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Detecting Severe Acute Respiratory Syndrome Using Smart Controllable Device

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DETECTING SEVERE ACUTE RESPIRATORY SYNDROME USING SMART CONTROLLABLE DEVICE

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ABSTRACT

Knowledge of diagnostic tests for severe acute respiratory syndrome coronavirus 2 continues to advance, and a better understanding of the essence of the tests and interpretation of their findings is significant. The use of thermal infrared thermometers has been adopted in many places to test and identify infected persons. This method of detection is still lacking because it has some limitations; the reuse of this device might also cause the spread and perhaps the most essential thing is that the direct contact of the infected person and touching surfaces can result to the spread of the disease to the personnel of the screening process and to the populace, so also it spends too much time examining the temperature of each person. This study proposes the design of a system using a remotely controllable device, a programmable microcontroller, with less or no human interactions, with the device embedded in the following module a remote controller, sensors; optical camera sensor, thermal imaging processing, Bluetooth module, Microphone module and neural processing engine for monitoring the screening process. The device informs authorities of the need to acquire data in real-time for instant notification. The proposed system can be used as a device for markets, banks, worship centers, schools, healthcare, and many more public areas. Data obtained from this device can be used for timing of vaccine campaigns, collected data from this device can be used for the allocation of medical materials as it generates real-time data. Lastly, this device will help in saving the lives of people and preventing the transmission of infection to other people.

Keywords*: Intelligent device, Arduino, Sensor, Diagnosis, Healthcare*

1. Introduction

An infectious and often deadly respiratory disease caused by the coronavirus. Severe Acute Respiratory Syndrome (SARS) spread around the world within a few months, but it was rapidly contained. SARS is a virus spread by droplets that enter the air while someone with a disease is coughing, sneezing, or talking. Fever, dry cough, headache, muscle aches and difficulty breathing are symptom of this disease. No complete treatment exists yet except supportive care extremely rare. It can spread easily by airborne respiratory droplets (coughs or sneezes), touching a contaminated surface, saliva (kissing or shared drinks), body to body contact (handshakes or hugs). Symptoms of this viral disease requires a medical diagnosis, symptoms which is mentioned earlier. People may also experience pain in areas like in the muscles body, fever, chills, or malaise, respiratory distress or shortness of breath the following symptoms are also common: cough, infection, or headache Patients with suspected infection usually go to health centers with symptoms such as fever over 38.5°C, dry cough, shortness of breath and diarrhea, which should be examined for respiratory symptoms (Cao M, Zhang D. *et al* (2020), Yuen K-S, Ye Z-W *et al* (2020), WHO (2020). In the study of Nanshan Chen *et al*., on patients of Wuhan Jinyintan Hospital, Wuhan, China, from the 99 patients with SARSCoV-2 infection, 51% had chronic diseases and they had symptoms of fever (83%), cough (82%) shortness of breath (31%), muscle ache (11%), fatigue (9%), headache (8%), sore throat (5%), rhinorrhea (4%), chest pain (2%), diarrhea (2%), and nausea and vomiting (1%) (Chen N, Zhou M, *et al 2020*). In another study of Huijun Chen *et al*. on nine pregnant women of Zhongnan Hospital of Wuhan University, Wuhan, China, patients with COVID-19 infection showed fever (in seven of nine patients), cough (in four of nine patients), myalgia (in three of nine patients), sore throat (in two of nine patients), Malaysia (in two of nine patients), diarrhea (in one of nine patients) and dyspnea (in one of nine patients) that by sampling and examining of their newborn babies, there were no signs of coronavirus in their neonates, which has shown that there is no evidence for vertical transmission of COVID-19 infection. Another study which is done by Huang et al. on 41 patients of a hospital in Wuhan with confirmed SARS-CoV-2 infection showed that 32% of patients had an underlying disease such as diabetes, hypertension, and cardiovascular disease and had clinical symptoms such as fever (98%), cough (76%), fatigue (44%), sputum production (28%), headache (8%), hemoptysis (5%), and diarrhea (3%) (Huang C, Wang Y, *et al* 2020). Moreover, the symptoms of four patients that their SARS-CoV-2 confirmed by Shanghai Public Health Clinical Center, Shanghai, China, showed that most of them had fever, fatigue, and dry cough and some of them had nasal congestion, runny nose, and diarrhea (Wang Z, Chen X, *et al* 2019). Another study done by Wang et al. on 138 Hospitalized Patients with confirmed SARS-CoV-2 admitted by Zhongnan Hospital of Wuhan University in Wuhan, China, shows that most common symptoms of

infected patients are fever, fatigue dry cough, anorexia, myalgia, dyspnea, expectoration, pharyngalgia, diarrhea, nausea, dizziness, headache, vomiting, and abdominal pain respectively. Researchers have suggested different ways to prevent the sars-cov-2.

