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Retraction

Retracted: IoT-Based Health Monitoring System Development and Analysis

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] M. M. Khan, T. M. Alanazi, A. A. Albraikan, and F. A. Almalki, "IoT-Based Health Monitoring System Development and Analysis," *Security and Communication Networks*, vol. 2022, Article ID 9639195, 11 pages, 2022.

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Research Article

IoT-Based Health Monitoring System Development and Analysis

Mohammad Monirujjaman Khan,[1] **Turki M. Alanazi**,[2] **Amani Abdulrahman Albraikan**,[3] **and Faris A. Almalki**[4]

[1]*Department of Electrical and Computer Engineering, North South University, Bashundhara, Dhaka-1229, Bangladesh*
[2]*Department of Electrical Engineering, College of Engineering, Jouf University, Sakaka, Saudi Arabia*
[3]*Department of Computer Science, College of Computer and Information Sciences, Princess Nourah Bint Abdulrahman University, P. O. Box 84428, Riyadh 11671, Saudi Arabia*
[4]*Department of Computer Engineering, College of Computers and Information Technology, Taif University, P. O. Box 11099, Taif 21944, Saudi Arabia*

Correspondence should be addressed to Mohammad Monirujjaman Khan; monirkhan.qmul@gmail.com

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This paper presents the design and implementation of a health monitoring system using the Internet of Things (IoT). In present days, with the expansion of innovations, specialists are always looking for innovative electronic devices for easier identification of irregularities within the body. IoT-enabled technologies enable the possibility of developing novel and noninvasive clinical support systems. This paper presents a health care monitoring system. In particular, COVID-19 patients, high blood pressure patients, diabetic patients, etc., in a rural area in a developing country, such as Bangladesh, do not have instant access to health or emergency clinics for testing. Buying individual instruments or continuous visitation to hospitals is also expensive for the regular population. The system we developed will measure a patient's body temperature, heartbeat, and oxygen saturation (SpO2) levels in the blood and send the data to a mobile application using Bluetooth. The mobile application was created via the Massachusetts Institute of Technology (MIT) inventor app and will receive the data from the device over Bluetooth. The physical, logical, and application layers are the three layers that make up the system. The logical layer processes the data collected by the sensors in the physical layer. Media access management and intersensor communications are handled by the logical layer. Depending on the logical layer's processed data, the application layer makes decisions. The main objective is to increase affordability for regular people. Besides sustainability in the context of finance, patients will have easy access to personal healthcare. This paper presents an IoT-based system that will simplify the utilization of an otherwise complicated medical device at a minimum cost while sitting at home. A 95 percent confidence interval with a 5 percent maximum relative error is applied to all measurements related to determining the patient's health parameters. The use of these devices as support tools by the general public in a certain situation could have a big impact on their own lives.

1. Introduction

These days, the expansion of innovations by wellbeing specialists is exploiting these electronic devices [1]. IoT devices are profoundly utilized in the clinical area. In this paper, the research is about an IoT-based health monitoring system. In particular, for COVID-19 patients, high blood pressure patients, hypertension patients, diabetic patients, etc., in a country territory, in rural areas, the number of doctors is not exactly the same as in urban areas. Medical equipment is not readily available in rural areas, except for government medical centers. The percentage of patients in these clinics is greater than that in government medical facilities. Similarly, the equipment has, for the most part, ended. As a result, if an emergency situation arises, this hardware component will send a report to the physicians or medical professionals as soon as possible. The remaining work will be done by doctors based on their reports. The IoT health-monitoring platform has provided us with a significant benefit in the advancement of contemporary medicine. IoT devices are widely used in the medical sector. And the technology we are talking about is a patient health monitoring system that uses the IoT. A sensor in this health monitoring system will collect information about the patient's health condition. It is smaller in size, faster, and more affordable. This system can be used to measure the oxygen saturation level, heart rate, and temperature of the human body and display the results on a web-based platform. The physical, logical, and application layers are the three layers of the system. It is a multi-parameter monitoring system that will monitor oxygen saturation level, heart rate, and temperature simultaneously. The term "IoT" was first referenced by Kevin Ashtor in 1998.

To begin with, as an apparatus layer that enables connections through the use of sensors and improvements, heart rate, oxygen saturation level, respiratory flow rate, temperature, and other parameters are all measured using sensors. The primary goal of this IoT is to enhance a cosmology-based response with the ability to track the state of health. One of the "important indicators," or important measures of wellbeing in the human body, is heart rate. It counts how many times the heart contracts or beats per minute [2]. Because of continuous work, security threats, and passionate responses, the heartbeat speed changes. The resting pulse refers to a person's pulse while he or she is relaxed. While relaxing, a person's pulse rate should be between 60 and 100 beats per minute after the age of ten. During exercise, the heart beats faster. There is a recommended maximum heart rate that varies based on the person's age. It is not just the rate at which your heart beats that matters. The heartbeat state is also important, and an irregular beating can indicate a serious medical problem. The heart is a powerful organ located in the center of the chest. When the heart thumps, it transports oxygen- and nutrient-rich blood around the body while also returning waste products. A healthy heart supplies the body with just the appropriate amount of blood at precisely the right time for whatever it is doing at the time. The pulse is frequently confused with the heartbeat, which refers to how often the supply pathways expand and contract as a result of the heart's siphoning activity. Because the compressions of the heart create the expansion of pulse rate in the channels that lead to a noticeable pulse, the beat rate is probably the same as the pulse. Measuring the pulse is an instantaneous percentage of the heart in this method. The typical pulse rate for adults over the age of ten, especially elderly people, is somewhere between 60 and 100 beats per minute (bpm). Competitors who have been thoroughly prepared may have a resting pulse of less than 60 beats per minute, with some reaching 40 beats per minute. It is noticed that the heartbeats of the patients change continuously. The heart rate is not stable for patients with chronic diseases like asthma, hypertension, heart disease, Chronic Obstructive Pulmonary Disease (COPD), etc. In addition, for the COVID-19-affected people, the heart rate also varies very quickly. It is critical to keep track of these patients' heartbeats in real time, which can be done with the help of an IoT-based real-time patient monitoring system.

