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SMART WEARABLE DEVICE FOR COVID-19

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Abstract - Corona virus disease 2019 (COVID-19) has emerged as a pandemic with serious clinical manifestations including death. A pandemic at the 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 diseases prevention. The objective of this article is to review enabling technologies and systems 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.

Keywords **–** ESP32,Internet of Things (IOT), Cloud Computring.

I. INTRODUCTION

Corona virus disease-2019 (COVID-19) has become a pandemic, affecting more than 210 countries throughout the world. COVID-19 is highly contagious, with reported average case-fatality rates ranging from 6.2% to 7.2% among the most-affected countries, and it is an acute public health issue. According to the latest data from the World Health Organization (WHO), the epidemic has infected more than 3,349,000 people and caused the deaths of more than 238,000 globally. As of 3 May 2020, the number of confirmed cases for COVID-19 is about 400 times more than the previous corona virus-induced severe acute respiratory syndrome (SARS) outbreak in 2002-2003, and the numbers of those infected with COVID-19 are expected to grow. The COVID-19 outbreak not only threatens global public health but also impacts many other aspects of life, in particular the global economy. Caused by the SARS corona virus 2 (SARS-CoV-2), COVID-19 most frequently presents with respiratory symptoms that can progress to pneumonia and, in severe cases, acute respiratory distress syndrome (ARDS) along with carcinogenic or distributive shock. Though SARS-CoV-2 and SARS-CoV share some common clinical manifestations, a new study shows that SARS-CoV-2 is highly efficient in person-to-person transmission and frequently causes asymptomatic infections. Clinical deterioration can occur rapidly, often during the second week of illness, which can lead to intensive care unit (ICU) admission and high mortality. Specifically, the severity of COVID-19 varies from asymptomatic, subclinical infection and mild illness to severe or fatal illness. Cases of COVID-19 are generally categorized into five groups: asymptomatic, mild, moderate, severe, and critical. According to data from China, 15-20% of COVID-19 cases require hospitalization, with around 15% of cases presenting with severe symptoms and 5% requiring intensive care, including invasive mechanical ventilation. In Italy and Spain, 40-50% of COVID-19 cases have been hospitalized, with 7-12% requiring admission to ICUs .

Given its severity and fast spread, the COVID-19 pandemic has raised huge challenges for global healthcare systems. COVID-19 can rapidly overwhelm health care systems, impairing their capacity to deliver services not only to patients infected with this epidemic disease but also to those with health problems that are not necessarily related with COVID-19. Lessons from epidemic centers such as China, Italy and United States show that COVID-19 can suppress the capacity of health--care systems even in countries with extensive health resources and universal care. Currently in most countries, to reduce the burden on health-care systems, patients with COVID-19 are triaged based on the severity of the disease, *i.e.*, critically ill patients are admitted to the hospital while patients with mild symptoms and without

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underlying chronic conditions may be cared for at home, and mild cases will not require intervention unless rapid deterioration occurs.

II. LITERATURE SURVEY

1. Survey Paper 1

Name of the authors: Yan-niMi, Ting-ting Huang
Title: "**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 2 160 000 worldwide (World Health Organization, 2020a). More than 82 000 cases had been confirmed and more than 4600 patients had died in China. At present, the outbreak in China has been essentially controlled. More than 100 countries worldwide are now facing and dealing with the COVID-19 epidemic, including the United States, Spain, Italy, Germany, Iran, France, the United Kingdom, and South Korea.

For an unprecedented epidemic such as COVID-19, it is important to assess its hazards. The case fatality rate (CFR) is the ratio of the number of deaths divided by the number of confirmed cases over a certain period of time. This is the most direct index to reflect the lethality of the disease. Since the occurrence of 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).

2. Survey Paper 2:

Name of the authors: Ivan V. Semernik, Alexander V. Dem'yanenko
Title: "Prospects for Designing a Portable System for Monitoring of the Patient's Condition with COVID-19"
Publications: 2019 IEEE

In this article the prospects and possibilities for creating an individual wearable system for monitoring the condition of a patient suffering from COVID-19 and preventing attacks of the disease are discussed. As the basic method of determining the condition of the patient is considered 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.

C. Survey Paper 3:

Name of the authors: DinkoOletic
Title: Wireless sensor networks in monitoring of COVID-19
Published: **:** IJRSE 2013

COVID-19 is one of the widespread chronic diseases. Rising prevalence increases the burden of personal disease management, financial expenditures and workload, both on sides of patients and healthcare systems. Firstly, the medical background of COVID-19 is given. Pathology and symptoms are presented. Afterwards, the problem of persistent COVID-19 management is introduced with a short overview of traditional disease management techniques. A review on approaches to COVID-19telemonitoring is made. Effectiveness of home peakflowmetry is analysed. Employment of low power wireless sensor networks (WSN) paired with smartphone technologies is reviewed as a novel COVID-19 management tool. Using the technology, the aim is to retain the disease in a controlled state with minimal effort, invasiveness and cost, and assess patient's condition objectively. WSN-s for sensing of both COVID-19 triggers in the environment, and continuous monitoring of physiological functions, in particular 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 detectiontechniques. At the end, research challenges for further studiesare identified.

