Chapter 1
COVID-19: Challenges and Advisory

Introduction

During the COVID-19 pandemic, governments and healthcare organizations must take some steps to reduce the spread of the virus and to treat the already infected persons. Infected patients with symptoms need to be hospitalized. Also, the patients without symptoms may still be releasing the virus, and therefore, they need to be quarantined for a predefined period (typically 14 days) until the virus release ends. The rapid increase of COVID-19 cases is putting immense pressure on the healthcare infrastructure.

Like other viruses, COVID-19 infection also goes through different stages such as

1. incubation in the host without symptoms,
2. the onset of full-blown symptoms,
3. a period during which viruses can still be released, and
4. finally, the recovered stage with no virus release.

Tracking down any “patient zero” is time-consuming and also resource-consuming, so also quarantining patients. The number of infected patients is increasing more rapidly than hospitals can afford to add beds, ventilators, monitors, personal protective equipment (PPE), and healthcare workers. Many of the hospital staff have also become infected themselves, generating even more stress on the remaining staff.

Researchers in physical sciences and engineering are engaged in research and innovation to take such challenges, describe new study problems, grow new theories, and generate user-centric explanations. In this chapter, an attempt has been made to provide a brief description of many innovative technologies involving sensors, wireless communication, the Internet of things (IoT), intelligent machine learning algorithms, and significant applications for the COVID-19 pandemic.
Throughout these substantial changes achieved by the COVID-19 pandemic, a few chances and difficulties have risen, especially in China. The Internet of Medical Things (IoMT) holds tremendous potential for applications in medicinal services on account of the social distancing and separation required to slow the pandemic, and also governments are continuously looking for endless ways to deal with human services [1].

Without a doubt, the problem associated with routine visits of the clinics and hospitals, the much feared and dreaded view of emergency clinics during the pandemic constrained the general population to look for different methods for access to human services. These are handled by online interviews offered by advanced smartphones and online clinical staff. The new innovative models like the Internet of Medical Things (IoMT) and computerized wellbeing are proposed that can change the approach in different countries and facilitates the best means to control advanced wellbeing during both emergency and optional clinical intercessions. Significantly, the possibilities for constant determination, avoidance, and mediation are tested by the need to approve the computerized wellbeing approaches in manners that are experimentally strong and socially justifiable [1].

Internet (Web) of Medical Things (IoMT) is assuming an essential job in the social insurance industry to expand the precision, uncompromising quality, and efficiency of electronic gadgets. Analysts contribute to an automated social insurance framework by interconnecting the accessible clinical assets and human services administrations. As the Internet of things (IoT) merges different spaces, IoMT has emerged into IoT for various healthcare services [2]. The current worldwide test of the COVID-19 pandemic has outperformed the conventional, radical, calculated, profound, social, and educational limits. Internet of things (IoT) empowered human services framework is valuable for the legitimate checking of COVID-19 patients by utilizing an interconnected system. This innovation assists with expanding the fulfillment at remote locations and lessens the readmission rate in the clinic. IoT usage impacts on decreasing medicinal services cost and improves treatment results of the infected patient. Accordingly, current explorations are endeavored to investigate, diagnose, discuss, and feature the general utilizations of the all-around demonstrated IoT reasoning by offering a comprehensive guide to handle the COVID-19 pandemic [3].

There is a minimum prerequisite for scholastic exploration on a few parts of this exceptionally infectious illness to discover successful methods for control and treatment of the disease, in the present time being, and also for the future. We try to explore a few open doors for scholarly exploration identified with COVID-19 and have additionally identified suitable recommendations to contain, forestall, and treat this viral contamination [4]. Cognitive Internet of Medical Things (CIoMT) is a disruptive innovation that gives constant clinical information about COVID. CIoMT is a promising innovation for quick finding, observing, remote wellbeing, and dynamic following for control of the disease. It helps in contact following and grouping, screening and surveillance, and in decreasing the remaining task of the clinical examination. In the period of cutting-edge computerized innovation, many human services dependent on the Internet of things (IoT) are picking up significance.
to manage the current COVID-19 pandemic. The CloMT is investigated to handle the comprehensive test. This idea of CloMT is most appropriate to this pandemic as each individual is to be associated and checked through an extensive system that requires a range of healthcare executives [5].

