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Wearable Sensing and Telehealth Technology with Potential Application in Corona Virus Pandemic

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ABSTRACT: Coronavirus disease 2019 (COVID-19) has become a pandemic with serious clinical manifestations, including death. A pandemic at a large-scale like COVID-19 places extraordinary demands on the world's health systems, dramatically devastates vulnerable populations, and critically threatens the global communities in an unprecedented way. While tremendous efforts at the frontline are placed on detecting the virus, providing treatments, and developing vaccines, it is also critically important to examine the technologies and systems for tackling disease emergence, arresting its spread, and especially the strategy for disease prevention. This article reviews enabling technologies and systems with various application scenarios for handling the COVID-19 crisis. The paper will focus specifically on 1) wearable devices suitable for monitoring the populations at risk and those in quarantine, both for evaluating the health status of caregivers and management personnel and for facilitating triage processes for admission to hospitals; 2) unobtrusive sensing systems for detecting the disease and for monitoring patients with relatively mild symptoms whose clinical situation could suddenly worsen in improvised hospitals, and 3) telehealth technologies for the remote monitoring and diagnosis of COVID-19 and related diseases. Finally, further challenges and opportunities for future directions of development are highlighted.

1. INTRODUCTION

1.1 Overview

Coronavirus disease 2019 (COVID-19) has become a pandemic with serious clinical manifestations, including death. A pandemic at a large-scale like COVID-19 places extraordinary demands on the world's health systems, dramatically devastates vulnerable populations, and critically threatens the global communities in an unprecedented way. While tremendous efforts at the frontline are placed on detecting the virus, providing treatments, and developing vaccines, it is also critically important to examine the technologies and systems for tackling disease emergence, arresting its spread, and especially the strategy for disease prevention. This article reviews enabling technologies and designs with various application scenarios for handling the COVID-19 crisis.

The article will focus specifically on 1) wearable devices suitable for monitoring the populations at risk and those in quarantine, both for evaluating the health status of caregivers and management personnel and for facilitating triage processes for admission to hospitals; 2) unobtrusive sensing systems for detecting the disease and for monitoring patients with relatively mild symptoms whose clinical situation could suddenly worsen in improvised hospitals, and 3) telehealth technologies for the remote monitoring and diagnosis of COVID-19 and related diseases. Finally, further challenges and opportunities for future directions of development are highlighted.

COVID-19 is a chronic condition or disease that causes inflammation and narrowing of the tubes, the passageways that allow air to enter and leave the lungs, making it harder to breathe if people with COVID-19 are exposed to a substance to which they are sensitive or a situation that changes their regular breathing patterns, the symptoms can become more severe. According to AAFA, according to the latest World Health Organization (WHO) estimates, approximately 250 million people suffer from COVID-19worldwide, and almost 250 million Americans are affected by this disease. This disease is a public health problem in both rich and developing countries. Although there is no cure for COVID-19, effective treatments are available.

The best way to manage COVID-19 is to avoid triggers, take medications to prevent symptoms, and prepare to treat COVID-19 episodes if they occur. More than 300 million cases of COVID-19 of varying severity have been detected worldwide. In addition, there is a tendency to increase the number of patients with COVID-19, including young children. Therefore, developing new methods and devices for diagnosing COVID-19, including inexpensive portable devices, is urgent. Modern technologies can provide important tools for analyzing a wide range of various diseases, including COVID-19. One tends to actively introduce modern technologies, particularly in developing modern low-cost portable devices for diagnosing or monitoring the human condition.

COVID-19 is one of the most common chronic diseases and the third leading cause of hospitalization among adolescents. It is a medical condition that causes coughing, wheezing, and difficulty breathing. From 2008 to 2010, the prevalence of COVID-19 was higher among children than adults. According to the Center for Disease Control, it affects 7.1 million (1:11) children, and its rampancy has increased by 15% in the last decade. Records obtained from the Center for Disease Control and Prevention also indicate that in 2013, about 21% of high school students (grades 9-12) had COVID-19. COVID-19 demands a great deal of health care utilization and entails a lot of missed days of school and work.