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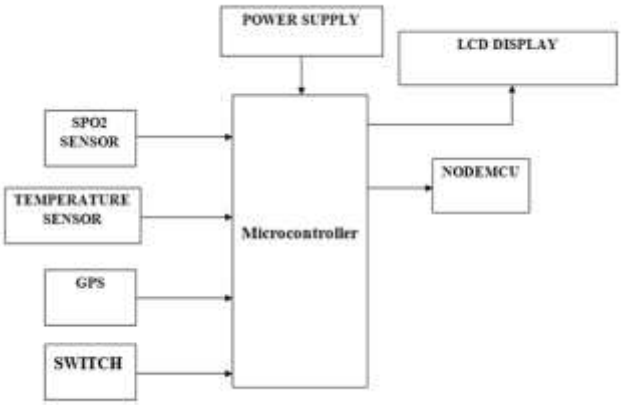
III. ARCHITECTURE



Currently, there are a large number of developments of portable systems that are capable of diagnosing or monitoring the condition of a patient suffering from COVID-19. However, the vast majority of such developments do not find widespread introduction into clinical practice, either due to the presence of deficiencies inherent in the methods used, or due to the complexity of the procedure for licensing medical equipment. Diseases was carried out. The analysis of the results presented in the article allows us to conclude that people around the world are very interested in the implementation of integrated monitoring, 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 the use of home systems, including portable systems, telemonitoring, and telemedicine.
Analysis of the effects obtained after the introduction of such programs of care about the health of the population, 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 the allergies and it is a common problem. Approximately 80% of people with COVID-19 have allergies to airborne substances such as tree, grass, and 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 said to be 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. Such that they can both easily recognize changes in the patient's COVID-19 severity and provide clear instructions on how to respond.

IV. METHODOLOGY

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

Temperature: For the temperature we have 2 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. The 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. The temperature of 30°C and above is considered also risky for the COVID-19tic patients.
The system uses microcontroller. A SPO2 sensor ,and Temperature sensor are connected to the Microcontroller. The temperature sensor gives the temperature value in degree Celsius. To measure the heart rate, the heart beat/pulse is detected 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

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be classified as “low”, “normal” or “high”. The Nodemcu module is used to send 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 concern persons.

While the symptoms described in the above are typical indicators of COVID-19, not all people suffer in the same way or the same combination of these symptoms. Research shows that some people may have the coughing, wheezing, chest tightness and shortness of breath, while others may have a different combination of the symptoms at different times [10]. Sometimes during an attack, some of the symptoms will be worse than others, and even vary from one episode to another. 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 in length and require emergency medical care The measurement results are transmitted via a wireless interface to a PC, tablet or smartphone and are recorded in an electronic diary or, for example, can be used to train a neural network. This will allow for 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 screen of the mobile device 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 hospital, and monitoring the effects of drugs.

V.REQUIREMENTS

HARDWARE REQUIREMENTS

- Arduino NANO
- SPO2 Sensor
- Temperature Sensor
- ESP 8266
- Load cell
- Power Supply

SOFTWARE REQUIREMENTS

- Embedded C
- Arduino Suite

FUNCTIONAL REQUIREMENTS:

- System should scan & Detect the COVID-19 patient condition
- System should measure the heart beat & temperature.
- System should self-monitoring allows the early detection of exacerbations.
- System should automatically investigate reasons for poor control.

CONCLUSION

When the engineer will design a new product he must study everything related to his idea to avoid its errors and he must interest to introduce 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 block diagram of the system is presented on the basis of a cheap patient status sensor in combination with a portable computing device - a smartphone, tablet, etc. Such a structure will significantly reduce the cost of the device, which will contribute to its wider distribution. As the main method of state control, it is proposed to use the method of measuring the transmission coefficient of the microwave signal through the patient's chest. In this case, measurements are carried out at a single point, but for a long time, for example, when the device is continuously worn during the day. The advantages of using microwave technologies allow us to apply the proposed structure to monitor the condition of patients of all age groups, including young children. The integration of additional sensors for the patient’s vital activity and the state of the environment, together with the use of modern IT technologies, will enable the creation of a comprehensive system for monitoring the patient’s condition and informing him of the necessary actions in a timely manner.

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