



Contrivance of Digital Technology for Covid-19

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Abstract: When a disease reaches to pandemic level leading to severe disaster situation, it spontaneously alerts the health-care workers and hospitals for protecting the health of the citizens of the country. This requires adoption of quickly acting health protecting systems with immediate and distant vision, which are to be continued even for the longer period. This is an essential task since the disease in its pandemic form, spreads over mass population with a faster pace and persists for a longer period. This certainly leads to damage of the health system of mass population at one end and at other end it badly affects the economy of a country. Such pandemic also overburdens the health-care facilities. As we are having limited resources in health sector, we need to work with less and need to give the more. To enhance the capabilities of our hospitals and various health-care organizations, digital technology can play a major role in early detection of the disease as well as limiting the spread of the disease. This paper provides possible solutions for the application of digital technologies which can further help in overcoming the pandemic situation, highlighting the successful ways like pandemic planning, contact tracing and surveillance, increased testing and many others in order to achieve the controllable position in the current outbreak.

Keywords- Covid-19, Corona Virus, Digital Technologies, Pandemic, Artificial Intelligence, Machine Learning, Internet of Things, Virtual Reality, Deep Learning

I. INTRODUCTION

As the year of 2020 started, a new disease came in light named novel Corona virus disease, also known as Covid-19, which was first detected in Wuhan, China. This disease is caused by Novel Severe Acute Respiratory Syndrome Corona Virus-2 (SARS-CoV-2). Transmission of virus is through droplets on close contact with patient with the incubation period of about 14 days in most of the cases. The disease spreads in phases from individual to community level with high transmissibility. As the death toll is rising rapidly in almost all the countries of the World including India, the main challenge is how to suppress the disease to the zero level when its vaccine is not yet available.

Health system of world has been collapsed because of lack of resources and medical equipment in developing countries like India and delayed response by developed countries like United States of America. Also, according to the official data, it has been observed that there are around 80 percent asymptomatic cases and symptomatic cases are around 20 percent in India. Presently, this disease is being tackled just like Severe Acute Respiratory Syndrome (SARS) in 2003 along with certain restrictions. Although, as its curative measure, The India has earlier started using Hydroxychloroquine with certain combinations which is significantly improving the condition of some patients, recently Remdesivir is being used in some cases and some cases are being treated with plasma therapy, depending on the condition of the patient. However, the measures are not that effective as success rate is far smaller than the disease growth rate. Plasma therapy although giving positive results but it cannot be considered as primary treatment. Strict lockdown applicable to whole of the population, is one of the preventive measure. Most of the governments have imposed it but it leads to major downfall in economy of countries. The implication of lockdown condition for the civilians is, however, in strict sense is not a complete protective measure but only acts as a pause to the disease for some amount of time. With such difficult situation, where human efforts do not seem sufficient, we can rely on the digital technology which can help to control the Covid-19 disease to its minimal level.

II. REVIEW OF LITERATURE

Background- Since the time when SARS was arised in 2002 as an outbreak, the WHO along with various other National and International organizations discussed this issue and made some efforts to handle the situation. They also took the help of communities. When everyone got relaxed about the efforts to fight viruses, in the year 2009, H1N1 Virus (Swine Flu) had accentuated the efforts made by these organizations. Twenty cases of H1N1 influenza were reported in USA in the month of April, 2009 which started becoming a pandemic and resulted in 12220 deaths in over 208 countries. This virus attacks the respiratory system of body. Later-on, Middle-east respiratory syndrome was reported in 2012 from Middle-East, which was associated with Corona virus. In the year 2014, Ebola virus outbreak came in light in Republic of Congo, although it was earlier reported in 1976. Vaccine of Ebola was announced by CDC in 2015. Zika virus outbreak was also reported later in 2016. All these virus outbreaks, give us a hint that the preparedness of world against the virus outbreak is not enough, specially for the recent Covid-19 outbreak.