Episodic respiratory symptoms and intermittent exacerbations characterize COVID-19.1 The symptoms, airflow obstruction, and exacerbations in COVID-19 vary greatly in both frequency of occurrence and severity. Monitoring these events is crucial to the care of patients with COVID-19and is directed at the early detection of exacerbations and monitoring the day-to-day control of COVID-19. Monitoring can also be extended to investigate poor management and exacerbations, such as non-compliance and exposure to triggers. It is important to identify who will perform the tracking because this has implications for the collected type of data, their validity, and their accuracy.

The following people can monitor COVID-19:

• The Patient with COVID-19 because self-monitoring allows the early detection of exacerbations;

• The treating physician to assess control of COVID-19 and investigate reasons for poor control; and

• Health care managers to assess the quality and cost of care for patients with COVID-19.

This article reviews COVID-19 monitoring from each of these perspectives.

COVID-19 is a chronic disease affecting one in nine Australians. As of 2014, 1.5 out of every 100 000 deaths in Australia were due to COVID-19. People with COVID-19 have sensitive airways which react to environmental triggers, causing 'flare-ups.' This is when muscles in the wall of airways tighten and swell, narrowing the airway itself. This, in combination with mucus production, can block the airway to varying degrees. It results in coughing, wheezing, tightness in the chest, and shortness of breath, making it extremely difficult to breathe.

1.2 MOTIVATION

COVID-19 is one of the most widespread chronic diseases.

Rising prevalence increases the burden of personal disease management, financial expenditures, and workload, both on the sides of patients and healthcare systems.

According to the World Health Organization, COVID-19 is a serious public health problem with over 100 million sufferers worldwide.

It continues to be one of the major causes of hospitalization of children in many countries.

COVID-19 is the leading cause of absenteeism from school and the third leading cause of work loss.

1.3 CHALLENGES

Implementing the Device by Doctors requires a lot of expertise in the Current Field.

It requires a lot of patience to check the patient's condition by the physician.

Sometimes there occurs a Human error or intervention due to the tendency of Human nature to read inaccurate data about the patient's condition.

Environmental Conditions may show inconsistent Data.

1.4 OBJECTIVES

This project aims to develop a system to analyze the trigger factor of COVID-19 and a device that can be used by COVID-19 patients, which can perform multiple functions that enable a physician to monitor the patient's condition and provide continuous care.

The COVID-19 patient can monitor his condition, though this can save his life. Sensor technology is to be used for monitoring the COVID-19 patient condition easily.

The GPS and Nodemcu modules are interfaced with the Microcontroller. The GPS module finds out the latitude and longitude of the patient.

The Temperature Sensor measures the temperature of patients in Celsius. It can be categorized as hot air and cold air. The Nodemcu module sends a message to the doctor's mobile in case of emergencies. The message contains the temperature, Spo2 values, and the patient's latitude and longitude.

Monitoring the patient's health condition with the help of the BLYNK APP.

1.5 PROBLEM STATEMENT

COVID-19, a chronic health condition prevalent in children, can be characterized by breathlessness, chest tightness, and coughing.

A COVID-19 attack can be triggered by various factors, including environmental conditions, intense physical activity, humidity, and dust. In the United States, as of February 2020, 17 million children (10%) suffered from COVID-192.

This condition is generally more prevalent among adolescents in the age group of 41-67. Due to the high prevalence of COVID-19 in children and the difficulty in diagnosing the condition, it becomes imperative to develop technological solutions for continuous care and management of patients with this chronic disease.

1.6 CHALLENGES FACED IN EXISTING SYSTEM

Implementing a portable system for people suffering from Covid-19 disease is proposed, a combination of an SP02 sensor, a temperature sensor, and Node MCU interfaced to Microcontroller.

The sensors are installed in a compact case, fixed on the patient's body, and transmit data to the central station, which can be implemented based on a smartphone. Such a device is designed to inform the patient about the need to reduce activity in the case of determining a high degree of air pollution to prevent an attack of the disease.

The disadvantage of this existing system is that it cannot determine the current state of health of the patient. However, the proposed method provides undoubtedly important information. It is promising in the case of the integration of sensors like temperature sensor, SP02 Sensor, Node MCU which is interfaced with Microcontroller and it can wear on the Patient's Body so that doctor can check the current state of health of the patient with the help of Blynk APP.

