IOT PLATFORM FOR VITAL SIGNS DETECTION USING NODE MICROCONTROLLER

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ABSTRACT

Using IoT technology to monitor patients' vital signs can help limit the spread of the coronavirus. Therefore, a cost-effective remote monitoring system measuring vital signs is proposed. Dual heart rate and oxygen level sensor, a temperature sensor, two microcontrollers, UNO as a power supply, and Node as the main controller are used in this system. The vital signs are monitored non-invasively utilising Photoplethysmography equipment and wirelessly relayed to the person involved via the Blynk platform utilising a Wi-Fi device. Photoplethysmography is the core technology for the entire system. It also shows how the system can connect to the internet worldwide, which lets it be used in different clinical tests.

Keywords: Blynk Platform, Internet of Things, Microcontrollers, Vital Signs

1.0 INTRODUCTION

Nowadays, vital signal monitoring systems are essential for identifying various diseases by reading the signal and providing a diagnosis by the appropriate authority, and becoming a crucial requirement in world life [1-4]. The Internet of Things (IoT) health monitoring system is the best solution for monitoring a patient's basic symptoms via an IoT network based on heart rate (HR), oxygen saturation (SpO_2), and temperature sensors as capturing elements, as well as microcontroller as a processing device, as well as a pulse sensor and temperature sensor, from which data is collected and sent to Raspberry PI [5, 6]. However, the major drawback of the system is that no interfaces for data visualization have been created [7]. On the other hand, an excellent integrated device that wirelessly sent a person's pulse to a computer, allowing individuals to test their HR by only looking at their phones rather than needing their hands each time sensing is analysed, was studied [8, 9]. Measurement of vital signs has been integrated into a single device. This study aims to develop and implement a smart, low-cost, and easy-to-use system that monitors a patient's vital activities, including temperature, heart rate, and SpO_2, using unique sensors for each variable and sending readings to the doctor's email and smart phone to keep track of the patient's condition.

2.0 LITERATURE REVIEW

This section describes the most recent scholarly sources on the topic of IoT-based vital sign measurement and monitoring systems. Katoch *et al.,* for example, created a WSN-based health monitoring system that monitors physiological functions in humans [10]. It looked at precautions taken in a potential investigation setting in the course of regular life. In addition, Pinto *et al*. created an Internet of Things-based system to track the health of the elderly. The proposed system's primary functions include data recording and monitoring, as well as the distribution of emergency alerts [11].

Additionally, Li *et al*. presented a healthcare-wide heart disease monitoring system [12]. The system demonstrated effectiveness in addressing the patient's cardiac state once the support mode was switched to the common mode. Healthcare services tailored to the individual's health status are also promoted. An intelligent Internet of Things (Help to You) system was proposed for the elderly by Basanta *et al*. [13]. The project's goal was to enhance the standard of care for the elderly. Jarjees *et al*. have developed another IoT-based system for continuous monitoring of respiratory parameters [14]. It is inexpensive, wearable, and highly reliable.

3.0 METHODOLOGY

This section describes the design and implementation of the hardware and software for the proposed system. Figure 1 illustrates the design and implementation of the hardware. It is evident that all sensors are linked to the main microcontroller (Node Microcontroller). Figure 2 shows the programming flowchart of the proposed system. Heart rate and the SpO_2 value are shown when the switching signal is 1, whereas the temperature reading is shown when the signal is 0. In order to provide power to the board, Arduino UNO Microcontroller contains a USB port. The circuit board is a useful tool for working on electronics projects.

