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Embedded Based Oxygen Level Detector in HealthCare Applications

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Abstract- Recent technological advancements have enabled us to check our health status using a variety of devices. It is now possible to monitor blood oxygen levels, heart rate, temperature, and other parameters without the assistance of a doctor. With these technological breakthroughs, it is now possible to create a basic, user-friendly health monitoring system that can be made available to the general public. The purpose of this study is to improve community health while also lowering the infection's detrimental impact on the economy and society. The suggested system monitors several health metrics in public settings using an Arduino and a sensor. These parameters are set in the entrance door frame of public buildings to monitor health and prevent the spread of disease.

Keywords – Body temperature, Blood oxygen level, Pulse rate

I. Introduction

The deadly Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-Cov-2) virus has spread over the world, wreaking havoc on the global economy and overwhelming public and private healthcare facilities.

Ethiopia initiated a state wide door-to-door temperature screening effort to identify, isolate, and treat those who are affected, or are likely to be infected, in order to prevent or reduce the spread of the novel coronavirus in the country of 110 million people. The goal of this project is to keep track of blood oxygen levels, temperature, and pulse rate in public locations in order to prevent the transmission of infection.

In public locations, illness propagation is prevented by monitoring blood oxygen levels, body temperature, and pulse rate. These parameters are installed in the entrance door frame of public locations such as malls, offices, schools, and colleges, along with a sanitizer dispenser. The specifics of the parameters that were measured are presented on the LCD display.

II. Exisiting Work

The system is designed to help prevent the spread of SARS-CoV-2 infection, as well as maintain and/or improve community health and reduce the epidemic's negative economic and social effects (Marlon Gan Rojo et. al.). The system is divided into two subsystems: the temperature reader (TR) and the sanitizer dispenser (SD), both of which are controlled by a single microcontroller and cannot operate at the same time. The TR is designed to perform similarly to existing and commercially available handheld infrared thermometers in terms of accuracy, display the temperature read to the user, and provide visual and audible alerts when the temperature read exceeds the critical body temperature of 38 degrees centigrade. When engaged, the SD is designed to distribute sanitizer in a cost-effective manner by dispensing only once and at the precise amount required. The system is designed for strategic deployment in public and private spaces such as public markets, banks, hospitals, schools, offices, and households, among other places.

This system is based on a remote patient monitoring system that is used to monitor various health metrics of a patient who is located distant in real time (Mohamed T A. Mahgoub et. al.). The two metrics calculated and communicated to a remote client via a server are oxygen saturation and body temperature. This paper's major goal is to demonstrate a remote Pulse Oximetry System for health monitoring. The framework is based on the premise that critical health signals can be collected from a patient and sent to a processer, where they will be processed, compared, and monitored in order to inform key persons in the event of an emergency. The biometric indicator that this device monitors is blood oxygen saturation. The technology utilised in this study is known as "Photoplethysmography," and it is based on changes in the intensity of light passed through the tissue as a result of arterial blood pulse. This method turns light intensity into a voltage signal, which is then utilised to calculate the patient's oxygen saturation. This is owing to the fact that oxygenated blood differs from deoxygenated blood in its ability to absorb the Red and Infrared wavelengths. The oxygen saturation in the patient's blood is calculated by comparing the two absorptions.

Hundreds of thousands of people have died as a result of Corona Virus Disease (Covid19), and millions more are infected every day (Navid Bin Ahmed et. al.). Pneumonia is caused by being severely infected with this virus, which produces greater pulse and breathing rates as well as lower oxygen saturation levels than is ideal. Pneumonia is diagnosed by looking for and measuring many health markers. Pulse rate and blood oxygen saturation (SpO2) are two of the most important health indicators used to diagnose Pneumonia and Bronchitis, along with a few others. Non-invasive measuring has become possible in a variety of methods because to the availability of sensor technology. Many researchers and scientists have previously produced hardware prototypes that include Embedded and IoT, but few have evaluated their performance and thus calculated/figured the relative minimal error percentage in order to reach an acceptable estimate in terms of disease detection.

