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6 Development of corona sensor

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6.1 Introduction

Since the dawn of the twenty-first century, our planet has experienced unprecedented outbreaks of deadly viruses such as Zika, Ebola, SARS, MERS, and others. The advent of novel viral species or the evolution of pre-existing viruses fueled the outbreaks of various viral diseases. Such diseases have already wreaked havoc on civilization. The loss of life was the most tragic, but the ramifications were just as bad: survivors’ psychological well-being and the socio-economic fallout were both
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devastating. In December 2019, the world was struck by a new virus known as SARS-CoV-2 (the disease caused by this virus is known as COVID-19). Even among health specialists, this condition was dismissed as just another strain of influenza. The virus, on the other hand, quickly exhibited its destructive character. If left untreated, the disease quickly spread and overwhelmed society’s healthcare infrastructure. The general population became concerned as a result of this. People raced to see doctors even if they had just minor or unrelated symptoms, causing hospitals to overflow. A cluster of pneumonia infections was recorded in Wuhan, China, in December 2019. The virus that caused the disease was identified as SARS-CoV-2 (later renamed COVID-19, Corona Virus Disease 2019, by the WHO) because it shared 80% of its DNA with the SARS-Coronavirus. The first death caused by this virus was reported in China on January 11, 2020. The WHO declared this disease a Public Health Emergency of International Concern (PHEIC) less than a month after the first incidence because it was extremely contagious. COVID-19 was named a pandemic disease by the World Health Organization on March 11 as it began to spread over the world. Sensors are tools to assist detect events or changes in the environment while also sending data to other electronics, most commonly a computer processor. The physical data are gathered and converted into a signal that can be processed, resulting in a readable result. Biosensor is a systematic tool that aids in the recognition of chemical compounds and then merges the organic element with a physicochemical indicator. It has a lot of potential in terms of detecting and diagnosing a variety of diseases, as well as this current pandemic [1–5].

A tool called a sensor is used to determine the occurrences or variations in an environment, as well as assisting in the delivery of data to other electronics, usually a computer processor. Obtaining a physical quantity and converting that quantity into a signal suitable for processing. Currently, an electrical signal is obtained by converting physical phenomena into electrical signals.

Biosensor [3,4,6] is a systematic tool that aids in the recognition of chemical compounds and then combines the organic element with a physicochemical indicator. A biosensor consists of a bioreactor (enzyme/antibody), a transducer (nanomaterials), and an electronic device with a processor and display [6]. In complementary metal oxide semiconductor [7,8], for example, parts like the transducer and electronics can be combined. Biomolecules are used by the recognition substance, which is commonly referred to as a bioreceptor. Biomolecules are used by organisms that are further modeled next to biological systems that interact with an intriguing analyte. The biotransducer calculates this relationship by producing a quantifiable signal that is comparable to the presence of the target analyte in the specimen. Biosensors are designed to enable for quick and accurate testing at the point of interest [9,10]. Biosensors are classified according to their biotransducers. Electrochemical biosensors, optical biosensors, and
other generic types of biotransducers used in chemical canaries include the following: Chemical canaries are categorized as biotechnology, agriculture, food technology, and biomedicine [11], and their optimal organization is determined by their application. Recently one group of authors reported an electrochemical sensor for the detection of SARS-CoV 2 as shown in Fig. 6.1.

6.2 Wearable sensors for COVID-19

COVID-19 wearable sensors COVID-19 is now considered a pandemic by the World Health Organization. COVID-19’s physiology and history
FIGURE 6.2 Schematic detailing of a smart phone application collecting physiological data from a wearable sensor for COVID-19 monitoring [19].