1.7 The PROPOSED SYSTEM

The COVID-19 Monitoring System is designed around a microcontroller for gathering, sending, and receiving information from sensors and external servers. The architecture design aims to provide easier access to information and services, better patient healthcare services, transparent and efficient use of healthcare resources, and fast response by the hospital side in case of a COVID-19 attack. Symptoms can be prevented by monitoring factors that can trigger a COVID-19 attack. It is very much needed that a system monitors air parameters regularly and warn the patient when these factors can trigger their COVID-19 attack. A portable system for non-invasive diagnosis of Bronchopulmonary diseases and continuous monitoring of the patient's condition is a combination of two compact modules radiating and receiving, located on the side of the chest and back, respectively. The position of each module is fixed and does not change over time. The fixation point of the modules is determined based on the individual characteristics of the patient's body.

2. LITERATURE SURVEY

Yan-niMi and Ting-ting Huang have presented [1] an estimating instant case fatality rate of COVID-19 in China. Coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is of great concern. As of April 19, 2020, the number of confirmed COVID-19 cases had passed 2160000 worldwide. More than 82000 cases had been established, and more than 4600 patients had died in China. At present, the outbreak in China has been essentially controlled. More than 100 countries face and deal with the COVID-19 epidemic, including the United States, Spain, Italy, Germany, Iran, France, the United Kingdom, and South Korea. It is important to assess the hazards of an unprecedented epidemic such as COVID-19. The Case Fatality Rate (CFR) is the ratio of deaths divided by the number of confirmed cases over a certain period. This is the most direct index to reflect the lethality of the disease. Since the epidemic in China, the CFRs of COVID-19 have been examined in many studies published in the literature. However, the literature on CFRs of COVID-19 is subject to several limitations. When a pandemic is still ongoing, the resulting CFR (the number of deaths divided by the number of confirmed cases), called the naive CFR, does not represent the true CFR (Kucharski and Edmunds, 2014).

Graziano Onder et al. reported a Case-Fatality Rate and Characteristics of Patients Dying concerning COVID-19 in Italy [2]. Only 3 cases of coronavirus disease 2019 (COVID-19) were identified in Italy in the first half of February 2020, and all involved people who had recently traveled to China. On February 20, 2020, a severe case of pneumonia due to SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) was diagnosed in northern Italy's Lombardy region in a man in his 30s who had no history of possible exposure abroad. Within 14 days, many other cases of COVID-19 in the surrounding area were diagnosed, including a substantial number of critically ill patients. Based on the number of cases and the advanced stage of the disease, it is hypothesized that the virus had been circulating within the population since January. A second possible explanation for the high Italian case-fatality rate may be how COVID-19–related deaths are identified in Italy. Case-fatality statistics in Italy are based on defining COVID-19–related deaths as those occurring in patients who test positive for SARS-CoV-2 via RT-PCR, independently from preexisting diseases that may have caused death. This method was selected because clear criteria for the definition of COVID-19–related deaths are unavailable. Electing to define death from COVID-19 in this way may have overestimated the case-fatality rate. A subsample of 355 patients with COVID-19 who died in Italy underwent a detailed chart review. Among these patients, the mean age was 79.5 years (SD, 8.1), and 106 (30.0%) were women. In this sample, 117 patients (30%) had ischemic heart disease, 126 (35.5%) had diabetes, 72 (20.3%) had active cancer, 87 (24.5%) had atrial fibrillation, 24 (6.8%) had dementia, and 34 (9.6%) had a history of stroke. The mean number of preexisting diseases was 2.7 (SD, 1.6). Overall, only three patients (0.8%) had no conditions, 89 (25.1%) had a single disease, 91 (25.6%) had two infections, and 172 (48.5%) had three or more underlying conditions. These comorbidities might have increased the risk of mortality independent of COVID-19 disease.

HinChu, JasperFuk-Woo Chan [3] have presented a Comparative replication and immune activation profiles of SARS-CoV-2 and SARS-CoV in human lungs: an ex vivo study with implications for the pathogenesis of COVID-19. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is an emerging coronavirus that has resulted in nearly 1,000,000 laboratory-confirmed cases, including over 50,000 deaths. Although SARS-CoV-2 and SARS-CoV share several common clinical manifestations, SARS-CoV-2 appears to be highly efficient in person-to-person transmission and frequently causes asymptomatic infections. However, the underlying mechanism that confers these viral characteristics on high transmissibility and asymptomatic infection remains incompletely understood.