**Technologies and Their Applications for Fighting the COVID-19**

Artificial intelligence (AI) is a creative innovation that is useful to battle the COVID-19 pandemic. This innovation is helpful for appropriate screening, following, and foreseeing the current and future patients. The significant uses of this AI are for new location and identification of the disease. Artificial intelligence is used to improve immunizations and medications to reduce the remaining task at hand of medicinal service staff [6].

COVID-19 (Coronavirus) pandemic has created a demand for fundamental social insurance gear, drugs alongside the necessity for advanced data-centric applications. Industry 4.0 is the fourth electro-mechanical transformation, which can satisfy modified prerequisites during the COVID-19 emergency. This disruptive change has begun with the use of advanced assembling and computerized data innovations [7].

The setting of whole urban areas in “lockdown” straightforwardly influences urban economies on multiple fronts and at different levels, including both social and financial viewpoints. This is being underlined as the scenario that makes strides in different nations, driving toward a worldwide wellbeing crisis, and global cooperation is looked for in various regions. The urban point of view and advances on how smart city systems should progress in improving normalization conventions for expanded information gathering and analysis in case of outbreaks like the current pandemic [8].

The clinical environment idea for battling coronavirus sickness (COVID-19), consolidated usage of purpose-of-care (POC) diagnostics, and the Internet of Medical Things (IoMT) [9] is shown in Fig. 1.1.

**Challenges and Opportunities**

The current flurry of innovations is trying to develop devices, modules, and systems to help specialists forestall the additional spread of COVID-19 while also helping those that are tragically contaminated. IoT, specifically and particularly when joined with other transformative advancements like cloud and AI, has great use in a broad scope of utilization during the emergency.
The broad scope of utilization demonstrates that IoT is an appropriate response in unraveling one of the novel difficulties created by COVID-19. The use of technology about IoT poses particular challenges and opportunities. The following are the significant challenges and opportunities in the present pandemic while considering the available technologies augmented with the Internet.

**Challenges Involving Data Collection**

During the beginning of widespread sickness outbreaks like COVID-19, the essential target of a COVID-19 framework is to gather data from the population. Few challenges have been identified to find and acquire the information identified with the COVID-19 spread. For example, while leading basic technological phrases such as “COVID-19 technology,” many ventures are trying to obtain internet-based health information. This may lead to the gathering of other undesirable significant information beyond human recognition or body temperature or places of visit.

There is a possibility that the agency which is collecting data may misuse it. Even other agencies can misuse the data through the collecting agency. In this manner, getting an assortment of applicable online networking information that coordinates to the correct arrangement of data becomes difficult. An extraordinary segment of online
networking information may, in the long run, end up being excess (e.g., retweets) or reworded from a separate unique post.

Moreover, a decent portion of Web-based health information is seen to be transient and also transitory. For instance, individuals may erase their past posts and online stores (i.e., Twitter and Facebook servers) for undisclosed and unknown reasons. Notwithstanding that, internet-based APIs, for example, Twitter, regularly force different rate confinements, which can intensely block the information aggregation during an emergency and critical situation. The information assortment process for COVID-19 accordingly requires a device that can find, get, and store the applicable data from clients continuously across Web-based health stations securely and reliably.

**Information Reliability Challenge for Data Collection**

Information produced by the obscure human sources on Web-based social networking lacks information reliability (i.e., the trustworthiness of the collected data). One significant challenge in dealing with online health for IoT innovation is to separate reliable data from temperamental human sources with obscure source questionable quality. Some research work tried to address and moderate the information quality issue. For example, Wang et al. [10, 11] introduced a structure to gauge the dependability of information sources and the correctness of the detailed estimations in internet-based health posts, which comes closer to the estimation hypothesis. Zhang et al. [12, 13] used past systems’ experience to address the adaptability and physical limitations and utilized the improved plans to verifiable social detecting applications. Yin et al. [14] presented a model “Truth Finder,” a probabilistic calculation that uses iterative weight updates to improve the nature and correctness of the information in social detecting. While many endeavors have been made while creating robust social detecting arrangements, certain restrictions affect these arrangements from being applied to COVID-19 situations. One drawback of current social detecting plans is that they exclusively depend on viral online life information. There are no other methods for checking the trustworthiness of the data during the COVID-19 parlance. Existing techniques are not customized toward disease discovery, which may prompt a forecast of faulty instances of COVID-19. For example, an individual posting an issue of breathing trouble may not experience the ill effects of COVID-19. It might be required to break down the patient’s different qualities and profiles, depending on prior posts. Thus, it remains an uncertain test to create dependable social detecting models that can investigate the vulnerability in the information.
Challenge of Information Modality