The pulse oximeter is the most commonly used gadget since it is a non invasive technique of detecting blood oxygen levels. Red and IR (infrared) LEDs (light emitting diodes) delivered signals to the photodiode in the pulse oximeter (G. Ates et. al.). To represent the value of blood oxygen saturation, an equation or relationship between the ratio (R) of signals (red and IR) received by photodiode and the oxygen saturation value (SpO2) is required. This equation is normally created via the calibration curve. To obtain this calibration curve, you'll need a calibration equipment. Because this device is so expensive, absorbation coefficients from healthy people were utilised to both build this curve and lower the price of the pulse oximeter. The R (ratio) value is computed in this study based on the absorption rates of signals supplied by red and IR LEDs in a finger mounted oxygen saturation sensor. The acquired R value was used as the input to fuzzy logic, which subsequently produced the SpO2 value. Also, using the linear regression method, a linear relationship between SpO2 and R values was constructed with absorption coefficients and compared to SpO2 values estimated using the fuzzy logic method.

Improvements in transportation technology, combined with population increase and mobility, have accelerated the spread of infectious diseases to unprecedented levels (Santoso Daniel et. al.). Fever is a common symptom of many viral disorders, especially influenza, and it can be easily detected with infrared thermography. The majority of thermography devices, however, are both expensive and non-portable. In the worst-case scenario, a pandemic flu breakout in a densely populated area will almost certainly result in a long line of afflicted people at the crisis center. We created a non-contact portable infrared thermometer for fever detection in clinical settings to overcome these difficulties. The device also includes an easy-to-use interface for entering pandemic flu symptoms. In a ticket-size summary, the body temperature reading and a list of symptoms are printed. When each suspect visits the doctor for further examination, they will bring this report with them. Overall bias and precision were 0.2 °C and 0.4 °C, respectively, according to inter-device testing under simulated clinical conditions and statistical analysis on temperature measurements between 35 and 38 °C. A single complete process could take less than a minute to complete.

III. Proposed Work

In this proposed system, we develop a system with hardware and software components that would optimize the health care application. The paper aims to achieve the following specific objectives: The use of embedded-based person health monitoring in public settings allows for remote monitoring of people's health. Design and implementation of an embedded system for health monitoring. In public settings such as offices, malls, colleges, and schools, the system has been able to measure body temperature, blood oxygen level, and pulse rate. On the LCD display, the measured parameters are presented, and an LED light shines. If a person is inside the door frame, an infrared obstacles sensor is utilised to detect their entry. The device assesses a person's body temperature, oxygen level, and pulse rate and determines if they are over or below particular thresholds. The measured data is displayed in an LCD display, which glows with LED light. Due to the height difference between the people, two detectors were installed in the door frame, one in the left and one in the right door panel. When detector 1 calculates, detector 2 is turned off, and vice versa. The spread of illness will be reduced in this project, the system will be capable of health monitoring through precise measures, and a sense of security will be established when in an airport, college, business, or any other location.

Advantages

- Time complexity is low.
- The feeling of safety can be created while in an airport, college, office or any other area.
- Less manpower.