People with close contacts and suspicious exposure need to be advised to have a 14-day isolation for medical observation, which starts from the last day of contact with the SARS-CoV-2 infected patients or suspicious environmental publicity (Sohrabi C, Alsafi Z, *et al.* 2019). When displaying any sign and symptom, mainly fever, respiration signs like coughing, shortness of breath, or diarrhoea, they must reach out for medical attention right now (Yuen K-S, Ye Z-W *et al* 2020). Contact surveillance has to be allotted for people who had been exposed to accidental contact, low-level exposure to suspected or confirmed sufferers, *i.e.* checking any symptoms whilst concluding everyday activities. Patients with a suspected infection should be isolated, monitored, and diagnosed in the hospital as quickly as possible. Doctors ought to make suggestions supporting the affected person's situation. Patients with mild signs and suspected infection may additionally remember in-home isolation and domestic care Yuen K-S, Ye Z-W et al (2020). Suspected infected with severe symptoms and those who have to stay in the health facility for remark through physician's judgment have to observe the isolation guidelines for suspected patients (WHO 2020). International site visitors should take ordinary precautions while getting into and leaving the affected regions, which includes avoiding near contacts with human beings with acute breathing infection, washing hands frequently, mainly after contacting with the ill or their surrounding environment; following appropriate coughing etiquette; and warding off close touch with live or lifeless farming animals or bats or other wild animals (WHO 2020). Passengers also ought to avoid a needless tour as possible.

Prior to this introductory portion, the remaining part of the paper is divided into various sections, each concentrating on a different aspect of the research work, below is a summary of the remaining part of the paper; Section 2 sets out the methodology, Section 2.1 discusses the structure, Section 3 discusses the findings and the discussion, and finally, Section 4 is the conclusion followed by references.

2. Method

This section describes the working flow of the system and the sub - system based on inter-relationship of the entire application. Arduino Integrated Development Environment 1.8.12 (IDE) is introduced, a multi-platform coding framework. This contains many features of the code editor, such as syntax colouring, easy-to-indent, and brace alignment. In response, IDE uploaded the code to the Arduino board by compiling and uploading programs by using

appropriate one-click mechanism. It is primarily used for drawing a variety of schematics and simulating real-time circuits that enable humans to gain access during the running phase, thus creating simulation in real-time (Jamal A., Narayanasamy AL D. D. *et al* 2019, Sim L. f., David C. W. *et al* 2019). Standard APIs are generated during the programming phase of the Open CV library. Arduino UNO board is used with an Intel processor-powered Neural Processing System. Face detection is accomplished using the Cascade Classification algorithm, which is provided by (Viola P. and Michael Jones 2020).