While information assortment is a diagnostic test in utilizing social detecting for following the COVID-19 spread, a more noteworthy problem exists in preparing the hurriedly created signs consisting of vast numbers of measurements. This test is distinguished as an information-oriented methodology in social detecting where a lot of unfiltered and unstructured information with different modalities requires to be processed [15–17]. In particular, information-based methodology alludes to the information pervasive in online networking, such as text, picture, location, audio, and video. Also, each type can additionally include distinctive dimensionality, which makes the information-based methodology considerably challenging. Instances of dimensionality can extend along with reports of (i) closeness to contaminated areas, (ii) the number of suspected cases, (iii) number and kinds of indications, (iv) intensity of side effects (i.e., low, moderate, or acute), (v) recuperation rate, (vi) death rate and (vii) the number of self-isolated cases. Ongoing social detecting devices primarily focus on examining the content information in internet-based life. This pattern is supported by the way that image and video information handling require substantial computational overhead.

Therefore, existing techniques do not concentrate on aggregating and dealing with different kinds of information, which may create false identification of COVID-19 infected persons. For instance, an individual may tweet about having COVID-19, yet dependent on a picture posted with the tweet; it might turn out that the individual’s indications have come due to a hypersensitive response. Aggregating text with other information, such as picture and location information, may yield increasingly precise forecasts of the COVID-19 spread. With these principles, given the sheer volumes of multi-modular information produced by the Web-based social networking clients about the COVID-19 scenario, arrangements should be created to use the diverse methodology of information productively. Additionally, since multi-modular information processing characteristically requires more processing power, care must be taken to strike a trade-off between location exactness and the computational requirement. Many challenges evolving from the information-based methodology are: (i) how to proficiently intertwine the various kinds of Web-based health information identified with COVID-19 into one information stream? (ii) how do we structure computations, to process a wide assortment of social information for the exact estimation of the COVID-19 spread? (iii) how to accelerate the examination of multi-modular information for quicker COVID-19 spread recognition by appropriating the calculation over different devices?
Scalability of Edge-Based Artificial Intelligence (AI) Model for COVID-19 Data Processing

Because of the worldwide COVID-19 outbreak, it is imperative to use and depend on versatile AI-based strategies that can adequately screen the condition of the spread from the social detecting information over any locality continuously. This requires the adaptable AI methodology that can be promptly deployed over the edge devices (e.g., smartphones, IoT gadgets, drones) to reduce idleness and data transfer capacity utilization and yield quicker data extraction for the COVID-19 spread. Unfortunately, existing AI-based methods, like deep neural network (DNNs), Multi-Layer Perceptron (MLPs), Hopfield network, Bayesian network, and recurrent neural networks (RNNs) have been initially used for high power computing platforms like GPU groups and are not customized for low computing power devices operating at the edge of the system [18–21]. Specifically, current AI models are related to periodic model updates that work in an integrated manner, which requires a large system transmission capacity. Notwithstanding that standard AI models need to set and refresh the model boundaries before generating reliable forecasts. Hence, regardless of whether the current AI methods could be adapted to execute on the edge devices, because of their substantial computation requirements for the model preparation, they would deplete the energy of the versatile and energy-constrained edge devices quickly and reduce the lifetime of the device. A couple of challenges associated with the AI model would be (i) how to parallelize the AI model preparation process over the edge devices to accelerate the model preparation and enhance data transfer capacity? (ii) how to advance the AI computations to run productively on the low powered edge equipment? (iii) how to modularize the AI computations so that they can be effectively deployed over a large number of edge devices?