can be distinguished using wearable sensors. About 1.3 billion wearable sensors are utilized to recognize COVID-19. COVID-19 can be detected using modern wearable sensors. Smartphones, Apple Watches, Fit Bits, and Bio Harnesses are among the wearable sensors used to monitor COVID-19. This is the digital level of human health diagnosis instruments [12]. The sensors not only track the COVID-19 virus, but also provide data on the patient’s health, disease symptoms, and recovery. Wearable sensors can also detect changes in the body’s condition [13]. The most effective technique to detect the presence of COVID-19 is by respiratory monitoring. The respiratory tract is affected by this virus [14]. COVID-19 symptoms are tracked using a remote-like wearable system, which also helps to prevent the disease from spreading [15]. These sensors detected COVID-19 symptoms such as fever and cough, as well as physiological ways for detecting cold. Wearable sensors are being utilized to provide information about people’s common health problems [16,17]. The resting heart rate, cardiac rhythm, and fever are all detected by the Huami wearable gadget [18]. Wearable devices are more useful for monitoring the health system and are a fantastic idea for maintaining social distance. In common locations, temperature guns are used to detect the temperature (Fig. 6.2).
6.3 Biosensor on cell for COVID-19

Cell-based biosensors (CBBs) are utilized to identify certain species using analytical information and then amplification into an optical and electrical signal using a processor. In comparison to CBBs, molecular based biosensors are more sensitive to environmental changes; yet, these biosensors may be modified to detect complicated responses inside a living cell using simple genetic engineering techniques [20]. SARS-CoV-2 can transmit through the air and can be found in a sample of air within the aerosol for 3 hours, according to experimental research. SARS-CoV-2 is lethal to humans and causes a variety of diseases. SARS-CoV-2 virus could be detected in the air using cell-based biosensors. However, these biosensors have yet to be demonstrated in real-world applications. A cell-based biosensor is utilized to detect the pollutant in the air, as previously mentioned. When the sensor comes into contact with harmful pollutants, it reports to the cellular response and developing cellular signals, which are then transduced by a secondary transducer, which produces electrical outputs and appropriate readouts.

6.4 Nanosensor for COVID-19

COVID-19 is unquestionably combated by nanotechnology [21]. Sensing technology is critical for the development of an effective sensor [22]. Graphene is a nonmaterial with electrical properties that is employed in sensor technology [23]. Nanomaterials are employed to find nanomedicine in modern technologies. These are used to diagnose, treat, and recover from a wide range of disorders [24] (Fig. 6.3). Chemical sanitization also employs nanomedicines [25]. Hydrogen peroxide in blood samples is measured using dendritic nanochips [26]. Nanomaterials are used by Chinese scientists to regulate SARS-COV-2, and the virus’s potency is reduced by 96.5 percent to 99 percent [27]. The identification of RNA is done with nanomaterials, and RNA-based detection is a quick diagnosis method [28]. Iron oxides and gold nanoparticles are now commonly utilized in testing kits [29]. For the detection of viruses and infectious diseases, nanotechnology is critical [30]. 2D materials, graphene, and carbon are used in nanoparticle-based diagnostic tools [31]. A nanomedicine provides information on COVID-19 fast infection [32]. Nanobiosensors are being developed in modern technology to learn more about the advanced identification of COVID-19 [33–35]. Hybrid nanomaterials are utilized to quickly identify Coronavirus [36]. Until now, the medicines hydroxy chloroquine, ribavirin, and lopinavir have been used to treat COVID-19 [37].
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6.5 Immunosensor for COVID-19

Immunosensor is a small, multiplex wireless item that can quickly detect COVID-19. It aids in the detection of nucleocapsid protein, IgM, and IgG antibodies to viral antigens [38]. On the basis of mass-producible laser-engraved graphene electrodes, it is also used for the inflammatory biomarker C-reactive protein [39]. High sensitivity, cheap cost, ultra-fast detection, wireless remote, and multiplexed sensing are some of the primary advantages of this novel approach (Fig. 6.4).