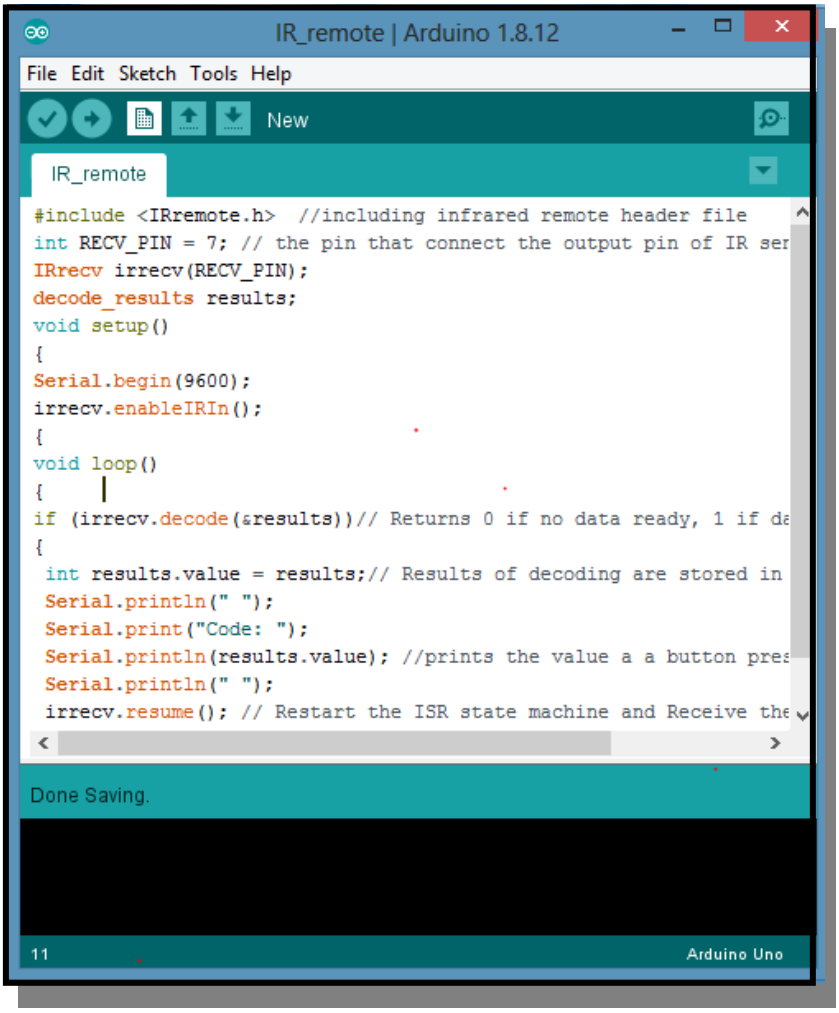


Figure 1: Arduino environment

Simulation is performed using proteus software and Arduino software. The code is first written on the Arduino Integrated Development Environment (IDE) for remote control, temperature sensor, sound sensor and Bluetooth module. To send and receive multiple protocol infrared signals while controlling the device, IR remote Arduino library, as shown in fig. 1. Identifying the pin that is attached to the output of the receiver module. The output of the simulation is displayed on the virtual proteus terminal for display. The pin legs of each sensor have been declared on the declaration space, preceded by the "void setup" in which the input and output

pins of the sensors are set up, and then finally followed by the "void loop" where the sensor results are replicated, then the code is compiled and transferred to another to pass or copy the compiled code to the Arduino board. This is conducted to validate and confirm that no errors have occurred, to see the results on the Arduino software serial monitor that is transmitted to the phone or computer via the Bluetooth module. Simulating using the proteus program shows that the control method is used to determine whether there is an error. When appropriate, the task of collecting the correct data is assigned to the device. Interfacing of the device is performed on the basis of a communication connection. This device gives warning when the temperature is higher than average. The GPS module defines the location of the person after the marking and sends a signal through the internet to the assigned authorities.