Challenge Location Information Privacy

One compelling issue in social detecting is client security, whereby the individual data of the online clients falls into inappropriate hands. Location-area information shared by clients can likewise be utilized to uncover other private data (e.g., ethnicity, race, monetary status). Online networking clients do not commonly agree to share and are also not required by applications. Many concerns have been raised across the country boundaries regarding this issue. The Government of India sponsored and recommended the “Arogyasetu” application. Similar applications worldwide are attracting criticism from a section of users and intellectuals regarding the privacy of data and possible misuse and state-sponsored surveillance. Along these lines, it has been seen that because of the worry of one’s area and privacy, numerous internet-based clients tend not to share their area data while revealing their perceptions in the Web-based model. It is found that under 10% of the tweets are geo-labeled (i.e., contained a topographical location area of the clients). Accordingly, applications
that vigorously depend on the area metadata from the Web-based social networking present to indicate the COVID-19 spread may fail to meet expectations when the quantity of geo-labeled internet-based data is quite scant. Thus, to follow up on the advancement of the COVID-19 spread, it is essential to acquire the specific areas of the spread of infected persons, i.e., COVID-19 affected areas [22–24].

**Challenge of Data Visualization and Presentation**

With the rapidly advancing conditions during the COVID-19 outbreak in different regions, it has become mandatory to introduce and present the data of the infection spread to the citizens in an ideal manner. This requires a data introduction framework that can both present information on the infection spread progressively and also alert individuals on time. A few strategies have been executed to introduce infection spread updates to the public in the recent past through various intuitive sites. Such a strategy for data dissemination and assortment exclusively depends on aggregating information from different news portal Really Simple Syndication (RSS) feed and the data sites which can prompt infections, recoveries, deceased, trend, etc. about the latest phenomena. Because of their distributed nature of data slithering and examining, existing electronic procedures cannot be straightforwardly applied to social detecting, which envelops unstructured and multi-dimensional social information.

Notwithstanding that, sites and smartphone applications depend on the steady accessibility of both the Internet and edge nodes, both of which may not be possible in all conditions. In this way, crucial data may not reach everybody, particularly with the old and less technically knowledgeable people without access to personal computers or smartphones. Due to the multi-lingual, multi-cultural, and varied educational and financial background, the presentation of data to the general population in an effective manner remains a significant challenge. Natural language mode and graphical displays have been widely used for data visualization and presentation but still is far from adequate and reachable to all sections of the population [25].

**Human Factor Challenge**

In any society, technology adaptation by the general public remains a big challenge. This issue becomes critical in an emergency like the COVID-19 pandemic. The human factor is a big challenge in data collection and aggregation. Given the fearful concerns and anxiety among the overall population during the COVID-19 pandemic, individuals are excessively enthusiastic, exciting, or one-sided in communicating their sentiments in the Web-based portals and other crowdsensing applications. Such unusual enthusiasm and conduct can conceivably trigger distorted or misconstrued perceptions and subsequently yield unwanted outcomes. Thus, a primary challenge would be how to deal with the mindset of the people, while containing the worry at
all levels? It is also essential to consider the individual segment more closely and model how individuals respond to the data introduced to them. A few people may end up being too sensitive, so care must be taken not to build up the justification for unwarranted turmoil. For instance, during the Ebola outbreak in Liberia in the year 2014, riots broke out among the people when authorities raised cautions of the outbreak. On the other side, we also have to understand that a good percentage of the populace tends to be indifferent to the conditions, disregard admonitions, and remain unusually quiet. The challenge is to find some kind of balance between presenting information and alerts so that people are informed enough to take precautions and prepare for eventuality and not be the reason for spreading panic among the citizens to avoid chaos. Thus, it stays a fundamental challenge to develop a successful and reliable model that can distinguish and detach the deception spread to produce dependable social signs showing the COVID-19 spread [26, 27].

