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Design and Implementation of a Portable COVID-19 Asymptomatic and Symptomatic Detection System

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Abstract: *Over the past three years, Uganda and the world at large has been devastated by the COVID-19 pandemic. The outbreak greatly affected the educational, political, social and economic sector negatively because stringent measures were put in place to combat the spread of the virus. Various testing kits and technologies were used to detect the virus in suspects however most of the basic technologies based their conclusion on symptomatic symptoms. This paper aims to design a system that detects both asymptomatic and symptomatic symptoms to give a precise conclusion about the status of the tested person there and then. The system captures the identity of the person using the RFID tag, detects the body temperature using a contactless temperature senor and then records the oxygen concentration using an Oximeter which are then processed by the NodeMCU controller according to the programming conditions and later stored for the administrator to access it by simply logging into the system via a web page from their work station.*

Keywords-COVID-19, RFID tag, Symptomatic, asymptomatic, sensor, Oximeter

INTRODUCTION

The world has been greatly affected, politically financially and health wise due the COVID -19 virus. The aetiology of the so called COVID-19 was found to be a novel coronavirus. It was established that the COVID-19 infection is transmitted by people carrying the virus through respiratory droplets expelled from the nose or mouth when a person coughs or sneezes. People can be infected by breathing in the virus if they are within close proximity with someone who has COVID-19, or by touching a contaminated surface and then their eyes, nose or mouth. The virus has been responsible for over 100 million infections globally, causing around 2.5 million deaths. COVID-19 can be diagnosed in hospitals using blood, saliva, or tissue sample. However, most tests use a cotton swab to retrieve a sample from inside nostrils. Currently there are no effective anti-viral drugs for SARS-CoV-2, so the primary line of defense is to detect infected cases as soon as possible. The high rate of contagion for this virus and the highly nonspecific symptoms of the disease that cause respiratory symptoms such as cough, dyspnea, fever and viral pneumonia, require urgent establishment of precise and fast diagnostic tests to verify suspected cases. The suspect detection system currently used in institutions is a temperature gun. Fever being one of the symptoms of a patient, a temperature gun is used to determine the body temperature. The normal body temperature can range between 97 F (36.1 C) and 99 F (37.2 C) so any temperature above this is suspected to be a patient. The problem with this method is that some COVID-19 suspect use fever reducing drug and others have infections that may cause an elevation in temperature. Fever is always referred to as the most common symptom of COVID-19. However, a July 2020 study by Ugandan Ministry of Health showed that out of 213 people with Covid-19 found that only 11.6% of them had experienced a fever and a December 2020 report by the same ministry estimated that 17% of people with COVID-19 are actually asymptomatic. This 17% is a large number to ignore and it is due to this that this paper has been done to take into account the 17% by further detecting the oxygen concentration in the blood and the heartbeat rate which are also compared to the normal oxygen concentration range (90% - 95% or higher) reading on a pulse Oximeter and heartbeat rate range 60-100 beats per minute which is done automatically.

LITERATURE REVIEW

Compared to other deadly viral outbreaks, COVID-19 has great potential to wipe out the entire human race if no early detection procedures are put in place to detect the virus with high precision and within shortest period possible. As on 22nd September 2021, Uganda registered 122,502 confirmed cases and 3,135 deaths. Additionally, the current admissions stand at 340 in both public and private facilities (272 in public, 66 in prisons and only 2 in the private facilities), of whom 144 (38%) are in the dire and critical category (Reported by ministry of health-Uganda) However, a means of detection of the symptoms the virus portrays are put in place to raise suspicion of presence of the virus in suspected individuals, this includes the temperature gun to measure the body temperature. However currents test performed on suspected people require blood sample examination where a molecular or antigen tests are carried out to give a conclusion about the status of the individual, regardless of whether they have any symptoms, a serological or antibody test which shows whether the body has antibodies to the virus can also be performed and If antibodies are present, it suggests that the

body has already dealt with SARS-CoV-2.However this testing isn't readily available to the community ,in addition to that it takes time for the results to be released in order to identify the suspect and isolate them for treatment. It is due to this that an improved COVID-19 detection system consisting of temperature sensors and pulse Oximeters has been designed to quickly determine and isolate the suspected individual for treatment.