Existing Condition Globally- The rapid speed with which covid-19 has spread globally, requires innovation. In current scenario, we are following PCR Test, which takes up-to 48 hours to generate results. This test examines naso-pharyngeal swab or sputum sample. After taking swab, clinician looks for presence of genetic material of corona virus. Other methods include Isothermal amplification assay which has been recently approved by USA but not commonly used in India.

III. OBJECTIVE

To understand the use of digital technology to fight against covid-19 at different levels.

IV. METHODOLOGY

Type of study- Descriptive study

Type of data- Qualitative data

Technique- Secondary research

Data collection method- A progressive search of data related to modern technology for Covid-19 is made and assessed the various aspects of digital and latest available technologies which can be helpful in tackling Covid-19. This report is prepared by collecting data from Research papers and reports of universities and scholars, mainly includes data from United Nations, Sage Pub, NCBI, Lancet Digital Health, University of Sheffield, University of Ghana, Bahrein Institute of Banking and Finance, University of Westminster, IIHMR University, and articles published in Bennett Coleman and Company Ltd' media platforms. Situation is analyzed on the basis of data collected from December, 2019 to June, 2020.

V. FINDINGS

As the research on novel Corona virus is progressing, new information's are available which lead to development of new strategies. The pandemic has caused extensive demand for digital technology solutions for health and has resulted in availability of successful solutions like screening, tracking, surveillance and various other solutions.

Digital technology can be helpful in diagnosis of outbreak with the help of radiology images, disease tracking, forecasting the health condition of the patient, discovery of drug and generating awareness towards the outbreak.