**Recommended Precautions by Health Organizations**

You can decrease your chance of being contaminated or becoming an instrument for spreading COVID-19 by staying inside the home and safe. Some of the usual guidelines include

1. Routinely and thoroughly clean hands with an alcohol-based hand sanitizer and wash them with soap and water for about 20 s. Washing your hands with soap and water or using alcohol-based sanitizers deactivates/neutralizes infections that might present on your hands.
2. Ensuring a distance of 1–2 m (3–6 feet) separation between yourself and other people is the key. When somebody with COVID-19 infection talks, hacks, or wheezes, they shower little fluid beads from their nose or mouth, which may contain the virus that is supposed to be in the air for around 1–2 m before falling. Thus, there is every chance that if you are excessively close, you can get exposed to the beads, which contains the COVID-19 infection. One of the essential measures to follow is to abstain from going to crowded places. Where individuals meet up in groups, you are bound to come into close contact with somebody that has possible COVID-19 infection. It is progressively difficult to keep up physical separation of 1–2 m (3–6 feet) always.
3. Wear a mask to cover the face, mostly nose, and mouth, to avoid entering the aerosol beads. This will also help you not to become an instrument to spread the infection in a case; unfortunately, you are infected and not even aware of it. We must ensure that all of us follow great respiratory cleanliness. This implies covering mouth and nose with your bowed elbow or tissue when you hack or sniffle. At that point, immediately discard the mask and wash hands. By following proper respiratory cleanliness, you shield the individuals around you from infections.
4. Avoid touching the face (nose, mouth, and eyes) to avoid infection. The most common source of infection is different surfaces, and through the surface, it infects the hands through inadvertent touch. Coronavirus can survive for quite a while on different surfaces, which is a significant reason behind its transmission. This infection can sully on various metal surfaces and remain active on these surfaces from hours to days, with a most extreme range on plastic and least on the copper surface. The liquor-based disinfectants can necessarily decrease the endurance of the infection. The two significant coronaviruses (SARS-CoV-2 and SARS-CoV-1) have critical continuing time on various metal surfaces, and their conduct is practically comparable on different metal surfaces and in mist concentrates. Thus, your hands become a source of infection, and touching your face is quite critical in getting infected [28].

5. Continuous monitoring of body temperature is also an adequate precaution for controlling the spread and seeking medical help. Increased body temperature has been one of the critical symptoms of COVID-19 infection. Although increased body temperature is not necessarily a confirmatory test of infection, it is one of the essential measurable parameters.

6. Home quarantine and self-isolation are preferable in case of suspected symptoms of COVID-19 to take care of yourself as well as your loved ones. Remain at home and self-detach even with minor side effects, such as hack, migraine, and mellow fever, until you recuperate. Evading contact with others shall shield them from conceivable COVID-19 and different infections. In case you have a fever, hack, and trouble breathing, look for clinical consideration, telemedicine, on-call medical assistance. National and nearby specialists shall have the most cutting-edge data on the circumstance in your general vicinity. This will secure you and help forestall the spread of infections and different diseases.

Sensor-oriented technology and IoT platforms have been leveraged to a greater extent to address the above precautions and used as a tool for enforcing people to follow these precautions.

**Safety Measures**

The world is now struggling to control the unprecedented spread of COVID-19 infections, which leads to a record number of morbidities and mortalities. Since there is no specific treatment for coronaviruses, and no foolproof method to contain the spread, there is an urgent need for global surveillance of individuals with active COVID-19 infection. An integrated digital disease surveillance system with the help of IoT is crucial to controlling this disease. Application of IoT in infectious disease epidemiology is an emerging field. The ubiquitous availability of smart technologies and increased risks of infectious disease spread through the globalization and interconnectedness of the world necessitates its use for preventing, predicting, and controlling
emerging infectious diseases. Several countries are working on Web-based surveillance tools and epidemic intelligence methods to facilitate risk assessment and timely outbreak detection. However, the widespread use of the available technologies is still not put to practice to its full potential.

**Contact Tracing**

The Internet of things utilizes the interconnected network for the data-flow and exchange of data. It also enables the patients, civilians, and health administrators to connect with the service providers for suitable actions. By employing the different IoT model in the COVID-19 pandemic, the effective and efficient tracing of the patients and the suspicious cases can be reasonably assured. A few practical smartphone-based applications are developed for the benefit of the people. In this regard, the Government of India has launched a smartphone application named “Arogya Setu.”

