ailment. Fever is a common symptom [16]. Heart rate and body temperature may be measured using both invasive and non-invasive procedures. Unobtrusive techniques are accurate and simple for consumers [17]. It is proposed that hospitals offer adequate room settings for patients [18]. Variables like humidity and CO2 levels influence the quality of the indoor environment. Toxic substances and certain humidity levels affect patients. The humidity level in the room should be between 30 and 65 percent for maximum comfort.

The research [19, 20] is restricted to a smart house [27] that developed a patient monitoring kit based on the IoT. Heart rate, electrocardiogram (ECG), body temperature, and respiration were all measured in the public. As far as hardware goes, a temperature sensor and a Raspberry Pi are utilized. The data from the sensors was gathered, analysed on a Raspberry Pi, and then sent back to the IoT network. The system is lacking in terms of data visualization interfaces, which is a major flaw. Banerjee et al. [28] presented a device for the non-intrusive detection of heart rate. The proposed system utilized rhizome, and indeed the data was displayed digitally, allowing for real-time monitoring.

This approach is comparable to other invasive therapies in terms of safety. Grego ski et al. [29] have developed a smartphone-based HRV system. The device measured finger blood flow and used that information to determine cardiac ischemia. The suggested solution called for an integrated gadget which thus automatically relayed their pulse to a computer, rather than utilizing their hands to detect their heart rate. Although this is a fantastic idea, it is not viable for continuous cardiac monitoring. developed a completely working smartphone-based coronary heart disease protection system. Highly dependent on real-time cardiac rhythm monitoring, the design was also incapable of identifying heart problems. They demonstrated a framework for monitoring health metrics on a smartphone depending on a Microcontroller. This Arduino Uno board receives the data from the analogue sensor. The inbuilt analogue to digital converter converts the gathered electromagnetic quantities to electronic. The morphological attributes of the gadget were sent through Bluetooth.

In this work, presents an IoT-based system that is a real-time health monitoring system utilizing the measured values of body temperature, pulse rate, and oxygen saturation of the patients. The Broadband component is made up of a little module. created a safety monitor for the IoT. The framework is divided into three levels: con- trol, device, and transport. In the

regulatory region, a DS18B20 sensor monitors body temperature, while a sensor module detects pulse. Eventually, the foun-dations com- ponent gathered server data. Some sensors could not be handled properly because to someone using an Arduino Uno board built a wireless sensor network (WSN) to track intelligent systems and heart palpitations. Spartan3 is a data processing FPGA that is used to analyze data in parallel. The inputs are dis-played on a Display, and all sensors are linked to something like a Microprocessor. Machine components, on the other hand, have not yet been completely integrated.

II. PROPOSED METHODOLOGY

The primary concept behind the system that we have presented is continuous health monitoring, which is why the system has a three-stage design. Fig. 1 shows the block diagram of the proposed system.

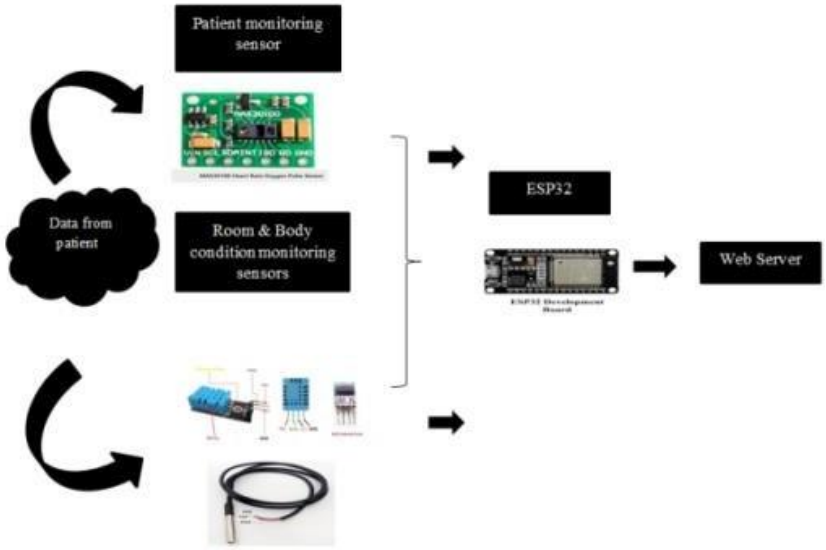

Fig. 1 Block diagram

These modules include the following:

- Sensor module.
- Information processing.
- Internet user.

The structure is implemented from a number of different hardware devices. During the implementation step, all of the hardware components are joined together. By connecting the Circuit board towards the device's physical pins, it is physically connected to all of the sensors. The ESP32 is used as a processing device since it has a Wi-Fi module that is incorporated into the circuit board.

