Emerging Technologies to Combat the COVID-19 Pandemic

SARS CoV-2 infection is spreading similar to wildfire across the globe. There have been already more than 2.5 million documented infected cases, causing more than 177 thousand fatalities.¹ The fact is that it took ninety-three days to the first million people, but for the second million, it took only thirteen days to happen.² A large part of the globe is under lockdown with despair lingering, and this universe in disarray. We need to look for competent and advanced technological solutions to combat this pandemic (and similar epidemics and pandemics in the future); otherwise, we could be staring at an unmanageable crisis.

Surge demands of critical care facilities have broken down the best health-care models in the world and facilities.³ The best industries have failed in providing even the simple protective suits to their governments. There is a need to rethink why the health-care sector has been so ineffective in treating such an infectious disease. We believe and recommend that the latest emerging technologies be urgently adopted at the global level, and the governments need to reinvest resources in making healthy nations, not powerful nations. Significantly more investment in health care is the need of the day, especially in preventive medicine, community health, and disaster management. The most critical asset in fighting this disease is our frontline doctors and health-care workers. However, unfortunately, our system has failed in saving them from this infection

also. South Korea, Japan, China, the USA, and many other developed countries are trying to use the latest technologies to minimize the effect of this pandemic and decrease the loss of life and loss to the economy.

The COVID-19 pandemic has taken the world as a surprise, and the majority of governments has failed to judge the magnitude of the problem and could not prepare themselves, in time. Thus, they lost the opportunity to add more resources and deploy the latest technologies. This pandemic has triggered an unprecedented demand for critical resources, and they need to adopt all the emerging technologies to help to combat this pandemic by way of several applications (Table 1), such as for population screening, infection tracking, vaccine development, effective quarantine, prioritizing the use and allocation of resources, and designing targeted responses. To avoid coming in contact with human beings and physical objects, which may be potentially infected, several innovative and emerging technologies are being considered by the health-care authorities to protect their workers and also to deliver the treatment and other facilities to the needy patients.^{4,5}

The positioning technologies are playing a crucial role in disaster management. Agencies can quickly get precise positions of locations to undertake relief and rehabilitation efforts accordingly. Smartphone-based application software is developed and used to identify the movement

Table 1 Applications of Emerging Technologies in the COVID-19 Pandemic.

S No	Emerging technology	Applications in the COVID-19 pandemic
	Artificial intelligence (AI)	<ul style="list-style-type: none"> Detecting virus, individuals with fever, and suspected symptoms of COVID-19 through the integration of thermal imaging, AI, computer vision, and cloud computing and accordingly advice for the treatment. Further, this has brought down the time of genetic detection to minutes.
2	Cloud computing	<ul style="list-style-type: none"> All necessary information is stored at a computing platform and made available to enable an enormous amount of computing power to the users with the help of the internet and helps in making real-time decisions in disease modeling. Software can be used with blockchain and other tools to model requirements of critical facilities at a different level, from the hospital to the nation.
3	Big data	<ul style="list-style-type: none"> Provide storage capacity for extensive data of the population in a format that can be used efficiently for analysis and necessary action can be taken toward the prevention of disease transmission, movement, health monitoring, and prevention system

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Table 1. (Continued)

S No	Emerging technology	Applications in the COVID-19 pandemic
4	Telemedicine	<ul style="list-style-type: none"> A patient can have a consultation from well-trained professionals on their medical conditions through video calls, avoiding the need for a hospital visit and thus helping the social distancing and man-to-man contact and disease transmission. However, these remote consultations are now possible with using better telecom infrastructure with virtual reality and augmented reality
5	Blockchain	<ul style="list-style-type: none"> Algorithm help provides real-time information to all the strategic partners and traceability in the process of disease control and helps toward effective management of the supply chain
6	5G + smart applications	<ul style="list-style-type: none"> The high-speed network allows real-time data of video and audio quality for patient data analysis, telemedicine, medical, and surgical intervention
7	Internet of things (IoT)	<ul style="list-style-type: none"> All devices are connected to the internet in the hospital and strategic locations. Thus, these connected devices help to inform the medical staff of any errors and change of requirements during the treatment process (similar to the factories of the future).
8	Drones	<ul style="list-style-type: none"> These unmanned vehicles controlled by remote location can undertake jobs of logistics providers and area surveillance and can also be used for disinfecting remote locations
9	Robotics	<ul style="list-style-type: none"> Undertakes repetitive jobs with precision and reliability in the hazardous environment of infectious disease in and around the hospitals and can make an intelligent decision with inputs from the population data analyzed through AI
10	Modern enterprise video communications platform	<ul style="list-style-type: none"> Application of the software helps in holding video and audio communications, chats, and webinars easily and quickly through large numbers of communication devices.
11	Additive manufacturing	<ul style="list-style-type: none"> Undertakes manufacture of personalized devices for health-care workers and patients, using 3D printing technology for the COVID-19, whenever required.
12	Smartphone apps	<ul style="list-style-type: none"> Uses high-speed network and help to track strategic locations, infected patients and registering the data and modeling of disease outcomes as per the application software and other technologies can also be integrated with the software.

of people and resources and even to determine if they are in contact with an infected individual. The software is used to model and optimize the supply chain with the latest algorithms. However, this needs an upgraded telecommunication infrastructure to offer 5G functionality. Molecular technologies with supercomputing facilities are trying to deliver the vaccine as early as possible.

Several engineering-based innovative and modern technologies need to be used to fight back this pandemic effectively. Recent practices have proven that new-generation technologies have huge advantages, and they are the building blocks for Industry 4.0. Thus, we see an essential role of these technologies in responding to this global emergency of public health challenges.⁶⁻⁸ An optimal help of the digital technologies such as artificial intelligence, big data, molecular biology, Internet of things, cloud computing, blockchain, additive manufacturing, 5G, and many more of such technologies are urgently needed to

effectively improve the efficiency of the global efforts in epidemic monitoring, virus tracking, prevention, control, treatment, resource allocation, and vaccine development. The COVID-19 pandemic has to be fought on the war level, with the latest technological innovations. Industry 4.0 (also known as the 4th industrial revolution) has now started, and the medical world has to gear up to come forward to embrace these emerging and promising strategies and implementing Medicine 4.0.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

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