Block Diagram

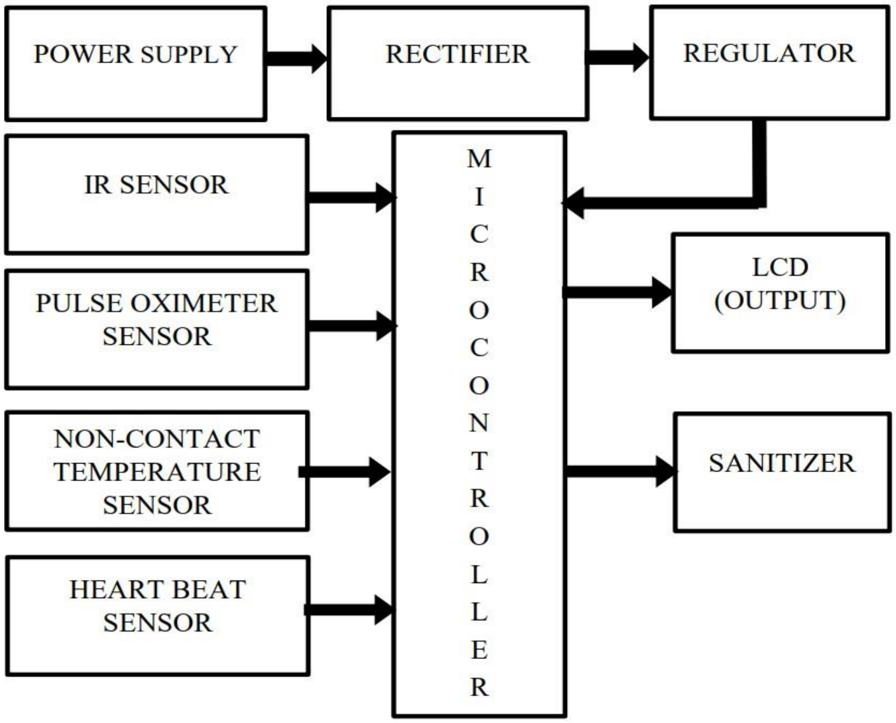

Figure 1. Block Diagram

Algorithm

Step 1: Start the program.
Step 2: Initialization of parameters.
Step 3: Open a function setup.
Step 4: Put a setup code.
Step 5: Open a function node.
Step 6: Displays as "HEALTH CARE DETECTOR" in LCD when the kit is in on condition.
Step 7: Displays "HUMAN DETECTED" in LCD when the IR sensor detected the person.
Step 8: Reads pulse rate, body temperature and blood oxygen level of the person.
Step 9: Displays "HUMAN NORMAL" in LCD when the pulse rate, blood oxygen level and body temperature are within the given range.
Step 10: Green LED light glows and sanitizer motor runs.
Step 11: Displays "HUMAN ABNORMAL" in LCD when the measured parameters are out of the range.
Step 12: Red LED light glows and sanitizer motor runs.
Step 13: Stop the program.

IV. Hardware And Software Description

4.1 Hardware Description

4.1.1 Arduino Uno

The Arduino Uno is a microcontroller board based on the 8-bit ATmega328P microcontroller. It has auxiliary components such a crystal oscillator, serial connectivity, and a voltage regulator to help the ATmega328P microcontroller. 14 digital input/output pins, 6 analogue input pins, a USB connection, a Power barrel connector, an ICSP header, and a reset button are all found on the Arduino Uno. The application of Arduino uno are Electronics product and system prototyping and projects that necessitate a large number of I/O interfaces and communications.

4.1.2 IR Sensor

An infrared sensor is a light-emitting electrical gadget that detects objects in the environment. An infrared sensor can both detect motion and measure the temperature of an object. Almost everything emits some form of infrared heat radiation. These types of radiations are invisible to the naked eye, but an infrared sensor can detect them. The two types of IR sensors available are the Active Infrared Sensor and the Passive Infrared Sensor.

4.1.3 Pulse Oximeter

Pulse oximetry is a non-invasive test that determines the oxygen saturation level in your blood. It can swiftly detect even little variations in oxygen levels. These figures show how successfully blood transports oxygen to the areas of your body that are farthest from your heart, such as your arms and legs. The pulse oximeter is a little device that resembles a clip. It's generally a finger that's attached to it.

4.1.4 Infrared Temperature Sensor

Infrared (IR) thermometers are used in a variety of industrial and therapeutic settings for sensing temperature. When other types of thermometers aren't practicable or the thing is fragile and unsafe to get close to, these non-contact temperature measurement devices come in handy. Infrared thermometers use infrared radiation to determine the surface temperature of objects without the need for physical contact.

4.1.5 Heart Rate Sensor

The change in blood volume through any organ of the body generates a change in light intensity through that organ, which is measured by the heart rate sensor (avascular region). The timing of the pulses is especially essential in applications where the cardiac pulse rate is being monitored. The rate of heart pulses determines the flow of blood volume, and because light is absorbed by blood, signal pulses are comparable to heartbeat pulses.