While individuals with coronavirus illness feel ill, their oxygen levels are often insufficient [3]. Low oxygen levels could be a precursor to the need for medical intervention. Pulse oximetry is a technology for determining the amount of oxygen-carrying hemoglobin in the blood. Most people consider it to be a vital indicator, analogous to blood pressure. With the help of a pulse oximeter, a light emission passes through the fingertip. By measuring how much light is taken in as it passes through the fingertip, the oxygen level, or saturation (SpO2), is managed. In any case, normal SpO2 levels for humans are often greater than 95%. A small number of patients with chronic lung disease or sleep apnea may have normal values of approximately 90%. A clinical expert should be counseled for SpO2 perusing underneath pattern or per office convention if the patient is a drawn-out consideration office occupant or has been recently assessed by a doctor for coronavirus-related concerns. Supplemental oxygen or different medicines may be required. Others in the network should contact a medical care supplier in the event that they experience wind or when the estimated SpO2 is less than 95%. The CDC identifies serious sickness from coronavirus in individuals who have a respiratory recurrence of more than 30 breaths every moment, SpO2, and a lower than 94% at room air adrift level (or, for patients with ongoing hypoxemia, an abatement from the pattern of more than3%). There are many patients with chronic diseases like asthma, COPD, and heart-related problems in the world. In COVID-19-affected people, the SpO2 level changes very rapidly and, without continuous monitoring, can cause death as well. It is essential to keep continuous real-time monitoring of the SpO2 level of the above-mentioned patients. Body temperature is another vital physiological parameter of humans. People with illnesses find it very essential to monitor their body temperature. High fever is one of the main symptoms of COVID-19 patients. It is very important to monitor the body temperature of such patients continuously. An IoT-based real-time SpO2 level, heart rate, and temperature monitoring system is very helpful now in the modern age. This motivates the development of an IoT-based health monitoring system.

Due to IoT-based health monitoring systems, it has become possible for users to get the necessary physiological information while sitting at home. This system has made life easier for elderly patients, as for them, the long way to the hospital can be both difficult and tiring. In this paper, we have chosen some specific sensors to detect certain problems. The system will collect data on the patient's heartbeat, oxygen saturation level, temperature, and other parameters.

IoT-based patient monitoring systems using sensors to detect, evaluate, and monitor two basic vital signs are discussed in a paper [4]. They used the Arduino Mega 2560 and ESP8266 Wi-Fi Module and two sensors modules to design an IoT-based patient monitoring system that can detect two primary vital signs of body temperature and respiratory rate, analyze the level of vital signs according to the patient's age, provide alerts for abnormal conditions, and display the results wirelessly through Android apps.

Wearable IoT-enabled real-time health monitoring system [5–9] is another work, in which the authors developed a wearable IoT-cloud-based health monitoring system for real-time individual health monitoring. The researchers used a variety of wearable sensors, including heartbeat, body temperature, and blood pressure monitors. Another example is a review of IoT-based health monitoring systems using Raspberry Pi, LPC2129, and wearable biomedical devices [10], in which researchers discussed IoT-based health monitoring systems utilizing Raspberry Pi, LPC2129, and wearable biomedical devices. An Android-based pulse monitoring system is presented in [11]. In [12], the author uses both MAX30100 and Lm35, so the author is measuring, but they show the value on the website, not on the mobile applications that are more widely available to people nowadays. The papers [1, 13] and [14] measure heartbeat and body temperature but not the oxygen level and also do not show the data in the mobile app or on the LCD display. The author of the paper [13] also measured the electrocardiogram (ECG) parameters alongside body temperature and pulse rate and showed the data on a web-based platform. Finally, in [14], the author measures everything except SpO2 and does not display the results on a mobile application. In the paper [14], the authors made this system using a different microcontroller called the ESP32, and the health parameters they discussed were body temperature and heart rate. All of them measure the heart rate and body temperature, but we also need to measure the oxygen level in our body. In the paper [15], the author used the ESP32 to connect the sensors, not the Arduino Uno. In the paper [16], the author measured body temperature and heart rate and showed the data on a website platform. In the paper [17], the author measured respiration rate alongside body temperature and heart rate and showed the value on an LCD display. In the paper [18], the author developed a system to calculate the heart rate, body temperature, and respiration rate, and the measurements will be shown in the mobile application. The author of the paper [19] introduced a solution that uses a Raspberry Pi microprocessor to record the patient's pulse rate and blood pressure and is wearable. In the paper [20], the author has made a system that can measure body temperature, heart rate, diabetes, BP, and cough detection and send the data to a mobile application as well as a wearable device. In [21], the authors have not used mobile applications in their design. In the paper [22], the author measures heart rate, body temperature, and blood pressure using an Arduino Mega. T. Y. Hoe et al. introduced a patient-centered IoT-based ECG monitoring system. In this case, the researchers only employed an ECG sensor to measure the ECG of patients [23]. In this study, the sensor is limited.