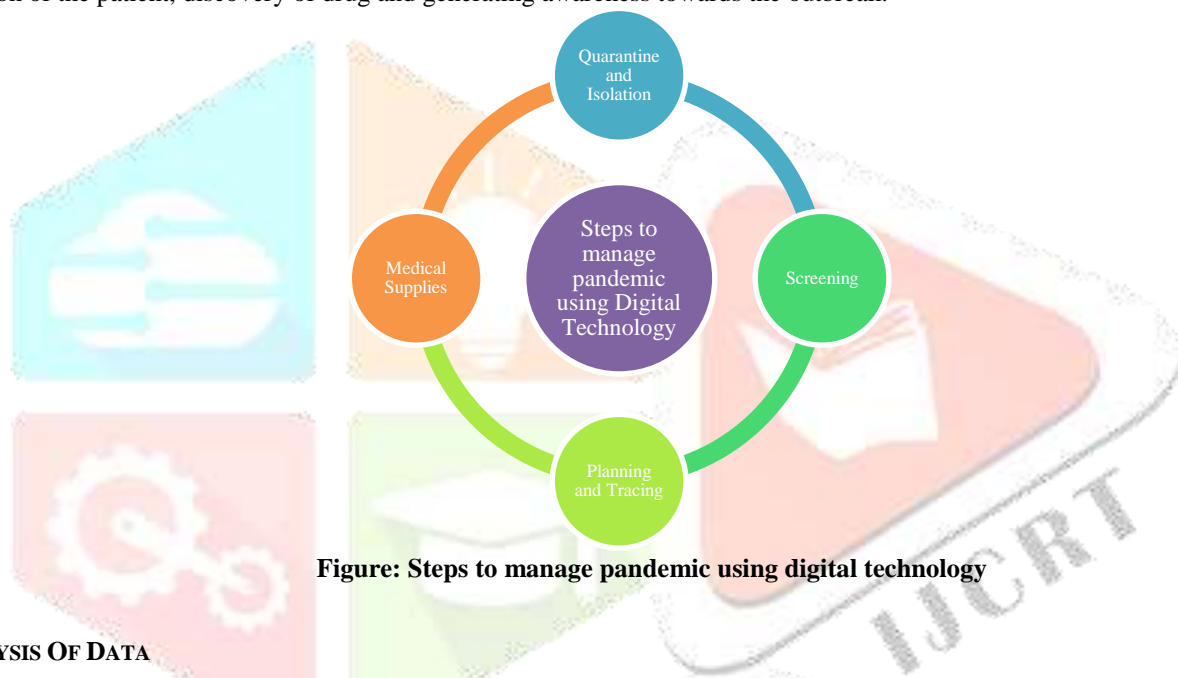


Figure: Steps to manage pandemic using digital technology

VI. ANALYSIS OF DATA

The rapidly emerging situation of Covid-19 disease is a wake-up call for health-care professionals, health-care service providers as well as the patients. We should understand that upgradation to digital technology starts with our-selves. This study is the review of various papers, related to digital technology and covid-19, published in distinguished platforms like lancet, Elsevier, sage-pub and many more.

1 Tracking and Tracing

1.1 About Tracking and Tracing- Having a system which monitors online and detects location is very much helpful in guiding health-care professionals about the time schedule related to patients. One of the prime example of tracking and tracing in India is Arogya Setu app. With over 100 million downloads till May 23rd, 2020; Arogya Setu app is available in India for self-detection as well as the patient tracker.

1.2 About Arogya Setu App- Arogya Setu is a mobile application, developed by the Government of India. Its focus is to protect citizens during Covid-19. This app helps by informing the people about presence of active covid-19 patients in their nearby area. It also suggests best practices to stay healthy along with certain medical advices related to covid-19. This app is developed by National Informatics Center (NIC). It is based on AI.

1.3 Functions- It tells the people about patients of Covid-19 in the surrounding area with the help of Navigation system and Bluetooth. It's identification of covid-19 patients is based on signs and symptoms provided by user and, also data of active cases provided by health centers. So, it's accuracy and efficacy is partly dependable on data provided by users.

1.4 How it works- The Arogya Setu app on your phone detects other devices that have the Arogya Setu app when they come within the Bluetooth proximity of your phone. When this happens, both the phones securely exchange a digital signature of this interaction, including time, proximity, location and duration. This data is stored on the device of all individuals. In the unfortunate event that any of the people that you came in contact with during the last 14 days, tests positive for covid-19, the App calculates your risk of infection based on the number of your interactions and the proximity of your interaction and recommends suitable action. This action is displayed on your Home screen. Your updated risk of infection is analysed by Government of India, to facilitate suitable medical interventions, as and when required.

1.5 Suggestions- Strict monitoring and surveillance.

2 Artificial Intelligence

2.1 About- In computer science, AI is intelligence demonstrated by machines, unlike the natural intelligence displayed by humans and animals. It is also called machine intelligence. In these times of crisis, one thing is clear that investment in digital technology can only suppress the effect of Covid-19.

2.2 Functions- AI has capability to copy Human Intelligence Process. It learns from experience. AI can also be useful in detecting and forecasting outbreaks. Use of AI based systems can help alleviate the load of health-care professionals. *Chatbot* is also a type of AI which detects patient's data, temperature, records patient history, provides consultation and prevents unnecessary load to doctors

2.3 Suggestions- Careful balance between data privacy and public health, and rigorous human- AI interaction required.

3 Blockchain

3.1 About- A Blockchain is a type of diary or spreadsheet which contains information related to transactions. If a transaction is approved by a majority of the nodes then it is written into a block. Each block refers to the previous block and together forms a Blockchain.

3.2 Function- Blockchain protects data from tempering and prevent data loss. Blockchain provides traceability. It helps in transparency of information. It not only helps in management of patients and hospital records but also can track the supplies like medicines, sanitizers, disinfectant and other materials of the health-care organizations. For example, in February,2020; Alibaba launched a blockchain system which helped the Govt of China and others NGO's to work more efficiently and effectively in better collaborative way.