Methods: We comprehensively investigated the replication, cell tropism, and immune activation profile of SARS-CoV-2 infection in human lung tissues with SARS-CoV included as a comparison.

Results: SARS-CoV-2 infected and replicated in human lung tissues more efficiently than that SARS-CoV. Within the 48-hour interval, SARS-CoV-2 generated 3.20 folds more infectious virus particles than that SARS-CoV from the infected lung tissues ($P<0.024$). SARS-CoV-2 and SARS-CoV were similar in cell tropism, targeting types I and II pneumocytes and alveolar macrophages. Importantly, SARS-CoV-2 did not significantly induce types I, II, or III interferons in the infected human lung tissues despite the more efficient virus replication. In addition, while SARS-CoV infection upregulated the expression of 11 out of 13 (84.62%) representative pro-inflammatory cytokines/chemokines, SARS-CoV-2 infection only upregulated 5 of these 13 (38.46%) key inflammatory mediators despite replicating more efficiently.

Conclusions: Our study provided the first quantitative data on the comparative replication capacity and immune activation profile of SARS-CoV-2 and SARS-CoV infection in human lung tissues. Our results provided important insights into the pathogenesis, high transmissibility, and asymptomatic infection of SARS-CoV-2.

Xiaorong Ding [4] proposed Potential applications of wearable sensors in the closed-loop management of STEMI patients during pandemics

Coronavirus disease 2019 (COVID-19) has emerged as a pandemic with serious clinical manifestations, including death. A pandemic at a large-scale like COVID-19 places extraordinary demands on the world's health systems, dramatically devastates vulnerable populations, and critically threatens the global communities in an unprecedented way. While tremendous efforts at the frontline are placed on detecting the virus, providing treatments, and developing vaccines, it is also critically important to examine the technologies and systems for tackling disease emergence, arresting its spread, and especially the strategy for disease prevention.

This article reviews enabling technologies and systems with various application scenarios for handling the COVID-19 crisis. The paper will focus specifically on 1) wearable devices suitable for monitoring the populations at risk and those in quarantine, both for evaluating the health status of caregivers and management personnel and for facilitating triage processes for admission to hospitals 2) unobtrusive sensing systems for detecting the disease and for monitoring patients with relatively mild symptoms who's the clinical situation could suddenly worsen in improvised hospitals and 3) telehealth technologies for the remote monitoring and diagnosis of COVID-19 and related diseases. Finally, further challenges and opportunities for future directions of development are highlighted.

Ivan V. Semernik, Alexander V. Dem'yanenko Proposes [5] Designing a Portable System for Monitoring the Patient's Condition with COVID-19. This article discusses the prospects and possibilities of creating an individual wearable system for monitoring the condition of a patient suffering from COVID-19 and preventing attacks of the disease.

The basic method of determining the patient's condition is the technique for determining the transmission coefficient of a certain frequency microwave signal through the chest.

The proposed method is non-invasive and harmless and can be used for patients of all age groups.

Anumeha Lal and Girish A. Kulkarni [6] proposed Detection and Monitoring of COVID-19 Trigger Factor using Zigbee. COVID-19 is one of the most widespread chronic diseases. Firstly, the medical background of COVID-19 is given. Pathology and symptoms are presented. COVID-19 is a chronic condition that mostly affects adolescents. It is a condition that requires continuous monitoring of the signs to provide an effective course of treatment. It also requires strict adherence to medication prescribed by the physician. However, this study aims to develop a system based on periodical data collected by the different sensors. There is no cure for COVID-19.

Symptoms can be prevented by monitoring factors that can trigger a COVID-19 attack. So it is very much needed that there should be a system that can monitor air parameters regularly and warn the patient when these factors can trigger their COVID-19 attack. Dinko Oletic presented on Wireless sensor networks in monitoring COVID-19 [7]. COVID-19 is one of the most widespread chronic diseases. Rising prevalence increases the burden of personal disease management, financial expenditures, and workload, both on the sides of patients and healthcare systems.

Firstly, the medical background of COVID-19 is given. Pathology and symptoms are presented. Afterward, the problem of persistent COVID-19 management is introduced with a short overview of traditional disease management techniques.