The development of an IoT-based health monitoring system is described in this study. The paper's main contribution is to create an IoT-based real-time health monitoring system. Various sensors have been used to measure the data of patients in real-time. A mobile application has also been developed. It was tested after the entire system had been developed. In this investigation, three separate real-life human test volunteers were used. In a country like Bangladesh, where most people from rural areas do not get enough medical facilities or cannot do regular testing of various types of health parameters such as pulse rate, oxygen level, body temperature, blood test, ECG, and diabetes. Since regular testing is quite costly, people from rural areas cannot go to hospitals or medical centers daily. In Bangladesh, especially in remote areas, healthcare facilities are not available. People need to travel a very long distance to get medical testing and treatment services. This system will help people who can not afford regular checkups such as pulse rate, oxygen level, and body temperature. This system is not only cost-friendly, but also easy to use. Our system will be helpful to all ages of people, particularly the elderly or Intensive Care Unit (ICU) patients. It will measure the heartbeat, oxygen saturation level, and body temperature of the patient and transfer the outcome to the web server and mobile applications. Subsequently, in the future, we can also create a website just like a mobile application to which individuals can get access and see the output by looking through the date and time. Besides, if there should be an occurrence of a crisis, the medical attendant or patient's relative looks at the patient's conditions. Our objective is to develop a system with high precision at the lowest possible cost, so anybody can utilize and manage the cost of this. This system will be very helpful now during the COVID-19 pandemic situation as well.

The first section contains an introduction. The materials and techniques are discussed in part two, and the findings and analysis are presented in section three. Finally, the conclusion is presented in section four.

2. Materials and Method

2.1. Introduction. The system's goal is to build a health monitoring system that can quickly measure a variety of health factors. In this part, the techniques and materials used in the system are detailed. The system's block diagram is presented in the first subsection. In this part, the techniques and materials used in the system are detailed. The system's block diagram is presented in the first subsection.

2.2. Block Diagram. The system's structure is depicted in Figure 1. Here, patients will measure their pulse rate and SpO2 using the max30100 sensor and body temperature using the Lm35 sensor, and patients can see measurement data in the mobile app and LCD display. The data will be shown in the mobile app with the help of a Bluetooth module that will receive data from the Arduino and save it in the cloud. From there, the data will be transferred into the mobile application, and the patients can view the measurement of the health parameters. After measuring the physiological vital data of the human body, it will be sent to the Arduino UNO, which will process the analog data into digital. After that, the data via Bluetooth module will appear on the mobile application. Measured data from the human body can be seen on the LCD display as well.

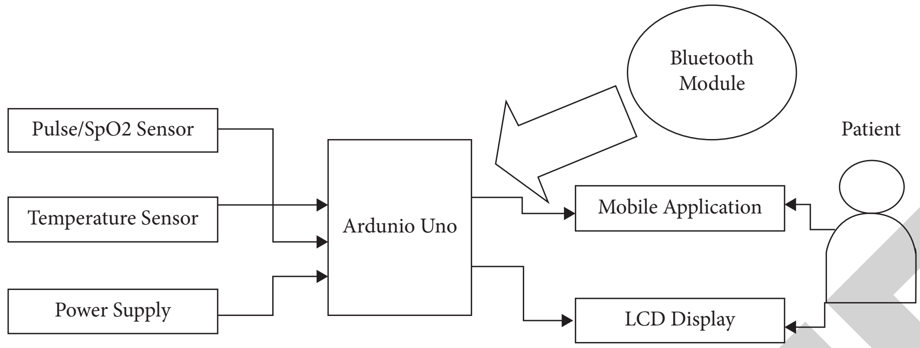

Figure 1: Block diagram of the system.

Table 1: Description of the components.

Components	Description
Arduino Uno	An open-source microcontroller based on the 8 bit ATmega238p microchip. It will work as an interface between the sensor and the mobile application described in this paper. This consists of additional components that help the microcontroller, such as a crystal oscillator, serial contact, voltage controller, etc. The Arduino Uno has 14 pins, including 6 pins for analog input, a link to the universal serial bus (USB), an ICSP header, and a reset button. The Arduino Uno provides an ICSP case.
Max 30100	The MAX30100 is a pulse oximetry and heart rate monitor sensor that can be powered by 1.8 V or 3.3 V power supply. A host microcontroller uses the I2C interface to communicate. The MAX30100 pulse oximetry subsystem consists of the ALC, a 16 bit sigma-delta ADC, and a patented disconnected time filter. It is ultra-low-powered, making it suitable for systems operating on batteries.
LM35	The LM35 is an integrated circuit temperature sensor with a temperature-dependent output voltage. It's a compact, low-cost IC that can determine temperature anywhere between -55 and 150 degrees Celsius. It can easily be interfaced with any ADC or development platform, like an Arduino microcontroller. It can be linked.
Bluetooth module HC-05	The HC-05 is a module that can provide wireless functionality. We are using this module to set up communication between the Arduino and the mobile application. The HC-05 module can easily be coupled with microcontrollers because it uses the serial port protocol (SPP). Power the module simply by using +5V and connecting the module's rx pin to the tx and the tx module pin to the MCU rx, as shown below.
LCD display	A 16×2 LCD display with I2C can show 16 characters in 2 lines. This means that you will only have four pins for the LCD display: VCC, GND, and SDA, as well as SCL.
Jumper wires	Without the requirement for soldering, flexible wire with connections on each end can be connected to other jumper wires or a pin header.
Bread board	It's a construction base.

2.3. Hardware Design. This health monitoring system consists of sensors and a microcontroller. We used the Arduino Uno as the microcontroller, and the sensors are MAX30100 (pulse rate and SPo2 measurement sensor) and LM35 (body temperature measurement sensor). And there are more components we are using, such as an HC-05 (Bluetooth module), to connect the Arduino with the mobile application and LCD display. All the needed components for the health monitoring system are described in Table 1.

Figure 2 is the circuit diagram for the system. An Arduino Uno microcontroller, two sensors (MAX30100 and LM35), a 16×2 I2C LCD display, and a Bluetooth module make up the circuit. The whole system is powered by 5V. The microcontroller (Arduino Uno) is connected to the computer using a USB (Universal Serial Bus) that sends commands to the device. The circuit was designed on an online circuit designing app called circuito.io.