4.1.6 Submersible Pump

A submersible pump (also known as a submersible motor or an electric submersible pump (ESP)) is a device with a hermetically sealed motor that is tightly connected to the pump body. The entire system is submerged in the pumped fluid. The main benefit of this type of pump is that it eliminates pump cavitation, which is a problem caused by a large elevation difference between the pump and the fluid surface. Submersible pumps, as opposed to jet pumps, which produce a vacuum and rely on atmospheric pressure, push fluid to the surface. Submersibles are utilised in heavy oil applications using hot water as the motive fluid, and they employ pressured fluid from the surface to drive a hydraulic engine downhole rather than an electric motor.

4.2 Software Description

4.2.1 Arduino IDE

The Arduino Software (IDE) includes a text editor for writing code, a message area, a text console, a toolbar with buttons for basic functions, and a series of menus. It communicates with the Arduino and Genuine hardware by connecting to them and uploading code.

4.2.2 Embedded C

The C Standards committee created Embedded C as a set of language extensions for the C programming language to address commonality issues that emerge between C extensions for different embedded devices. To handle exotic features like fixed-point arithmetic, many different memory banks, and fundamental I/O operations, embedded C programming has traditionally required nonstandard additions to the C language. The C Standards Committee modified the C language in 2008 to solve these difficulties by establishing a uniform standard that all implementations must follow. Fixed-point arithmetic, named address spaces, and basic I/O hardware addressing are among the features not accessible in standard C. The main () function, variable definition, datatype declaration, conditional statements (if, switch, case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, and so on are all used in embedded C.

4.2.3 Proteus Software

Proteus (PROcessor for TExt Easy to USe) is a procedural programming language developed by Simone Zanella in 1998. Proteus integrates many features derived from a variety of other languages, including C, BASIC, Assembly, and Clipper/dBase; it is extremely versatile when dealing with strings, with hundreds of dedicated functions, making it one of the most powerful text manipulation languages. Proteus is named after Proteus, a Greek sea god who looked after Neptune's entourage and provided responses; he was known for his ability to shift into several forms. The fundamental purpose of this language is to convert data from one form to another.

V. Result And Discussion

5.1 Result and Simulation

This is the proposed block diagram which shows connections between Arduino Uno and other components.

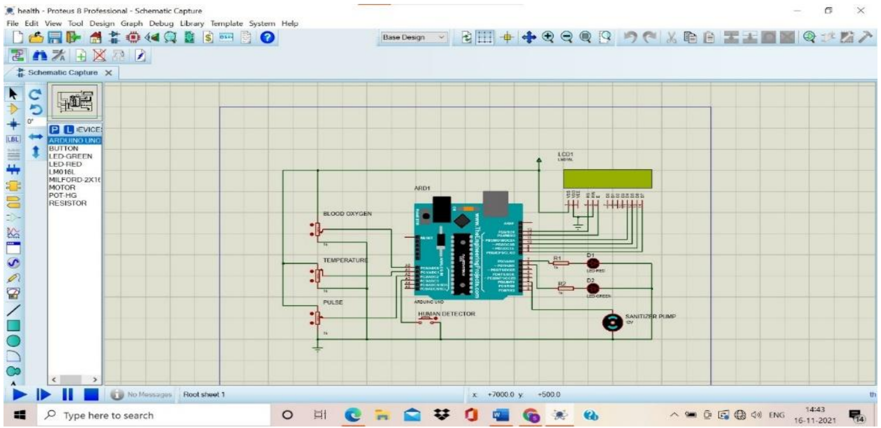

Figure 2. Simulation Block Diagram

In this below figure shows the human detection through the IR sensor and the result was displayed in LCD.