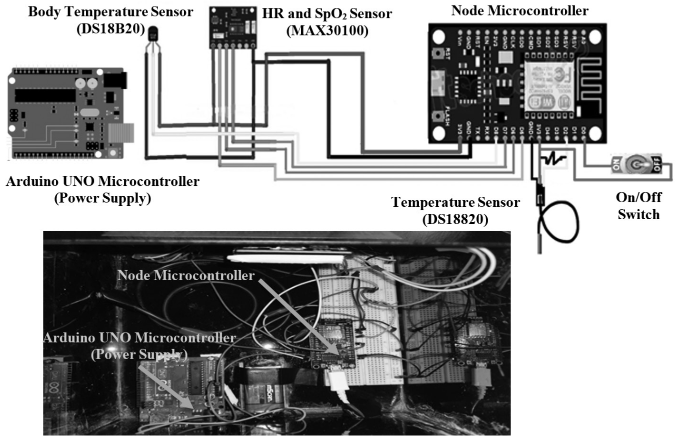


Figure 1: Hardware System Design and Implementation

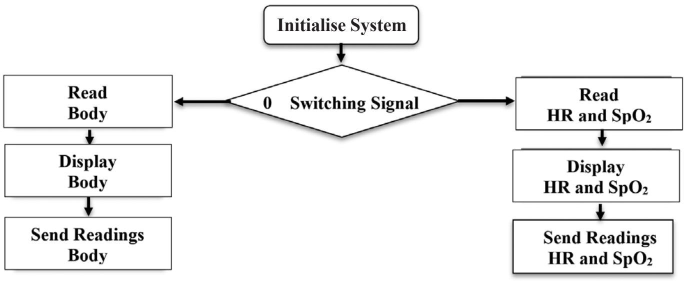


Figure 2: The Flowchart of the Software Program of the Developed System

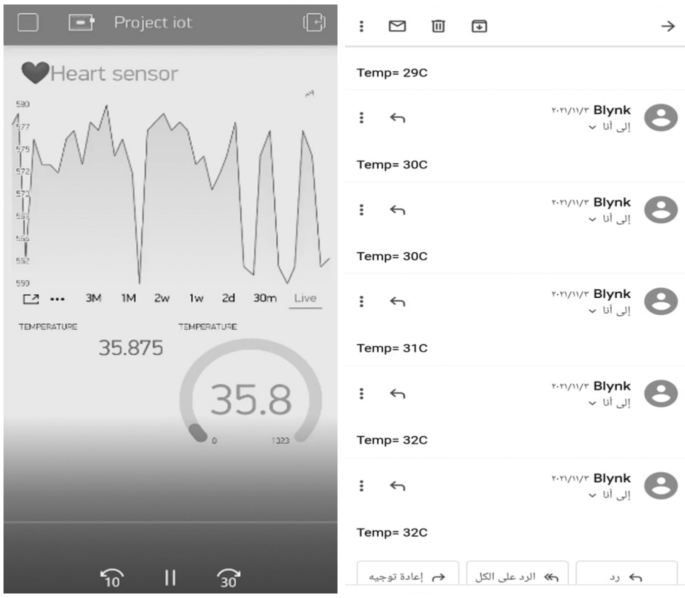
(a) Proposed System *(b) Conventional Devices*

Figure 3: Comparison Reading

4.0 RESULTS AND DISCUSSION

A Jumper fingers pulse oximeter (model JPD 500E) was utilised to validate the HR and SpO_2 values of the proposed system. Regarding body temperature, a digital pediatric thermometer by Chicco has been utilised. Figure 3 depicts a comparison of the detected values between proposed and conventional systems. Figure 4 is the mobile screen shoots that present the mobile application to display Vital signs and mail box that shows the received mails of Vital signs too. The table 1 illustrates the comparison between the readings of the proposed system (experimental value) and conventional devices (acceptable value). The percent reading error between the proposed system (experimental value) and the conventional devices (acceptable value) have been computed using equation 1. This equation reveals the precision of the proposed technology in comparison to commercial systems. The maximum error computed is less than 4% for all parameters listed as acceptable values.

$$\text{Percent } Error\,\% = \frac{accepted\ value - experimental\ value}{accepted\ value} \times 100\% \quad (1)$$



(a) Mobile application displays temperature and heart sensor readings *(b) Mail box shows the received mails that were sent by Arduino*

Figure 4: Mobile screen-shoot

Table 1: The Comparison between the Readings of the Proposed system (Pro) and the Conventional Devices (Cd.)

Case No.	Temperature (C°)			Heart rate			SpO_2 rate		
	Cd.	Pro.	Error %	Cd.	Pro.	Error %	Cd.	Pro.	Error %
Case (1)	36.2	36	0.6%	81	81	0.0%	99	96	3.0%
Case (2)	37	36	2.7%	90	88	2.2%	99	96	3.0%
Case (3)	36.4	35	3.8%	92	90	2.2%	99	99	0.0%

5.0 CONCLUSION

The primary objective of the project is to develop and implement a smart, user-friendly, low-cost system that uses specialized sensors to monitor the patient's vital activities (temperature, heart rate, and blood oxygen level) and solves the problem of one reading sent by Blynk platform through the proposed control switching method, then transmits readings to the doctor via the internet (Wi-Fi) to track the patient's condition. The monitoring systems are designed to lower healthcare expenditures, such as the high cost of monitoring patients in hospitals or the cost of keeping track of doctor visits. In compared to commercially available systems, the projected outputs are rather impressive.

Nevertheless, utilising a high-quality sensor may improve accuracy. To further improve the system's response time and decrease measurement errors, a sequential reading technique employing many types of microcontrollers has been integrated into the updated version of the proposed device. ■

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