Figure 3 is the prototype of the whole health monitoring system. In Figure 3, the connections between the sensors, Bluetooth module, and microcontroller are shown, as is the connection between the microcontroller and a device using a USB. Also, the data is received in the mobile application, and the serial monitor of the Arduino IDE is shown in Figure 3. The circuit is mainly made with an Arduino Uno and two sensors that can measure three human body parameters. A 5 V power supply powers the sensors, LCD display, and microcontroller. The microcontroller is connected to a laptop using a USB that sends commands to the sensors. There is also a Bluetooth module that helps mobile applications read data from the system.

2.4. Cost of Materials. The device is developed and produced at a cheap and affordable price, as shown in Table 2. Because of the system's design innovations, the overall cost of the system is Taka (Tk.) 1443, making its deployment relatively economical. The price of the parts required for the gadget to be produced is broken out in Table 2. The device was designed to sell cheaply at Bangladeshi Taka 1443, which works out to less than 17 US dollars when converted. In Table 2, the overall cost has been shown.

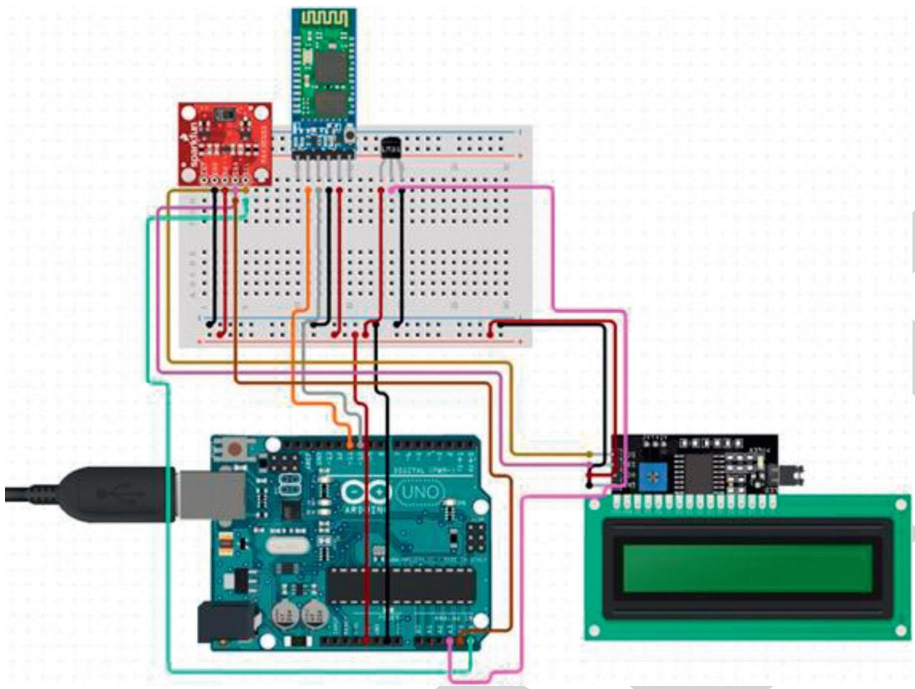

Figure 2: Circuit diagram for the system. The system displays the Arduino microcontroller, which controls the sensor to measure the health-related parameter.

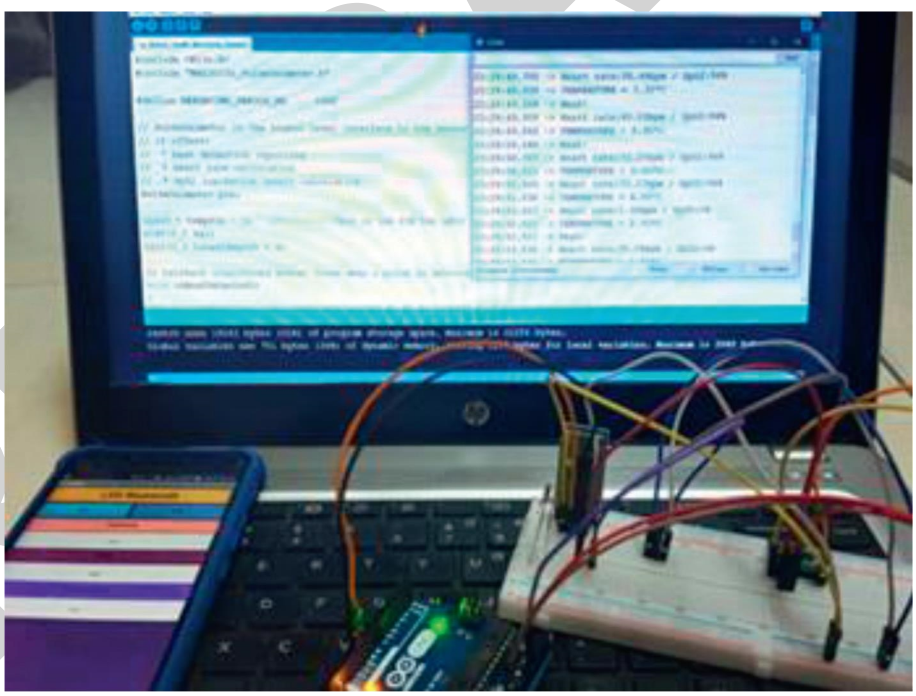

Figure 3: Prototype of the health monitoring system.

2.5. Software Materials. The mobile application was developed by the MIT inventor App. After developing the application, we simply load it onto the mobile device, and a link will be provided to download the application. After connecting the Bluetooth device to the application through scanning with the mobile, a connected message will be viewed. Then, after performing the required process, we can show our collected results on the screen. Users will use the visual block language to build applications by dragging and dropping components into the design view. This tool enables individuals worldwide to create digital solutions to pressing problems. With the help of the Bluetooth module HC-05, the microcontroller will now be connected to the mobile application. Figure 4 showcases the system from the MIT inventor's view.