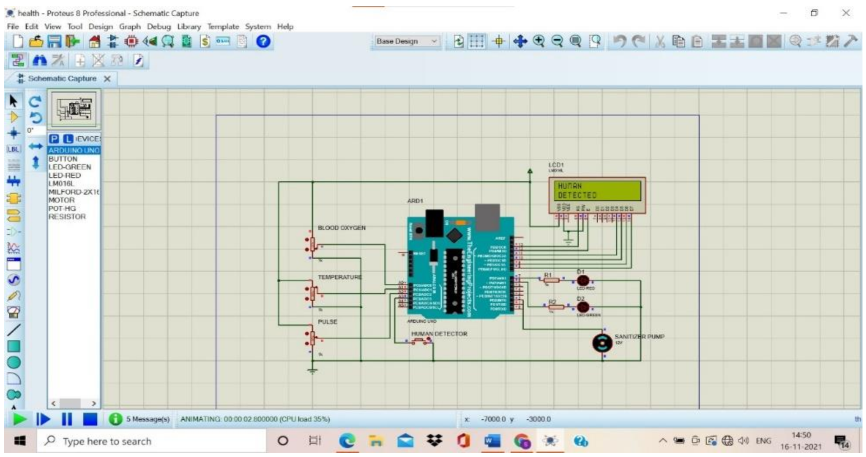

Figure 3. Human Detection

In this, it sense the body temperature, blood oxygen level and pulse rate and measured values are displayed in LCD.

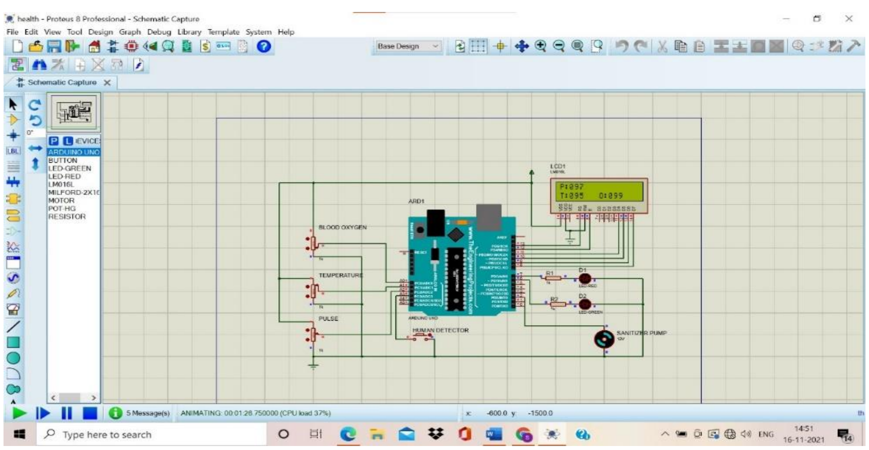

Figure 4. Measurement of Body Temperature, Blood Oxygen Level and Pulse Rate

If the human body temperature is below 99 deg F, blood oxygen level is 70 to 100 mm Hg and pulse rate is in the range of 60 to 100 beats per minute it indicates that human normal in LCD.

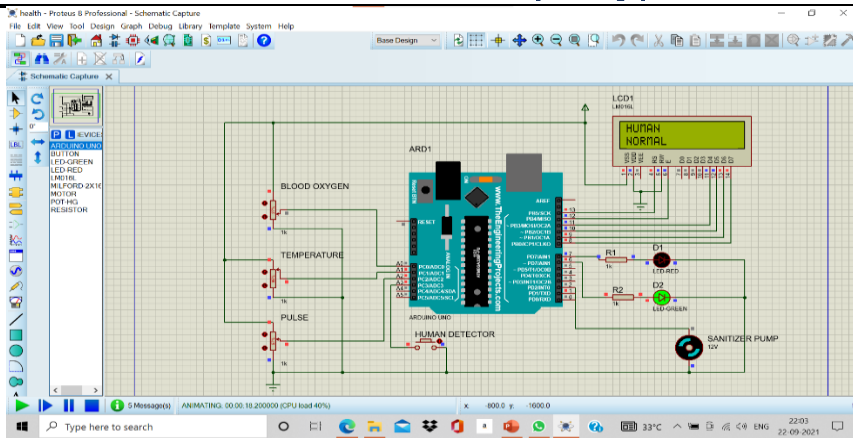

Figure 5. Human Normality

In this figure, the measured parameters are shown.