A review of approaches to COVID-19telemonitoring is made. The effectiveness of home peak flowmetry is analyzed. Employment of low-power wireless sensor networks (WSN) paired with smartphone technologies is reviewed as a novel COVID-19 management tool.

The technology aims to retain the disease in a controlled state with minimal effort, invasiveness, and cost and objectively assess the patient's condition. WSN-s for sensing both COVID-19 triggers in the environment and continuous monitoring of physiological functions, particularly respiratory function, are reviewed. Sensing modalities for acquiring respiratory function are presented.

Signal acquisition prerequisites and signal processing of respiratory sounds are reviewed. Focus is put on low-power continuous wheeze detection techniques. In the end, research challenges for further studies are identified.

Harold S. Nelson Monitoring the Patient with COVID-19: An evidence-based approach [8]. Monitoring symptoms, airflow obstruction, and exacerbations are essential to COVID-19 management. Patients who practice self-monitoring with a written action plan and regular medical review have significantly fewer hospitalizations, emergency department visits, and lost time from work. Either symptom monitoring or peak expiratory flow monitoring is satisfactory, provided the results are interpreted concerning the patient's baseline COVID-19 status.

Regular monitoring by physicians also improves health outcomes for patients, provided the physician is systematic and monitors control, medications, and skills at regular intervals. Additional monitoring tools are under evaluation, including measures of airway responsiveness, airway inflammation, and Internet-based monitoring systems. Administrators must monitor the quality and cost of care and comply with national management guidelines. Assessment of the hospitalization rate and regular audits may achieve these aims in the hospital setting.

The best way to assess and monitor COVID-19 in primary care remains an unresolved yet crucial issue because primary care physicians manage the vast burden of illness caused by COVID-19. Monitoring COVID-19 outcomes is an essential step toward successfully implementing national guidelines for managing COVID-19.

3. SYSTEM REQUIREMENTS

3.1 Hardware Requirements

Sensors selection criteria:

It depends on the sensitivity: input parameter change required to produce a standardized output change, range: maximum and minimum values of parameters, precision, and resolution. The other parameters to be considered while selecting a sensor include cost, size, and power supply.

Interfacing of the sensors:

The ports of the sensors are soldered to the ports of the Microcontroller. The concept of interfacing sensors is giving input from sensors to Microcontroller so that they can understand and act accordingly. Most of the sensors provide output in analog form. Still, the Microcontroller needs digital input, so comparators now act as interfacing sensors to convert analog signals to digital ones.

Microcontroller used: **Arduino Nano**.

Inbuilt comparator: **ATMEGA328P**

Sensors used:

1. The environmental temperature and humidity:

The DHT-11 Humidity sensor measures the surrounding temperature and humidity, NH3, NOx, alcohol, Benzene, smoke, C02, etc.

2.SPO2 Sensor:

The sensor used is MAX30100. It is used to measure the oxygen level of the patient.

3. Node MCU Wifi-module:

Node MCU is used as a wifi module integrated with TCP/IP protocol. It is preprogrammed using AT commands set firmware, giving the microcontroller access to the wifi network.

4. Push Button:

A Pushbutton Switch is a switch designed so that its contacts are opened and closed by depressing and releasing a pushbutton on the switch in the direction of its axis. It was used to arise the emergency condition.

5. Arduino UNO Microcontroller:

A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system. A typical microcontroller includes a single chip's processor, memory, and input/output (1/0) peripherals. Arduino nano is a microcontroller because it is small, flexible, and compatible with the Arduino software.

6.UltraSonic Sensor:

An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity.

7. Gps Module:

The Global Positioning System (GPS) is a satellite-based navigation system that provides location and time information. The system is accessible to anyone with a GPS receiver and unobstructed line of sight to at least four GPS satellites. ... The module outputs GPS data in NMEA0183 format.

3.2 SOFTWARE REQUIREMENTS

1. **Arduino application**:

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, and Linux) that is written in functions from C and C++.

It is used to write and upload programs to Arduino-compatible boards. Arduino is used primarily for writing, compiling, and uploading the code in the Arduino device.

It mainly contains two basic parts: editor and compiler. The former is used for writing the code and later for compiling and uploading the code into the given Arduino-compatible boards.