Table 2: Cost of the components.

Component	Model	Quantity	Price/Unit (BDTK)	Price (BDTK)
Pulse oximeter and pulse rate sensor	MAX30100	1	300	300
Body temperature sensor	LM35	1	70	70
LCD display	16 × 2 I2C	1	273	273
Microcontroller	Arduino uno	1	430	430
Bluetooth module	HC-05	1	30	90
Jumper wires		20 × 3	280	280
Bread board		1	85	85
Total cost				1443

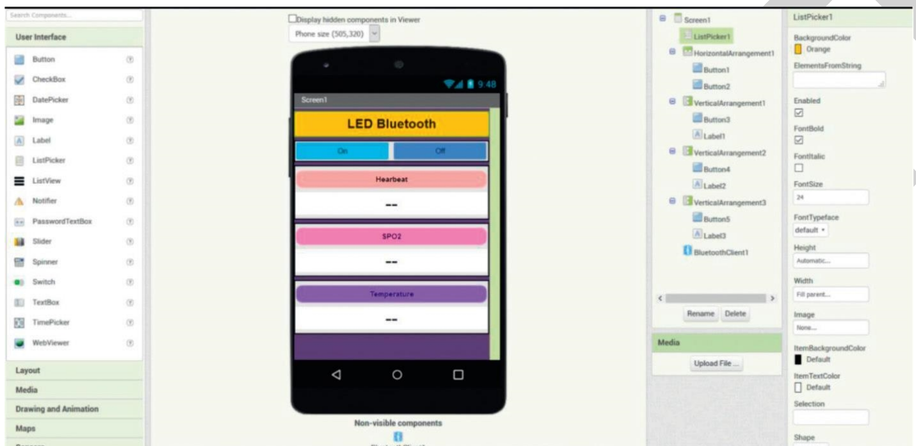

Figure 4: MIT inventor app view.

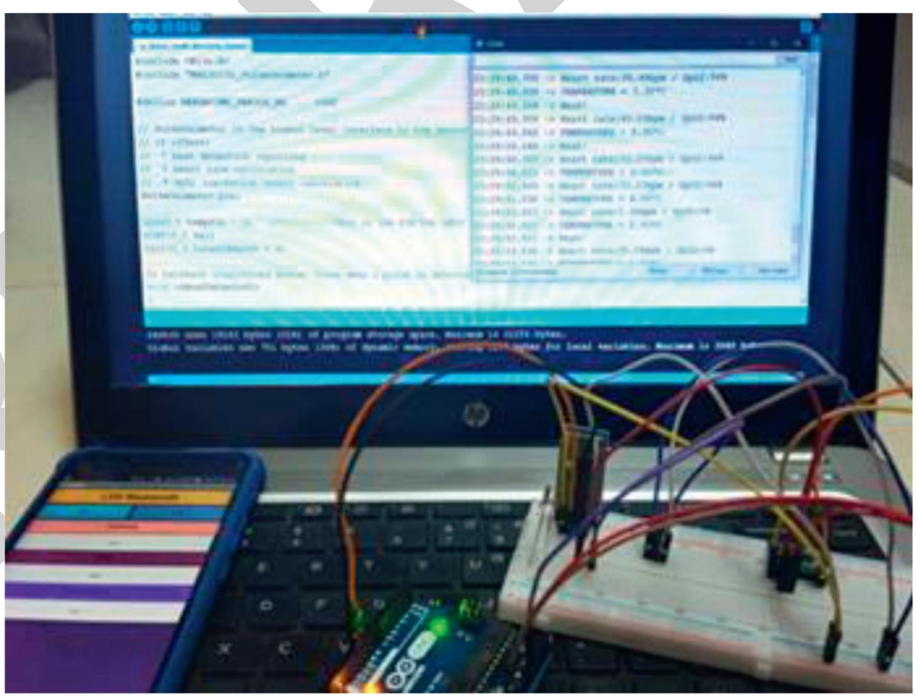

Figure 5: Diagram showing full system consisting of the mobile application and microcontroller.

3. Result and Analysis

The system created for this research study is shown in this section, along with the results obtained by the system. The completed system consists of the pulse rate and SpO2 sensors and the body temperature sensor connected to an Arduino Uno. The Arduino is connected to a device with the help of a USB, which will help power up the system. When

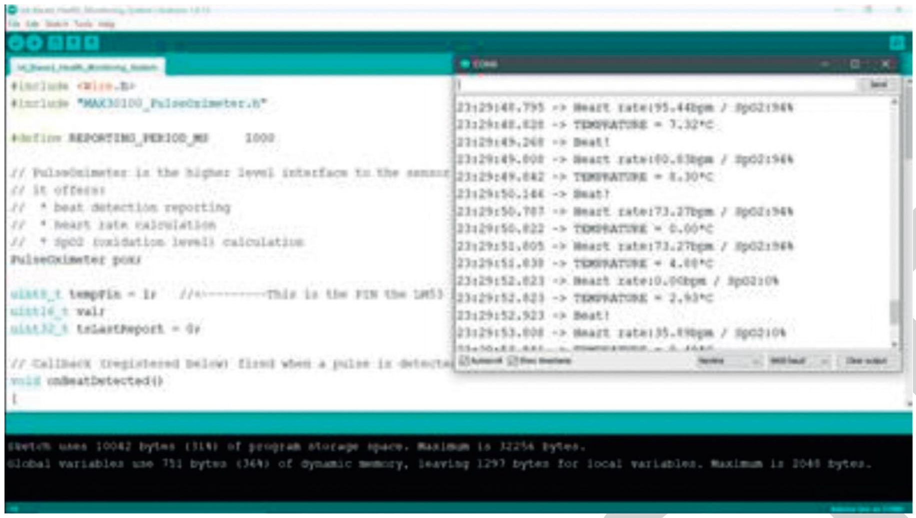

Figure 6: Diagram showing the measurement in the serial monitor of Arduino IDE.