6.6 Recent development of COVID-19 sensors

Many researchers across the world are attempting to discover a possible COVID-19-curing treatment derived from plants, animals, or other microorganisms, or repurposing existing drugs, medications, or vaccines. Bharat Biotech International Limited has demonstrated significant progress in the development of the vaccine, indicating that the month following is the most critical period for researchers. The vaccine is being developed, and the percentage of spread is being reduced, by isolating
6.6 Recent development of COVID-19 sensors

India is the third-worst-affected country, with around 1.8 million cases, according to the COVID-19 report. The COVID-19 vaccine is being developed by a collaboration of companies and medical organizations. In which 30 different Indian businesses are working on developing vaccinations to combat the disease. Seven firms are now undergoing testing and investigations, according to the WHO [41]. COVAXIN, ZyCoV-D, Mynvax, and Astra Zeneca are some of the vaccinations that are currently being tested. Russia was the first country to complete human clinical trials of the COVID-19 vaccine [42]. In the month of June 18 [43], Russia permitted two types of possible COVID-19 trials, which were produced by the Gamaleya National Research Centre for Epidemiology and Microbiology. The first vaccine, which is administered intramuscularly, was produced at the Burdenko Military Hospital. After the vaccine, the volunteers were instructed to stay in isolation in the hospital for roughly 28 days [43]. Other hypotheses that place a focus on smartphone-based sensing systems have gotten a lot of attention and have been built within a smartphone (Fig. 6.5). It is built with a technology that can detect any location. This approach could be used as an alternative to more expensive technologies [44]. Practice of Nano bioengineering analytical clinically [45] is another recently established method for COVID-19 diagnosis. Electrochemical biosensors’ analytical performance is being improved [46].
Conclusion

COVID-19’s resurgence over the world has worried people and drawn more attention to health. It presented a challenge to researchers working on the creation of treatments, vaccines, and new technologies to prevent the virus from spreading. The body temperature is detected using a thermal scanner, but the virus is not detected. RTPCR is also used to identify COVID-19, although it has been deemed ineffective since it produces erroneous results. A biosensing device is also worn in the form of a smart band and has the ability to measure body temperature. To identify the virus, an optical sensor that combines two different types of effects, namely visual and thermal, is used. A powerful biosensor, such as a cell-based biosensor, has the ability to detect and amplify some species, molecular biosensors to monitor virus in the environment, and also plays a critical role in the pharmaceutical sector, environmental monitoring, and food analysis, among other things. In reality, scientists have concentrated their efforts on developing new technology and developing a quick diagnostic sensor that can identify SARS-CoV-2 in less than a minute. Jing Wang and his colleagues created a new optical sensor whose receptor functions as a complementary sequence for the RNA sequence to identify the virus. A biosensor with plasmonic photothermal effect was also developed, which promotes local temperature and inhibits noncomplementary sequence binding to the sensor’s DNA strands. Biosensors based on cells are also
used to identify species, which are then amplified into an optical and electrical signal by a processor. It can also be employed in a wide range of conditions, such as pH and temperature. The app “Aarogya Setu” was created to alert users about coming into contact with an infected person. Furthermore, studies have shown that SARS-CoV-2 can transmit through the air and that cell-based biosensors can detect it; however, these sensors have yet to be proved. Many molecular assays were developed to identify SARS-CoV-2 RNA utilizing non-PCR methods, such as nucleic acid sequence-based amplification techniques and loop mediated isothermal amplification. Many more ways for diagnosing the virus at a lower cost should be developed. As a result, instruments like biosensors that can diagnose the virus quickly are required to prevent the virus from spreading quickly. High sensitivity, repeatability, and other aspects of biosensor and other technology should be improved.

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Non-Print Items

Abstract
The outbreak of corona virus (COVID-19) has imposed serious concern all over the world as many part of the globe have been severely affected by this. It has become essential to develop efficient methods for the treatment and detection of this virus. Among the new approaches, the nanosensor has played a vital role in tracing and detecting the virus. Sensors are tools to assist detect events or changes in the environment while also sending data to other electronics, most commonly a computer processor. This chapter contains the approach followed and development in several biosensors, wearable sensor, and colorimetric sensors toward the identification of corona virus.

Keywords
COVID-19; Nanosensors; Wearable sensors; Biosensors