Similarly, the mobile application called “Close-Contact (English name of the Chinese app)” is launched for its citizens in China. These applications inform the app user about the closeness to the corona-positive person. The US Government, Singapore Government, Australian Government, and other countries also launched a similar mobile application for its citizens. Apart from COVID-19, it can alert and track similar diseases to improve the general public’s safety. It digitally captures the patient’s data and information through the designed mobile application without any human interaction.

Contact tracing is an observation and regulation technique proposed around 80 years back to control syphilis. Rather than overseeing individual cases while looking for clinical consideration, contact tracing attempts to detect the path of infection spread from infected patients to those they have been in close physical contact. A few methodologies for contact tracing are first-request, single-step, iterative, and review or retrospective was utilized previously during different outbreaks. The first-request method recognizes those individuals the patient quickly came into contact with and informs them concerning the potential infection and the need to look for clinical counseling or self-isolation. It does not bother about following the contacts of contacts, leaving that to second-request procedure as and when the initial request contact looks for clinical consideration.

Single-step contact tracing recognizes all individuals that the infected individual came into contact within the recent past. As any of those are additionally distinguished as contaminated, their contacts are detected, and the procedure follows. One issue with single-step contact tracing is that asymptomatic persons can spread the disease until they are identified and separated. However, iterative contact tracing keeps on following and reapply the significant indicative test to contacts iteratively before their condition may be identified through manifestation screening. The procedure proceeds until no newer infected persons are found. Retrospective contact tracing follows a similar process as either single-step or iterative with the expansion. It also works backward by considering the individuals with which the infected patient had
been in contact within their ongoing past, intending to determine who it was that contaminated the patient. These methodologies are shown in the following Fig. 1.2.

With our expanded global village concept, worldwide populace, global aircraft travel, megacities, and mass travel, traditional contact following alone cannot contain the virus spread. Conventional contact following was utilized right during the SARS period. It ignored the possible contamination, which immediately spread through the more extensive network. Specialists and researchers stress upon some new methodologies that are required to do the contact tracing in the present scenario. Current contact following methods has been proposed utilizing universal and almost omnipresent smartphones. The smartphone advances facilitate recording and reporting when we have come into close physical contact with others. It is accepted that mechanized contact following will help in handling circumstances when we either do not know about or cannot remember, each contacted individuals. It gives (a) development centered portable programmed contact recording; (b) contact distinguishing proof, (c) contact notice, and (d) narrowcast information. This new technique leads to contact tracing applications like “COVIDSafe,” “Arogy setu,” etc., which will fundamentally lessen the probability of contamination of your loved ones and keep your family protected from COVID-19 infections.

IoT-based smart disease surveillance systems have the potential to be a significant breakthrough in the efforts to control the spread of the current pandemic in the
current global situation. As much of the required infrastructure is already in place (i.e., smartphones, wearable technologies, internet access), this technology can have a significant impact on limiting the spread of the epidemic that involves only the collection and analysis of data already gathered. IoT and related new technologies are currently helping early recognition of spread and prevent the spread of infectious diseases that include the COVID-19. Smart disease surveillance systems based on IoT are quite affordable and would provide simultaneous reporting and monitoring, end-to-end connectivity, data aggregation and analysis, tracking and alerts, and remote medical assistance to detect and control infectious disease outbreaks. More researchers are now developing automated and effective alert systems for early and timely detection of outbreaks of such diseases to reduce morbidity and mortality and prevent global spread. These timely and effective public health measures are the essential requirements to avoid the risk of continuing outbreaks and the possibility of a local outbreak turning into a global pandemic such as COVID-19.

**Safe Blues: A Method for Estimation and Control of the Spread in the Fight Against COVID-19 [29]**

As is evident from the experience to manage the crisis, there is an immediate need for timely and accurate information about the spread of the COVID-19 virus. Such information can be used as input to the predictive models that could be used by different governments to help in their decision-making process. In general, the spread of a virus depends on both the biological properties of the virus and also on the behavioral properties of the populace.

Researchers have started doing research to study the biological properties of COVID-19 since the start of the outbreak. On the other hand, the enforced social distancing measures forces changes in the population behavior, which is very hard to observe and predict. As a result, providing a real-time estimate of the expected number of individuals infected by an infected person is very difficult. The error in estimation at different stages of the pandemic can result in an improper decision, affecting human life and having significant economic consequences.