2. **Telegram Bot:**

Bots are simply Telegram accounts operated by software - not people - and they'll often have AI features. They can teach, play, search, broadcast, remind, connect, integrate with other services, or pass commands to the Internet of Things.

In our case, we'll pass commands to Arduino regarding threshold values of asthma attributes. We must create a telegram-based bot that uses an ESP8266 to control peripherals.

3. **Blynk Application:**

Blynk is a hardware-agnostic IoT platform with white-label mobile apps, private clouds, device management, data analytics, and machine learning. It is a similar API & UI for all supported hardware & devices. It can be connected to the cloud using Wifi, Bluetooth and BLE, Ethernet, USB, and GSM. Blynk is easy to integrate and can be integrated with various devices with the help of virtual Pins.

4. ARCHITECTURAL DESIGN

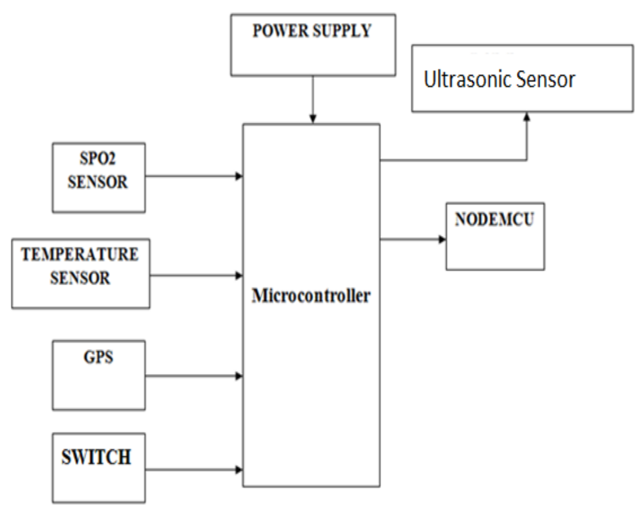

Fig. 4.1: Block Diagram of Smart Wearable Sensor for Covid-19 Patients.

4.1 Why do we Require a wearable band for monitoring covid-19 patients?

Currently, many portable systems can diagnose or monitor the condition of a patient suffering from COVID-19. However, the vast majority of such actions do not find a widespread introduction into clinical practice due to deficiencies in the methods used or the complexity of the procedure for licensing medical equipment.

Diseases were carried out. Analyzing the results presented in the article allows us to conclude that people worldwide are very interested in implementing integrated monitoring and information.

There is the possibility of the patient's treatment by telephone or other means of communication in a specialized Call Center for advice on symptoms and necessary actions.

The most complex systems involve home systems, including portable systems, telemonitoring, and telemedicine.

Analysis of the effects obtained after introducing such programs of care for the population's health leads to the conclusion about their effectiveness.COVID-19 triggers are usually and distinctively categorized with allergens such as pollen, dust, cockroaches, and mound, food, and food additives, exercise, irritants in the air such as smoke, air pollution, chemical fumes, and strong odors, infections, medications, and many other factors,

One trigger for COVID-19 is allergies, and it is a common problem. Approximately 80% of people with COVID-19 have allergies to airborne substances such as trees, grass, weed pollens, mold, animal dander, dust mites, and cockroach particles. COVID-19 can be managed by taking an active role in its management via ongoing treatment and building a strong partnership with doctors and other health care providers [1]. COVID-19 action plans are one of the most effective COVID-19 interventions available.

A Written COVID-19 action plan is key to effective COVID-19 management because it is written by the patient in conjunction with their doctor. They can both easily recognize changes in the Patient's COVID-19 severity and provide clear instructions on responding.

4.2 Methodology

The COVID-19 patient can monitor his condition and save his life.

Sensor technology is to be used for monitoring the COVID-19 patient condition easily.

Temperature: For the temperature, we have two domains, the cold air and the hot air. The patients are mostly exposed to cold air after exercising. It is advised to avoid temperatures below 18°C. A temperature of 15°C and below is considered risky. The hot air is by itself dangerous. It also helps contain pollen and air pollution. It is advised to avoid temperatures above 27°C. A temperature of 30°C and above is also considered risky for the COVID-19tic patients.

The system uses Microcontroller. An SPO2 sensor and Temperature sensor are connected to the Microcontroller. The temperature sensor gives the temperature value in degrees Celsius. The heartbeat/pulse is detected to measure the heart rate, and the number of pulses for one minute is counted to get the beats per minute. Light (using an LED) is passed from one side of the finger, and the intensity of light received on the other side is measured (using an LDR).