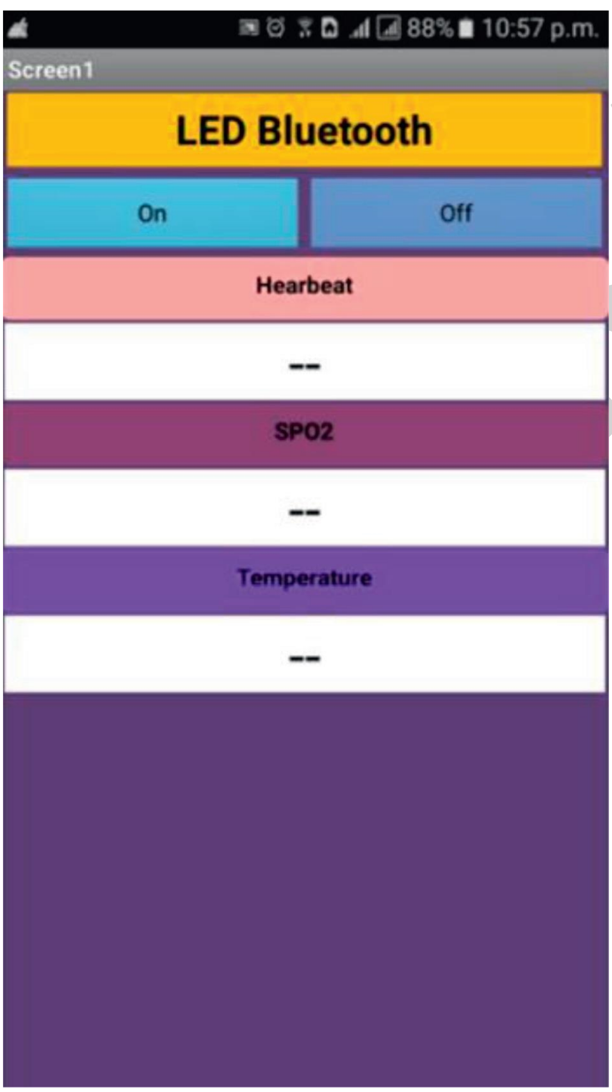

Figure 7: Diagram showing the mobile application we are using before the Bluetooth is 'On'.

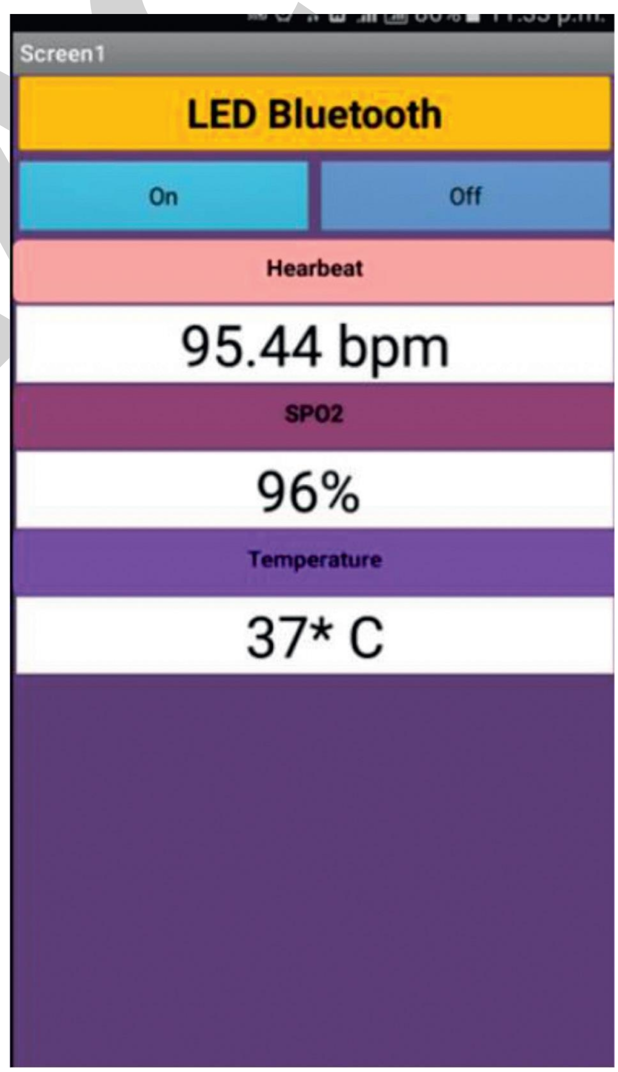

Figure 8: Diagram showing measurements in the mobile application after Bluetooth is 'On'.