A BASIC BLOCK DIAGRAM OF THE PROJECT IS SHOWN BELOW

NodeMCU

The NodeMCU is the central masterpiece as it's the microcontroller that does the management of all other components, and at the same time it's the Wi-Fi module, that gives network connectivity to the project. Still to come, NodeMCU acts as the server for this project, it establishes a WIFI access point through which it serves a web page used to display records of the data.

RFID System

The RFID system was connected to NodeMCU through SPI communication, that is, a master – slave relationship. The system first determines the identity of the person whose measurements is to be taken by simply swapping the RFID tag at the reader.

Temperature Sensor

Non-contact temperature Sensor was used to collect the temperature data for an individual which was then sent to the NodeMCU for processing.

Oximeter

The Oximeter was used to detect blood oxygen and heart rate which then sent to the main processor and then processed as conditioned during the programing of the microchip.

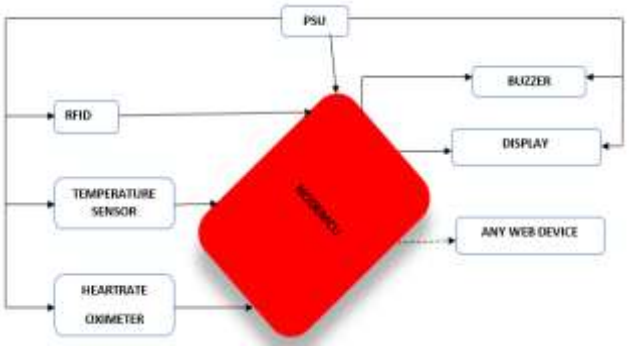

Figure 1: Block diagram of a Portable COVID-19 asymptomatic and symptomatic detection system

ELECTRONIC CONTROL CIRCUIT DIAGRAM IS SHOWN BELOW

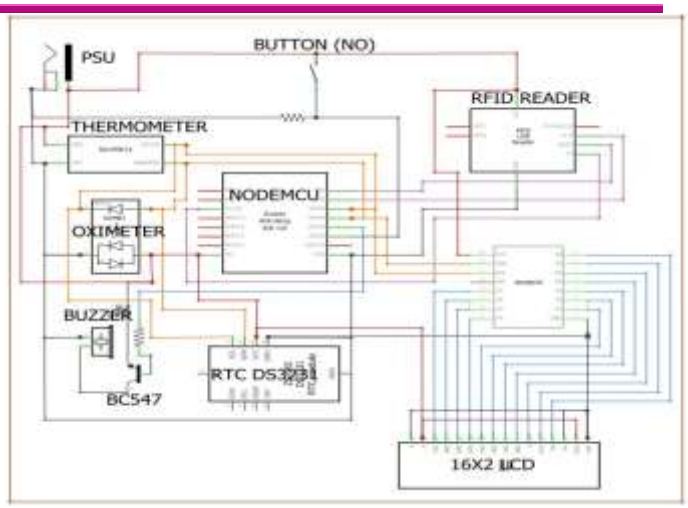

Figure 2: Electronic Control Circuit Diagram

FLOW CHART OF THE AUTOMATIC COVID-19 ISOLATION SYSTEM FOR SUSPECTS

The flow chart below was used to design and Implement a Portable COVID-19 asymptomatic and symptomatic detection system. It illustrates the series of events starting from identification of the person when the RFID tag details are captured up to the point when the status of the person is displayed on the LCD screen. This algorithm was implemented using Embedded C language of the Arduino IDE.

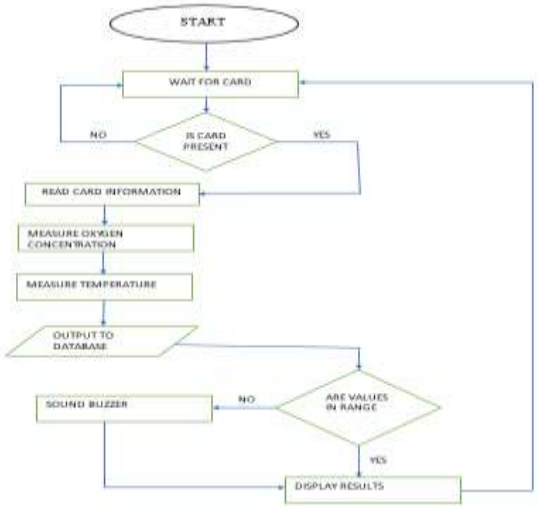

Figure 3: Flow chart of a Portable COVID-19 asymptomatic and symptomatic detection system.