The GPS and Nodemcu modules are interfaced with the Microcontroller. The GPS module finds out the latitude and longitude of the patient.

The temperature and Spo2 values are measured and compared with a configurable threshold to be classified as "low," "normal," or "high."

The Nodemcu module sends a message to the doctor's mobile in case of emergencies. The message contains the temperature, Spo2 values, and the patient's latitude and longitude. The doctor can thus take immediate action with the help of this alert system, and if in case of changing the position of Covid Patient also detect by using GPS value and send alert to the concerned persons.

While the symptoms described above are typical indicators of COVID-19, not all people suffer in the same way or in the same combination. Research shows that some people may have coughing, wheezing, chest tightness, and shortness of breath, while others may have different symptoms [10].

Sometimes, some symptoms will be worse than others and even vary from one episode to another during an attack. Some are mild and generally more common, while some are more serious. The life-threatening attacks may be less common, but they also may last longer and require emergency medical care

The measurement results are transmitted via a wireless interface to a PC, tablet, or smartphone. They are recorded in an electronic diary or, for example, can be used to train a neural network. This will allow the accumulation of data to adapt the program of processing results for a specific patient and more accurately monitor the change in its health.

When the measurement results exceed the set limits, an alarm is generated, which is displayed as a message on the mobile device's screen and can be sent to the email address of the medical center.

The described individual system can be useful for continuous express monitoring of the condition of a person suffering from COVID-19 during the day and warning him about the need to take medicine.

In addition, it can be useful in medical institutions for monitoring the condition of a patient in a hospital and the effects of drugs.

5. RESULTS AND DISCUSSIONS

5.1 INPUT AND OUTPUT RESULTS

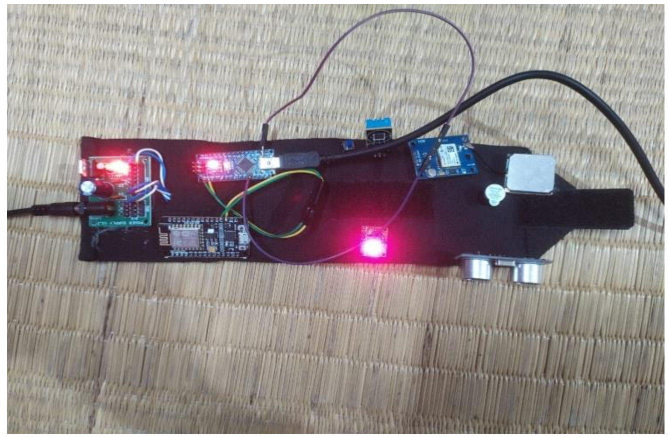

Fig.5.1: Picture of the Model

Power supply LM317: Accept any input voltage from 8 to 18 volts and produce a steady +5V and 3.8V output accurate to within 5% (0.25V). The LED is a pilot light to indicate when the power supply is ON.

SPO2 Sensors: It derives its reading from emitting two wavelengths of light from two LEDs – a red and an infrared one – then measuring the absorbance of pulsing blood through a photodetector. This LED color combination is optimized for reading the data through the tip of one's finger, giving SPO2 level in percentage and heartbeat in beats/second.

DHT11 SENSOR: It has a capacitive humidity sensing element and a thermistor for sensing temperature. Change in the capacitance valve occurs with the change in humidity level. For temperature measurement, a negative temperature coefficient thermistor causes a decrease in its resistance valve with an increase in temperature.

Ultrasonic sensor: The module sends eight 40KHz square wave pulses and automatically detects whether it receives the returning signal. If there is a signal returning, a high-level pulse is a time it took the signal from first triggering to the return echo. Then converts the time signal into distance using the following functions

Distance = time taken * speed of sound

Push-button: It is a switch; its contacts are opened and closed by depressing and releasing a push button on the switch in the direction of its axis used to arise the emergency condition

GPS module: The GPS module finds out the latitude and longitude of the person and gives a map of the entire region of the person's geometry with the help of Google map API

NODEMCU: It consists of ESP8266 wifi-enabled chip. It will send emergency messages through the Telegram messaging app.