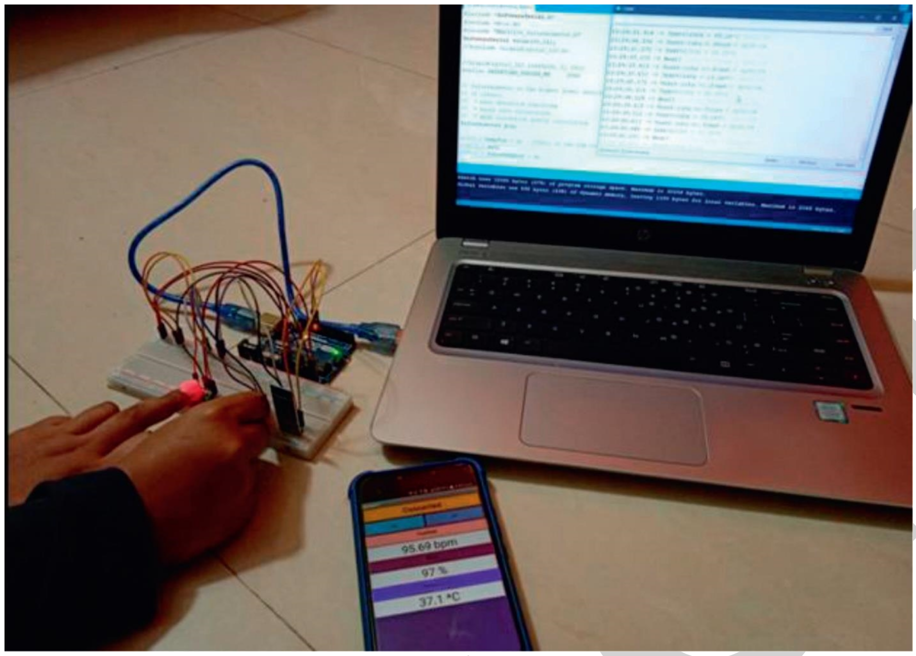

Figure 9: Diagram of “Patient 1” utilizing the IoT-based device and given their test results instantly.

we upload data to the Arduino, the system starts working, and the measurement data will be shown in the serial monitor of the Arduino Integrated Development Environment (IDE) and the Liquid Crystal Display (LCD) display, and the data will also be shown in a mobile application with the help of a Bluetooth module.

The full system diagram is shown in Figure 5, including the measurements of the pulse rate, SpO2, and body temperature, shown in the serial monitor of the Arduino IDE and in the mobile application. Figure 6 shows the data of the measurements of all the parameters in the serial monitor of the Arduino IDE. The data value is taken from the sensors MAX30100 and LM35.

In Figure 7, the Bluetooth in the system is turned on or off via the options in Part “LED Bluetooth” in the mobile application. Before turning the Bluetooth “On,” a default sign “--” representing nil will show on the screen for heartbeat, SpO2, and temperature measurement. Figure 8 shows the diagram showing measurements in the mobile application after Bluetooth is “on.” When we turn the Bluetooth “on” in Figure 8, the data will be sent into the IoT system we built via the Bluetooth device. After collecting the data, the collected results will be visible in the mobile application. It might take a moment of time, depending on the available data connection. In Figure 8, the measured heartbeat, Spo2, and temperature are displayed on the mobile application.

In Figure 9, we examined an individual to measure their heartbeat, Spo2, and body temperature. We addressed this individual as “Patient 1.” In the figure, their immediate data is collected and shown in the mobile application. The data shows that “Patient 1″ has normal health and nothing to be concerned about. And thus, they do not need to contact medical assistance.

In Figure 10, we examined an individual whom we will refer to as “Patient 2.” A similar process to “Patient 1″ has been followed, and thus, their health data was determined. However, we could see that their body temperatures were unusually high. It might mean that this individual has a high fever. Thus, this individual could monitor their health instantly and get medical assistance over the following days. If their heartbeat rate goes high or low, they could contact doctors with their data over the course of testing.

In Figure 11, we examined “Patient 3” to measure their health data in the same pattern. “Patient 3” has a higher heartbeat rate. Over the next few days, they would be able to measure their health data and figure out their own health through medical help again and again.

The test results and analysis of all the patients’ measurements for each health parameter are provided below. To test the system, three real human test subjects were used for this study. Measurement results were obtained using our developed system in this study. Real-life measurement and implementation of the system were carried out. The real-life test results obtained using the systems are shown in the following tables, consecutively. Table 3 shows body temperature measurement analysis on three different people. During the measurement, the temperature data was taken three times for each patient case. The temperature values are very close for each measurement setting of a test subject. However, due to different human bodies, the data varies slightly for each test subject.

Table 4 shows the pulse rate measurement analysis on three different people. The same people were used in this case as were used for the temperature measurement case. In Table 4, it is noted that the heart rates of three different people are comparable. The results obtained using the proposed system show standard values for heart rate. We

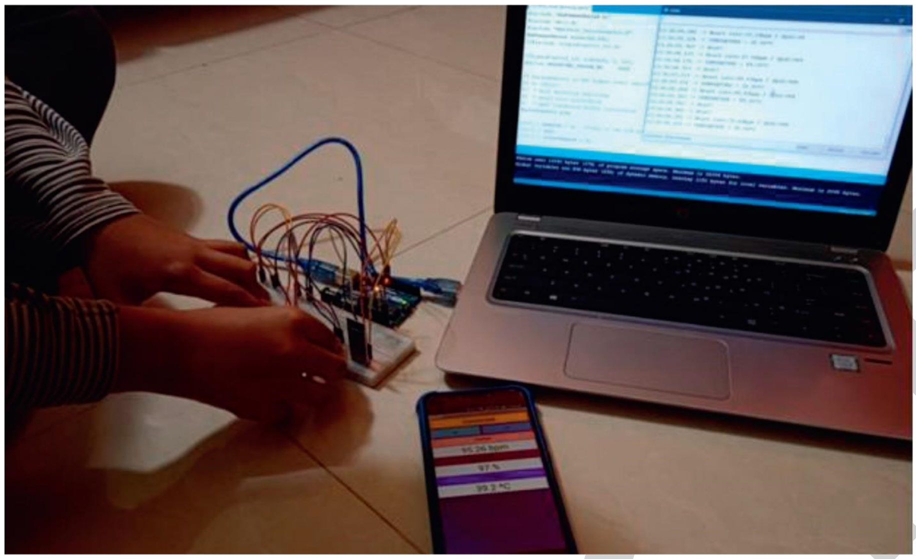

Figure 10: Diagram of “Patient 2” utilizing the IoT-based device and given their test results instantly.