A connection is established between the voltage-controlled and ground-connected pins of each sensor and their respective voltage-controlled and ground-connected pins on ESP32 microcontroller. When the signal pin of the heartbeat sensor is connected to the ESP32's D26 pin, the heartbeat sensor is deemed to be operational. A patient falls under this category. The DHT11's data pin is linked to the ESP32's D14 pin to monitor the room's temperature. In this arrangement, the DHT11 just measures the room's relative humidity.

A variety of hardware components make up this system. Fig. 2 shows the circuit diagram of the system. The approach was tried on a variety of individuals of varied ages and situations. Under test settings, we manually analyzed the discrepancy be- tween real and observed values from sensors including pulse, body temperature, and ambient temperature. This procedure was utilized for all sensors. The room temperature sensor is not used, therefore only humidity is detected. We have utilized the data to evaluate the system. Heartbeat, body, and room temperature data are given together with the error rate for each sensor.

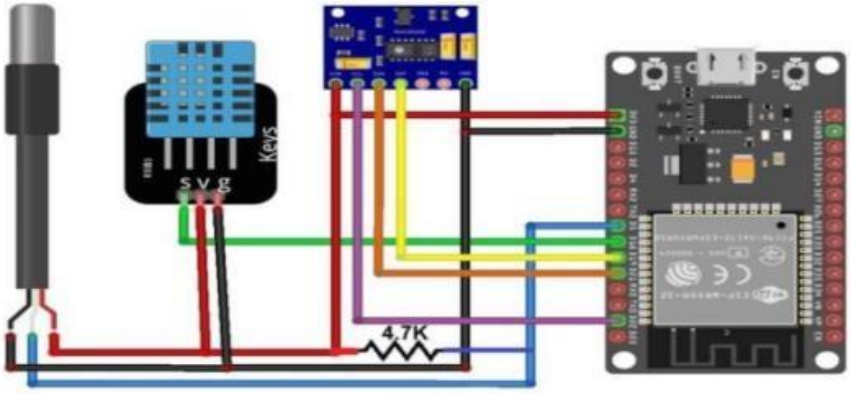

Fig. 2: Circuit diagram

As can be seen, the true and seen data vary somewhat in this circumstance. A motion artefact caused by the patient's movement during treatment causes the divergence. In certain cases, sensor misalignment causes inaccurate data recording. Furthermore, light dispersion from a variety of sources adds to the divergence of the light spectrum. Light dispersion from various sources also contributes to the spectrum's divergence. The designed system monitors heart rate, body temperature, and room humidity, and the error rate is shown in the sections below. The greatest mis-take rates are 5.28 percent, 0.92 percent, and 5.17 percent, while the lowest are 0.88 percent,

1.64 percent, and 1.47 percent. The error rate in each scenario is less than 6%, which is considered acceptable.

A doctor operating from afar may use data to make a conclusion. The smart health environment establishes a threshold for various indications, as discussed below. If the data reaches a specific level, medical workers may be more motivated to take-action.

In this paper, we will monitor the heart rate data, spo2 rate, body temperature, sur- rounding temperature and humidity. In this module max30100 sensor measures the patient heart rate and Spo2, DS18B20 is a sensor which measures the body temperature and DHT11/DHT22 measures the patient surrounding temperature and humidity. DHT11 data will help us to maintain the room properly. This module is specially designed for the covid effected patients and old aged people. Figure 3 shows the hardware circuit for IoT operations.