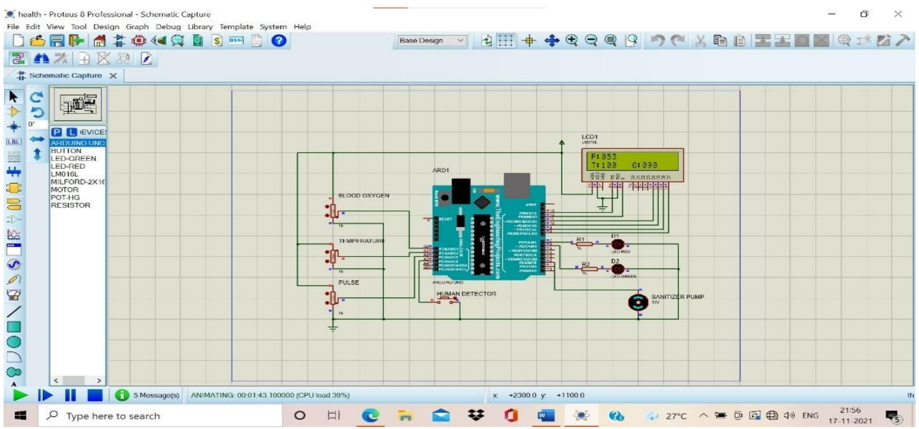

Figure 6. Parameter Measurement

In this figure, if the measured parameters are crosses the ranges then it indicates as abnormal in LCD.

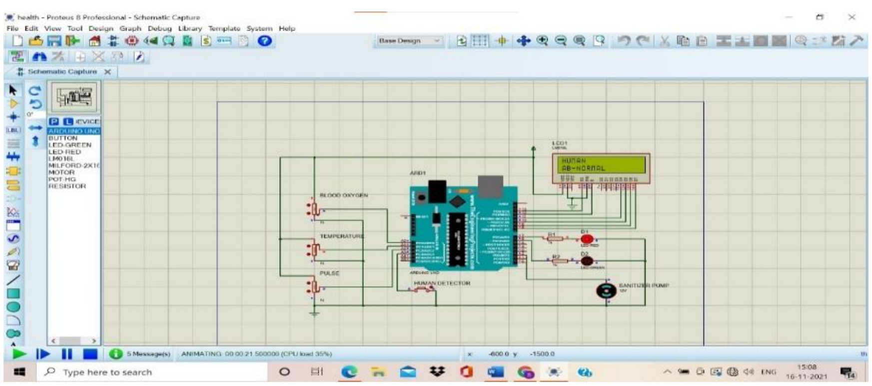

Figure 7. Human Abnormality

5.2 Discussion

The current version of the system can post three parameters as blood oxygen level, body temperature and pulse rate and displays in LCD board. As for the future works the blood oxygen level and pulse rate in non-contact mode and with the use of smart card the person who indicates as abnormal the person's detail are send to the nearest medical team with the measured readings with the help of IOT.

V. CONCLUSION

In this project, we analyzed embedded based oxygen level detector in healthcare application. The blood oxygen level, body temperature and pulse rate is detected to find the person is infected or not. The measured blood oxygen level, body temperature and pulse rate is displayed in LCD. If the measured readings is above or below the given range then the red LED light glows and displays abnormal in LCD board. If the measured readings is within the given range then the green LED light glows and displays normal in LCD board. Automatic sanitizer is used to prevent the spread of infection in public places. The simulation for this project is implemented with the help of proteus software and output results are verified successfully. This system is used in public place like office, college, school ,malls and supermarket etc. This system used to reduce the spread of infection in public places.

REFERENCES

[1] De Kock, J. P., Tarassenko, L., Glynn, C. J., & Hill, A. R. (1993). “Reflectance pulse oximetry measurements from the retinal fundus”, Biomedical Engineering, IEEE Transactions on, 40(8), 817-823.