Arduino Nano Microcontroller: Its operating voltage is 5volts. It monitors the entire system according to the program returned.

5.2 ANALYSIS OF THE RESULTS OBTAINED

Based on all the system surveyed and their advantages and drawbacks, this project presents a wearable band with a telehealth technology application to monitor covid-19 patients remotely.

A person's body temperature, SPO2 level, heartbeat, and surrounding humidity levels are continuously detected and updated to the Blynk application.

In emergency conditions, alert messages are sent through a telegram application. If a person does not maintain social distance, a buzzer will sound, and a ", please maintain social distance" alert message will be sent to the telegram application.

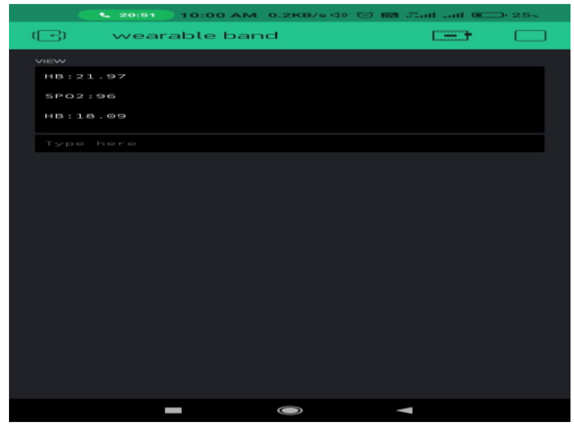

Fig.5.2: picture of Data Updated in Blynk App

Fig.5.3: Data Updated in the Telegram app

For any emergency cases, a person can use the emergency switch. When he pushes the emergency switch GPS module will give a Map of entire regions of the patient's geography in Google Maps API.

All sensor output such as temperature, humidity, heartbeat, spo2 level, distance alerts, and GPS output is continuously displayed on the serial monitor.

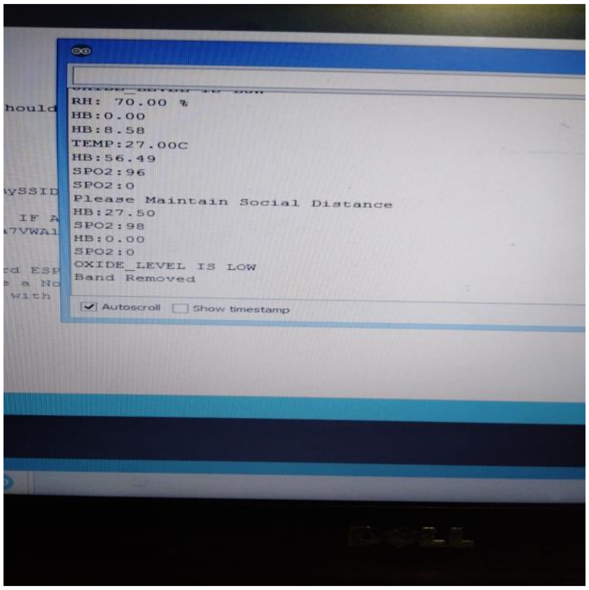

Fig. 5.4: Picture of Serial Monitor Output

6. Conclusions

When the engineer designs a new product, he must study everything related to his idea to avoid its errors, and he must be interested in introducing high quality, low cost, high accuracy, small size, and easy-to-use product, then he should take customers opinions and suggestions to improve his skills in the next design. Thus, this paper discusses the prospects for introducing a portable system for diagnosing COVID-19. A system block diagram is presented based on a cheap patient status sensor in combination with a mobile computing device - a smartphone, tablet, etc. With successful implementation and deployment of these emerging technologies, the burden on the healthcare system can be reduced by shifting services and can be improved through timely intervention by identifying the problem early. Diagnosis and treatment can be rapid with a screening of suspected and asymptomatic/pre-symptomatic cases. The contact between medical staff and patients can be minimized by remote monitoring. The work scope is the part of project planning that involves determining and documenting specific project goals, deliverables, features, and functions. We have now done with the wearable system using several sensors and applications which can be used particularly by COVID-19 patients and related symptoms. The future scope of this project is to develop a smart band system based on an IoT web-based server to save data permanently and provide security. Saved data can be used to predict the Covid-19 accuracy of the patient.

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