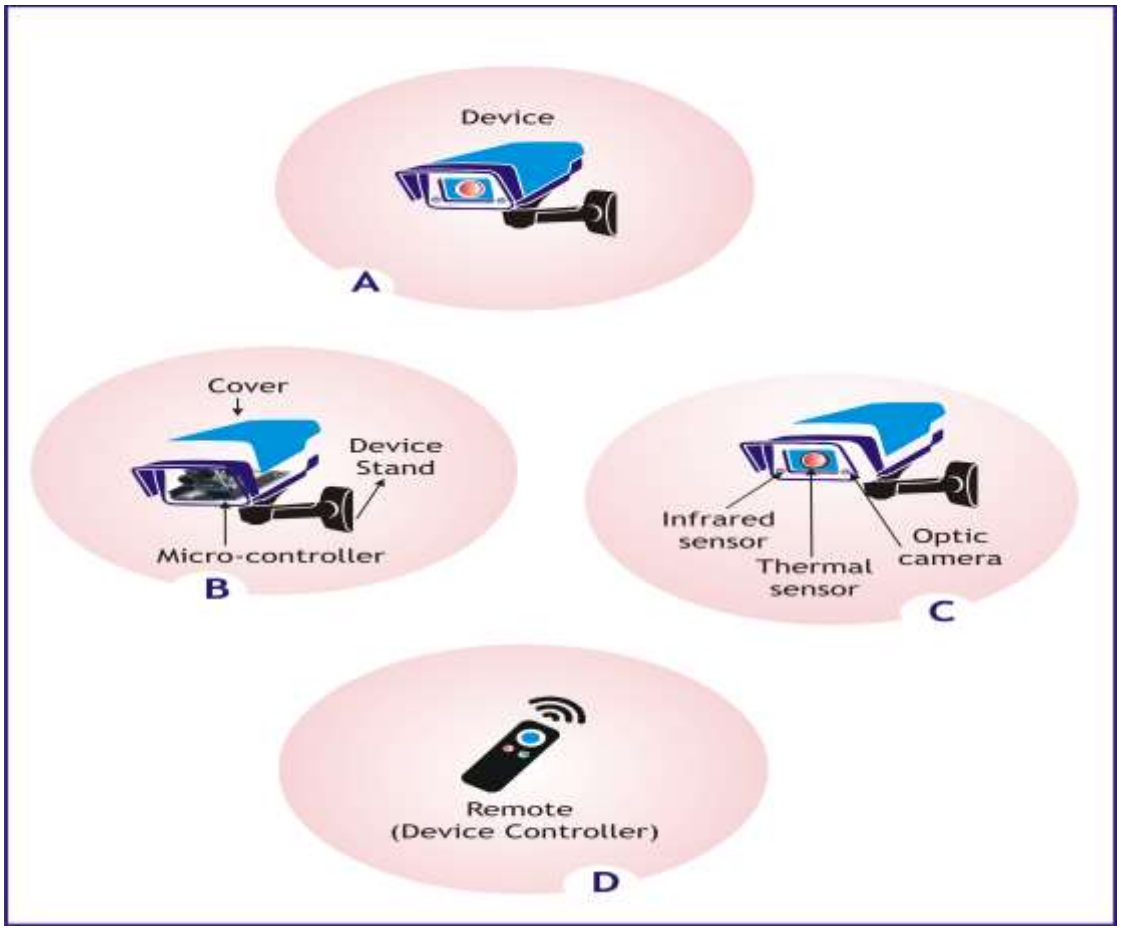


Figure 2: Device Components

A. Device **B.** Microcontroller (embedded inside device) **C.** Sensors **D.** Remote controller

The micro-controller processor is integrated to Arduino-UNO via Arduino IDE. The system is fitted with separate sensor models, enabling detailed information on face detection and temperature measurements to be obtained. The optical camera and thermal infrared sensor Fig. 2, give data on the temperature at which different points of interest were identified. The

thermal camera, also known as thermal imaging, thermal imaging, is a system that allows infrared radiation to produce an image similar to a traditional camera that uses visible light to produce images. The thermal camera is used to detect hot bodies and to understand the high temperature fluctuations. As the thermal camera reflects the body at high temperatures, it produces high strength of the infrared spectra. The next section describe the system frame work.

2.1 Work Flow

The necessary work flow of the Frame work as shown in Fig. 3 begin by testing the suspected persons via using a remote control to control the device, if symptoms like high temperature, dry cough and other related symptoms are suspected, then it captures persons using thermal and Optic camera embedded in the device otherwise it shows a negative result, meaning there are no symptoms related, it then follows by specifying the GPS location and finally sends notification and GPS location to the monitoring authorities for updates, suspected persons whose result are positive will be taken to the nearest Isolation centre by trained personnel for further investigation. The next section explains the results with discussion.