TEST AND RESULTS

The project is basically designed to help institutions and public offices identify COVID-19 suspects and isolate them immediately to avoid the spreading of the virus. The RFID tag, Temperature sensor, and the Oximeter module were

integrated together with the microcontroller as the central processing unit, while the buzzer and the LCD screen were connected to the microcontroller as the output tools. Details of the person are captured from their Identity Card by the RFID reader, then the temperature is measured by the temperature senor, the person is then prompted by the system to place their finger on the Oximeter which take the heartbeat rate and determine the oxygen concentration of the person under testing. The microcontroller runs the codes and compares the captured reading of temperature, oxygen concentration against the normal readings as programmed then the status is displayed on the LCD screen. All the captured information is them stored on the hard drive which is then later accessed by the administrator as evidence. The images below were taken during the testing process.

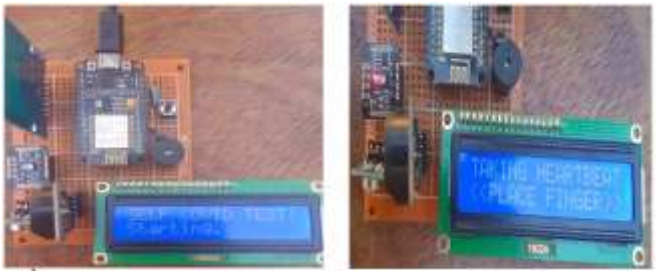

Figure 4: A portable COVID-19 asymptomatic and symptomatic detection system Implementation

CONCLUSION

The fully assembled system was able to read the RFID tags, measure the oxygen concentration and temperature, these records were stored in daily files on NodeMCU's file system and at the same time displayed on the LCD screen. The system was also accessible wirelessly via WIFI for the administrator to login and review all records at any given time. Furthermore, the system was able to display on the LCD whether the finger is placed probably on the Oximeter or not, it also prompted the user to start the test for data to be captured after every user. Most importantly, the project narrowed down the probability of clearly singling out a COVID-19 suspect by testing several signs and symptoms before drawing a conclusion. A slight change of about +-one degree in the temperature measure of the system was noticed whenever there was a significant change in the surrounding environment. The project was powered by a 5VDC power supply which makes its power consumption very user friendly.

REFERENCES

[1] MINISTRY OF HEALTH, "CORONA VIRUS (PANDEMIC) COVID-19," MINISTRTY OF HEALTH UGANDA, 19 FEBRUAURY 2020. [Online]. Available: https://www.health.go.ug/covid/about-corona-virus/. [Accessed 15 MARCH 2021].

[2] www.nytimes.com.

[3] C. W. TIM JEWELL, "EVERYTHING YOU SHOULD KNOW ABOUT THE 2019 CORONA VIRUS AND COVID-19," HEALTHLINE, 2 MARCH 2020. [Online]. Available: https://www.healthline.com/health/coronavirus-covid-19. [Accessed 22 MARCH 2021].

[4] G. A.-S. J. Gostic KM, "Estimated effectiveness of symptoms and risk screening to prevent the spread of COVID-19," 2020.

[5] "Presidential's speech on COVID 19," 22 September 2021.

[6] J. Seladi-Schulman, "MEDICALNEWSTODAY," 06 MAY 2021. [Online]. Available: https://www.medicalnewstoday.com/articles/coronavirus-testing. [Accessed 09 JULY 2021].

[7] All About Electronics, "WHAT IS RFID," 4 APRIL 2018. [Online]. Available: https://passive-components.eu/what-is-rfid-how-rfid-works-rfid-explained-in-detail/.

[8] Arduino, "Introduction to Arduino," JULY 2019. [Online]. Available: http://www.arduino.cc/en/main/arduinoBoardUNO.

[9] C. a. Maity, 2020. [Online]. Available: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/trchnical-guidance/naming-the-coronavirus-disease-covid-2019-and-the-virus-that-causes-it;. [Accessed 1 july 2021].