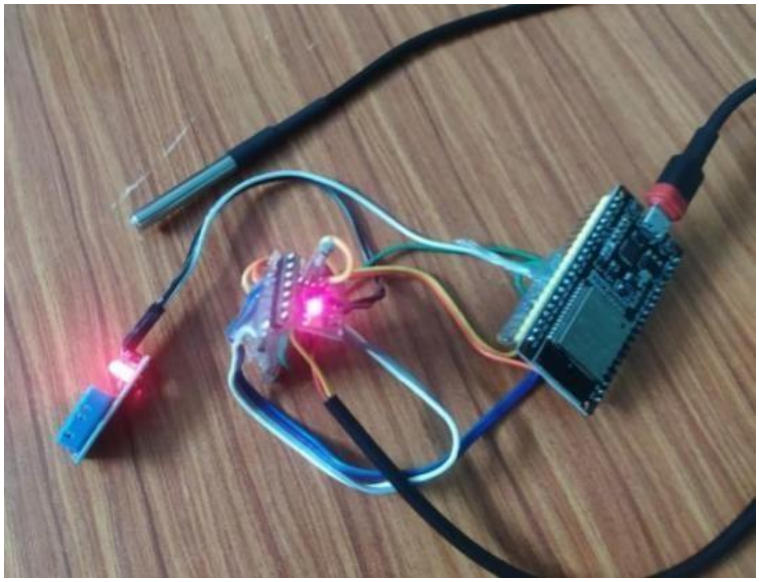

Fig 3. Hardware circuit

Doctors need to go directly and check the covid patient health, in this process there is a possibility of doctors also get effected by the covid. So, by using this module, we can get the patient health monitoring data like heart rate, spo2 rate and body temperature continuously in web server without any direct contact with the patient by using mobile or laptop which are shown in Fig. 4 and Fig. 5 respectively. Initially when we run the module, we will get an ip address that should be copied and pasted in the mobile or laptop browser then we will get the data as shown below. In web server for every 2 seconds data automatically updates without human intervention.

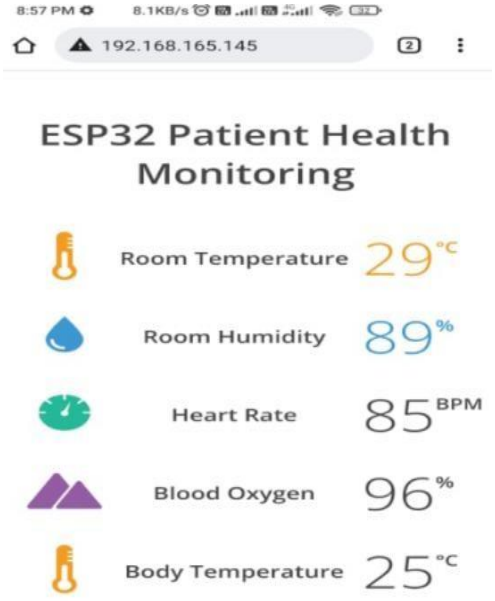

Fig 4. Results in mobile phone

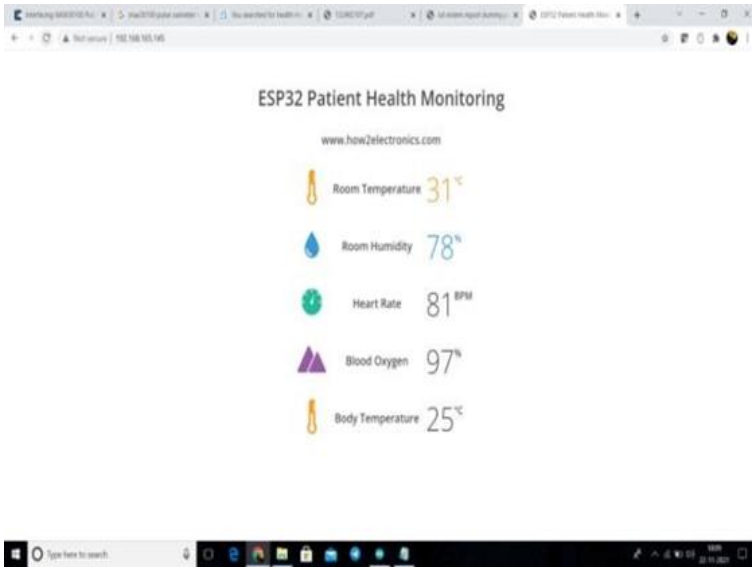

Fig 5. Result obtained from Laptop

III. CONCLUSION

Patient Health Monitoring is beyond the apple accept started to analyze assorted abstruse explanations in order to improve healthcare accouterment in an address that accompaniments absolute casework by assembling the abeyant of IoT. Similarly, as for every thought of traditional system, this framework even now being used from their manufacturing Be that as it is thick, as cumbersome with handle separately Also extent Furthermore expense need aid also additional contrasted with those propel framework What's more also it detracts more than 1minute for getting the correct come about. The health-monitoring system takes less than a minute to compute the result of ECG, Blood Pressure and Temperature Monitoring. Scope also decreases likened to the conservative scheme because combination of no. of medicinal data sensors on a sole piece. So, Time-cost Complication is reduced. When comparing observed data to true data in the existing healthcare system, the success ratio is often more than 95 percent in all scenarios. Despite the fact that the tests are performed outside of a hospital, actual healthcare practitioners are able to witness and track the findings instantaneously as they occur. The technology may be beneficial to nurses and doctors in the event of an epidemic or crisis since raw medical data can be processed and examined in a short period of time. The proto-type was created with ease of assembly and operation in mind. It is possible that the approach will aid you in improving your general health if you have an infectious disease such as coronavirus (COVID-19). The newly developed technology will improve the current healthcare systems, and it is possible that it may save many lives.

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