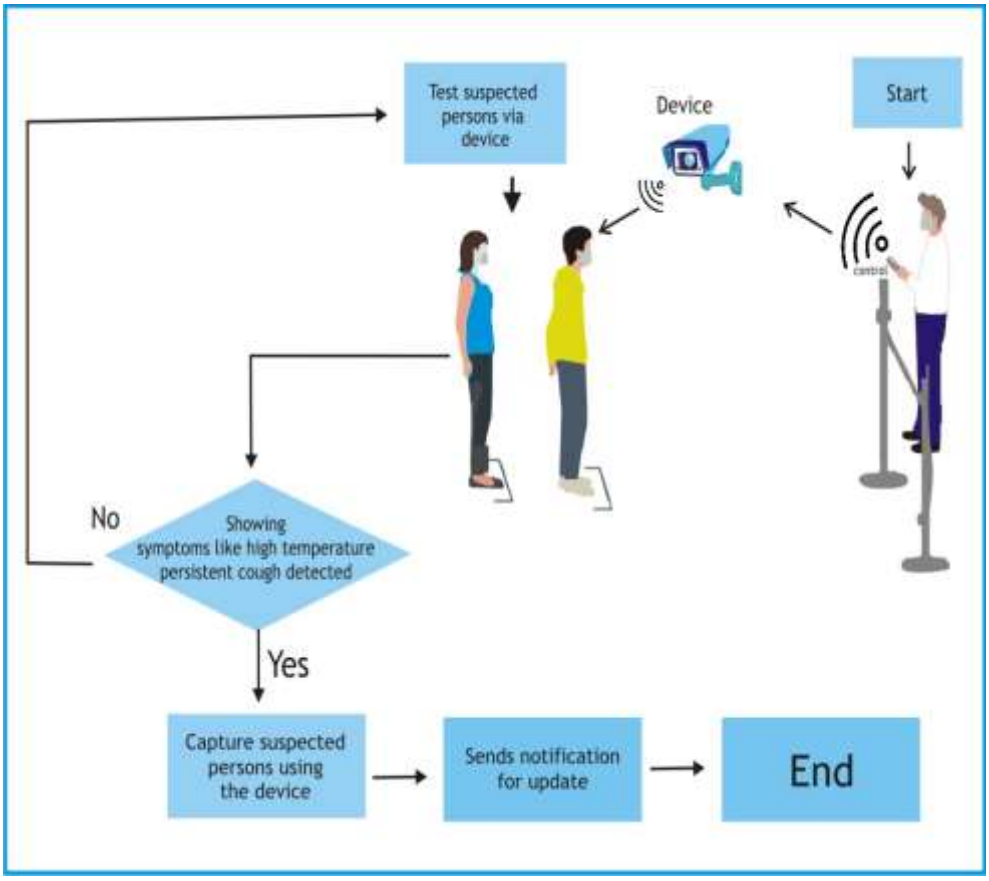
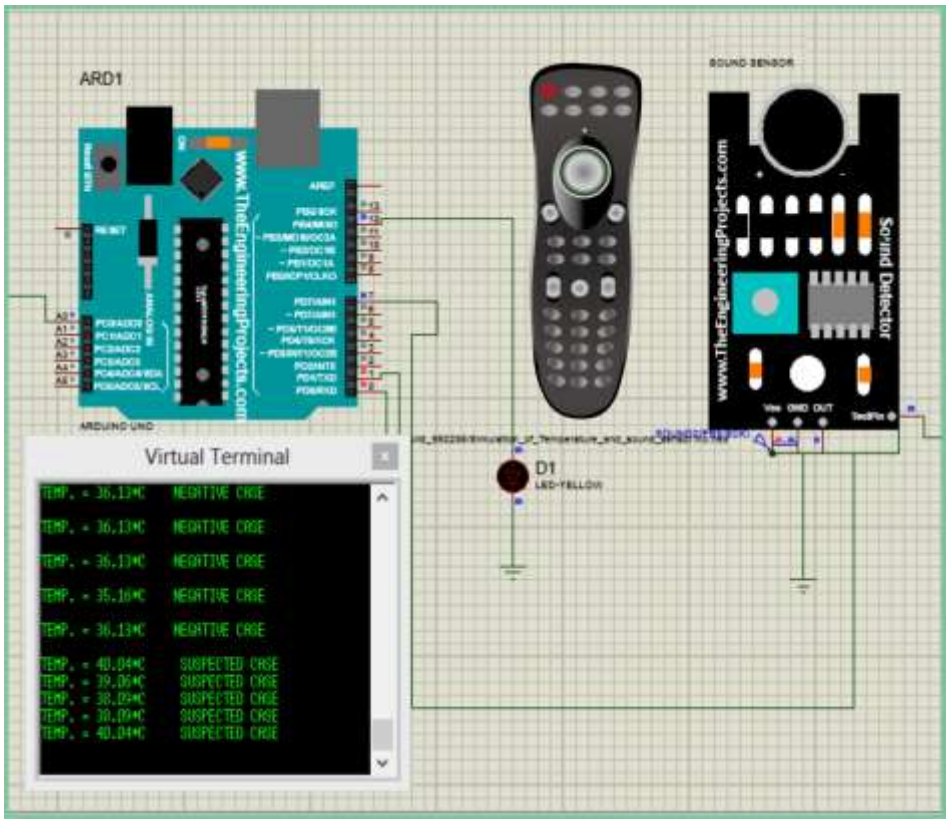


Figure 3: System Frame work flow

3. RESULT AND DISCUSSIONS

During the testing procedure, the proposed design performed well to confirm its effectiveness and confirm the performance of the adopted control technique, Fig. 4 Shows the simulation environment for the Proteus. The simulation is done using the Proteus software as shown in Fig.4. Virtual terminal which shows negative and suspected cases. Arduino is a device consisting of a basic intelligent base board with microcontroller Arduino's Visual Designer



(AVR), digital support, and Arduino pin headers (connectors).Therefore, there is a range of peripheral boards (shields) that plug in the pin headers to shape the design hardware, within AVR, the model's consists of stages in which decisions are taken on the Arduino Uno board.

Figure 4: Proteus environment

4. CONCLUSION

Considering the various diagnosis methods such as serological, molecular, and radiological can help the health centers in the detection of SARS-CoV-2, likewise early detection and monitoring system is important. Using this device for the diagnosis and screening procedure would therefore be less time consuming and little or no human interaction with this device which could also cause the spread of the viral disease quickly. In conclusion using this effective method in the diagnosis of infection is very important, which is vital in saving lives of people and preventing the spread of infection to the populace at large.

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