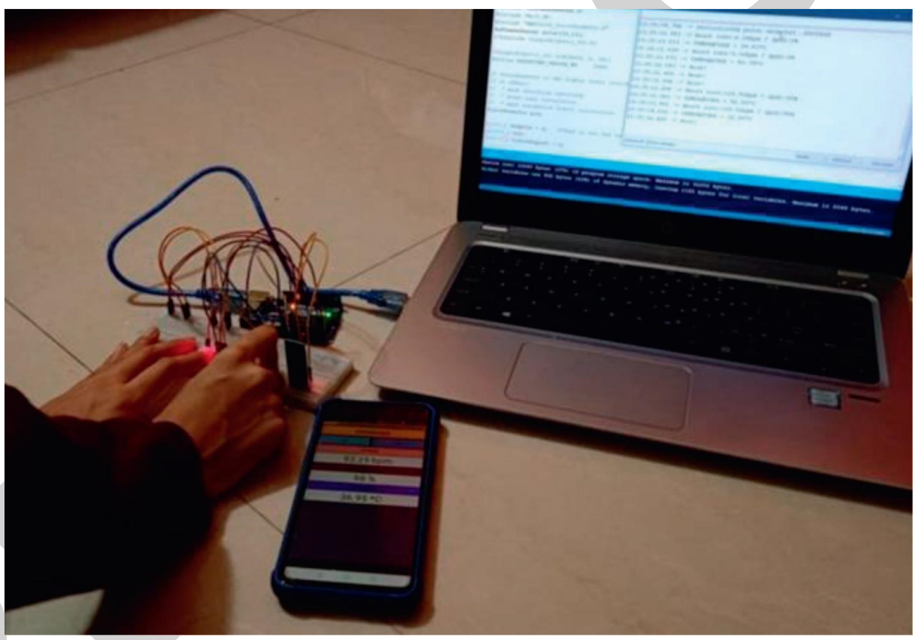

Figure 11: Diagram of “Patient 3” utilizing the IoT-based device and given their test results instantly.

Table 3: Body temperature test results on three different people of the proposed system.

Body temperature	Patient-1	Patient-2	Patient-3
Take-1	39.20	37.10	36.95
Take-2	39.43	36.95	36.80
Take-3	39.80	37.33	37.20
Average	39.48	37.13	36.98

Table 4: Pulse rate test results on three different people of the proposed system.

Pulse rate	Patient-1	Patient-2	Patient-3
Take-1	95.26	95.69	93.25
Take-2	95.22	95.78	93.56
Take-3	95.38	95.42	93.10
Average	95.29	95.63	93.31

know that the heart rates of different people can vary. However, the proposed system shows good results.

Table 5 shows the SpO2 measurement analysis on three different people. In this SpO2 measurement setting, the same people were used as were used in the other two cases. From Table 5, it is observed that the SpO2 levels for three people are quite close. For different test subjects, the measured SpO2 values changed slightly. The proposed system shows standard values for SpO2.

Table 5: SpO2 test results on three different people of the proposed system.

SpO2	Patient-1 (%)	Patient-2 (%)	Patient-3 (%)
Take-1	97	97	98
Take-2	97	97	98
Take-3	97	97	98
Average	97	97	98

Table 6: Hardware comparison with other articles.

No	Name	Heart rate measurement	SpO2 measurement	Body Temp measurement	Data in mobile app	Data In LCD display
1	This paper	Yes	Yes	Yes	Yes	Yes
2	Ref [12]	Yes	Yes	Yes	No	Yes
3	Ref [1]	Yes	No	Yes	No	No
4	Ref [13]	Yes	No	Yes	No	No
5	Ref [14]	Yes	No	Yes	No	No
6	Ref [15]	Yes	No	Yes	No	No
7	Ref [16]	Yes	No	Yes	No	Yes
8	Ref [17]	Yes	No	Yes	No	Yes
9	Ref [18]	Yes	No	No	Yes	No
10	Ref [19]	Yes	No	No	No	No
11	Ref [20]	No	No	Yes	Yes	No
12	Ref [21]	Yes	Yes	Yes	Yes	No
13	Ref [22]	Yes	No	Yes	No	No

Table 6 shows the hardware comparison between this health monitoring system and other existing similar-type health monitoring systems.

4. Conclusion and Future Work

The design and implementation of a health monitoring system using IoT are presented in this study. This IoT-based device allows users to determine their health parameters, which could help regulate their health over time. Eventually, the patients could seek medical assistance if the need arises. They could easily share their health parameter data instantly within one application with the doctor. As we know, the IoT is now considered one of the most desirable solutions in health monitoring. It makes sure that the parameter data is secured inside the cloud, and the most important thing is that any doctor can monitor the health of any patient at any distance. The paper is about an IoT-based health monitoring system using Arduino that has been developed. The system will measure a patient's body temperature, heartbeat, and the SpO2 levels in the blood and send the data to an app via Bluetooth. This information is also transmitted to the LCD panel, allowing the patient to see their current health state quickly. Elderly patients, asthma patients, COPD patients, patients with chronic diseases, COVID-19 patients, and diabetic patients will be able to keep their health in check over time with the help of the system we developed.

The system could be improved and adjusted in a variety of ways in the future. The system's microcontroller can be replaced with a Raspberry Pi and tweaked in a variety of ways. The sensors used in the system can be improved, and we can measure several health parameters when additional sensors are added. For the system's security, new algorithms may be integrated with the whole system [24–28].

Data Availability

No data were used to support the findings of this study.

Conflicts of Interest

The authors declare that they have no conflicts of interest to report regarding the present study.

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