“Safe Blues” team [29] assumes that in an imaginary world, one may think of creating a benign biological virus that has similar spreading properties as COVID-19 and is traceable through cheap and reliable diagnosis. Then by intentionally spreading such an imaginary virus among the population, the spread of COVID-19 could be easily estimated as the benign virus would respond to population behavior in a similar manner to COVID-19. However, such a benign biological virus does not exist, so the team propose a safe and privacy-preserving digital alternative to the benign and call it as “Safe Blues.”

The Safe Blues method uses Bluetooth signals in a similar way of existing contact tracing apps. The existing contact tracing apps, deployed on personal mobile devices,
are monitoring viral threats and collecting data about potential contacts. Such mobile apps can be adapted to transmit Safe Blues signals in a privacy-preserving manner.

The Safe Blues idea is that mobile devices mimic virus spread via the safe exchange of Bluetooth signals. The aggregated counts are reported to a server without any private information. The infection count can be estimated by periodically creating various strands of Safe Blues and repeatedly spreading them through the population using their smartphones. This estimation will help government and other organizations to plan their operations and be prepared. The estimated result is supposed to be a near-real-time measure depending on the level of social distancing.

At the moment, when government tries to impose different social distancing directives, it is not clear what the population compliance is? Even if compliance is being followed immediately, it often takes weeks to see the effect on the spread of COVID-19. In such a scenario, it is difficult for the government to decide an optimal social distancing measure. However, the Safe Blues idea will produce a much faster and precise feedback.

Government implementing “Safe Blues” during the COVID-19 pandemic obtains information during that period, which will be highly beneficial for decision making in the battle against COVID-19 and to mitigate second or third waves of attack. The experimental simulation analysis shows that Safe Blues data is able to predict COVID-19 infection within the asymptomatic population. For this, statistical machine learning and artificial intelligence methods, mixed with solid epidemiological models, are used to build estimates of COVID-19 spread as a function of live measurements of Safe Blues spread. It is expected that COVID-19 progresses, the estimates will become more and more precise.

At the end, government will be in a better position to know how to optimally “flatten the curve” or keep the curve below the healthcare system threshold. The implementation of Safe Blues within an existing contact tracing software platform is straightforward and does not require complicated software design. The “Safe Blues” model does not seek to develop an independent mobile app, but rather integrates the idea in the existing contact tracing applications.

Advisory for the Use of Sensors and IoT Framework

The advancements in the electronics, MEMS technology, sensor, wireless communication, and overall IoT framework are being utilized to address the issues and challenges arising out of the COVID-19 pandemic. Internet medical clinics and Webchat, extensive information investigations for contact tracing, use of BLE signal strength or GPS tags, distributed computing, Internet of things, artificial intelligence, robots, 5G telemedicine, and clinical data frameworks are extensively used to encourage clinical administration and management of COVID-19 patients and infections. Many countries, including China, USA, Singapore, etc., showed that wellbeing data innovations assume a significant job in reacting to the COVID-19 infection spread with
the utilization of the IoT and sensors together with cloud computing infrastructure and artificial intelligence integrated machine learning [30–32].

This pandemic has set off an extraordinary interest in advanced wellbeing innovation arrangements. It has uncovered adequate mechanisms, such as for populace screening, following the disease, contact tracing, organizing the utilization of designated medical equipment, and planning focused on reactions.

Healthcare providers should take the travel history of all patients with respiratory indications and any international travel in the previous two weeks. They should set up an arrangement for the patients with the respiratory ailment in the outpatient department and give them necessary protective gear. The healthcare providers also should utilize protective covers themselves while analyzing such patients and practice hand cleanliness. Suspected cases ought to be shifted to government-assigned habitats for separation and testing.

Patients suffering from extreme pneumonia and deep respiratory trouble need to be assessed for travel history and put under contact and bead detachment. Regular purification of surfaces should be done immediately. They need to be tested for COVID-19 infection using different testing methods like the R-PCR test. Medical practitioners and administrators need to be vigilant and keep themselves aware of the advances in protocols, technology, and spread patterns around the world. Individuals and groups should practice the utmost responsibility and avoid spreading misinformation and rumors to mislead the general population.

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