[2] G. Ates, K. Polat. (2012). “Measuring of oxygen saturation using pulse oximeter based on Fuzzy logic”, IEEE International Symposium on Medical Measurement and Applications, Budapest, Hungary.

[3] G. W. J. Clarke, A. D. C. Chan, A. Adlar. (2014). “Effects of motion artifact on the blood oxygen saturation estimate in pulse oximetry”, IEEE International Symposium on Medical Measurements and Applications (MeMeA), Portugal.

[4] Ghosh, A.M., Halder, D. and Hossain, S.A. (2016). “Remote health monitoring system through IoT”, 5th International Conference on Informatics, Electronics and Vision (ICIEV) (pp. 921-926), IEEE.

[5] H. Kiourmars and L. Tang. (2011). “Wireless Network for Health Monitoring Heart Rate and Temperature Sensor”, Fifth International Conference on Sensing Technology, 2011, pp. 362-368.

[6] J. Wan, Y. Zou, Y. L, J. Wang. (2017). “Reflective type blood oxygen saturation detection system based on MAX30100”, IEEE International Conference on Security, Pattern Analysis, and Cybernetics (SPAC), China.

[7] M. Nogawa, T. Kaiwa, and S. Takatani. (1998). “A Novel Hybrid Reflectance Pulse Oximeter Sensor With Improved Linearity and General Applicability to Various Portions of The Body”, in Proc IEEE Conf. Eng. Med. Bio. Soc., vol. 20, no. 4, pp. 1858-1861.

[8] Marlon Gan Rojo, Jolan Baccay Sy, Eunelfa Regie Calibara, Alain Vincent Comendador, Wubishet Degife, Assefa Sisay. (2020). “Non-Contact Temperature Reader with Sanitizer Dispenser (NCTRSD)”, International Journal of Scientific and Research Publications, Volume 10, Issue 9, 583 ISSN 2250-3153.

[9] Mohamed T A. Mahgoub, Othman O. Khalifa, Khairul Azami Sidek, Sheroz Khan. (2015). “Health monitoring system using Pulse Oximeter with remote alert”, International Conference on Computing, Control, Networking, Electronics and Embedded Systems Engineering.

[10] N. B. Ahmed, S. Khan, K. N. Tahsin, and I. Afrida. (2018). “Implementation of a low-cost heartbeat monitor as part of a larger health monitoring system”, 3rd International Conference on Inventive Computation Technologies, IEEE, pp. 813-818.

[11] Navid Bin Ahmed; Shahriar Khan, Nuzhat Arifa Haque, Md. Shazzad Hossain. (2021). “Pulse Rate and Blood Oxygen Monitor to Help Detect Covid-19: Implementation and Performance”, IEEE International IOT, Electronics and Mechatronics Conference (IEMTRONICS).

[12] Rotariu and V. Manta. (2012). “Wireless system for remote monitoring of oxygen saturation and heart rate”, computer Science and Information Systems (FedCSIS) Federated Conference, vol. 9, no. 12, pp. 193-196.

[13] S. Bharati, G. Gidveer. (2012). “Waveform analysis of pulse wave detected in the fingertip with PPG”, International Journal of Advances in Engineering & Technology, Vol. 3, Issue 1, pp. 92-100.

[14] Santoso Daniel and F. Dalu Setiaji. (2015). “Non-contact portable infrared thermometer for rapid influenza screening”, International Conference on Automation Cognitive Science Optics Micro Electro-Mechanical System and Information Technology (ICACOMIT). IEEE.

[15] S.C. Millasseau, J.M. Ritter, K.Takazawa, P.J. Chowienczky. (2006). “Contour analysis of the photoplethysmographic pulse measured at the finger”, Hypertens. Journal, 24(8), 1449-56.

[16] V. Betta, F. Cascetta and D. Sepe. (1997). “An assessment of infrared tympanic thermometers for body temperature measurement”, Physiol. Meas.