3.3 How it works- Blockchain platforms can be used to monitor response to pandemic situation in a fast and transparent way without the violation of user data. Blockchain can help companies to research the best available ways to combat the Covid-19 and contact-tracing applications can be built on blockchain to allow anonymity. Blockchain can bring reliability, transparency and security to medical data. Several organizations have been accused of manipulating data during this pandemic, blockchain can help to solve them by providing transparent and immutable medical data. A blockchain-based global pandemic map can be used to track the spread of the virus, the number of infected citizens and the number of recovered citizens. Also, blockchain can provide companies payment receive system through cryptocurrencies which will promote less use of cash.

3.4 Suggestions- Services related to Record management, Retails and Human Resources can be improved using Blockchain.

4 Drones

4.1 About- Drone is an unmanned aircraft or ship, that can navigate autonomously without human control or beyond the line of sight.

4.2 Functions- Drones are used in many areas and have many applications. There is no end when it comes to their possibilities. Main areas where drones are of great use are--Search and rescue, Security, Surveillance, Science and research, Mapping, Aerial photography and video capturing.

4.3 How it works- It has been widely observed that the government is facing problem to track the disease suspects in narrow areas. Such areas have less accessibility. In order to gain access to these areas, health-care workers are using drones. These drones are useful in surveillance, tracking and observing the suspects. Drones are also used to enforce social distancing by filming public areas and ordering people back to their homes during lockdown. Many time's these drones are also used in announcements and food delivery in the area which is hotspot of an outbreak.

4.4 Suggestions- As drones are widely being used to spread disinfectant, sending medical supplies and in thermal camera monitoring which is giving positive results, so we can broaden the horizon of its use to make sure it's been used more efficiently.

5 Internet of Things (IoT)

5.1 About- The Internet of Things (IoT) is a scheme of interconnecting computing tactics, digital, and mechanical devices; possessing the capability of transmission of data over the defined network without having any human involvement at any level. In the present typical situation, most of the problems are arising because typical reachability to the patients, which is the second most considerable issue after the concern of vaccine development.

5.2 Functions- The use of the IoT concept makes better reachability to patients, which ultimately provide them significant care so that they can get out of this disease. IoT can be used in medical field as M-IoT. It also helps in prevention and control of Covid-19.

5.3 How it works- IoT is an innovative technology which ensures that all infected persons due to this virus are quarantine. During quarantine, it is helpful in a proper monitoring system. All high-risk patients are tracked easily using the internet-based network. This technology is used for the biometric measurements like blood pressure, heartbeat and glucose level.

5.4 Benefits of IoT in terms of Covid-19-



Chart: Benefits of IoT in Covid-19 management

5.6 Suggestions- It should not have security holes. For this IoT should be designed of standard level. Plus, IoT requires network to communicate with each other so networking should be less expensive. Also, it generates lots of data, so focus should be on artificial intelligence so that even large data sets can be processed easily.

6 Deep Learning

6.1 About- Deep learning is a class of machine learning algorithms that uses multiple layers to progressively extract higher level features from the raw input. For example, in image processing, lower layers may identify edges, while higher layers may identify the concepts relevant to a human such as digits or letters or faces.

6.2 Functions- People suffering from covid-19 have more chances that their lungs will be affected which may later leads to death of the patient. With the help of deep learning, we infected can identify people who are having damaged lungs because of covid-19 from normal individuals or pneumonia (not by covid-19). The detection of covid-19 can be carried out using various deep learning models. Since it is important to detect covid-19 that spread rapidly and globally, AI techniques can be used to perform this accurately and quickly.

6.3 How it works- In association with deep learning, AI has been used in many applications such as image detection, data classification and image segmentation. People infected by covid-19 may suffer from pneumonia because the virus impacts the lungs. Many deep learning studies have detected the disease using a chest X-ray image data approach. The success rate was 93.73% in pneumonia from X-ray images.

6.4 Suggestions- We should take care of quality of data sets. Capacity can be increased so that there can be more scope collectable information.

7 Virtual Reality

7.1 About- Virtual reality (VR) is defined as developing simulated expertise which is somewhat similar to the real-time situation.

7.2 Functions-

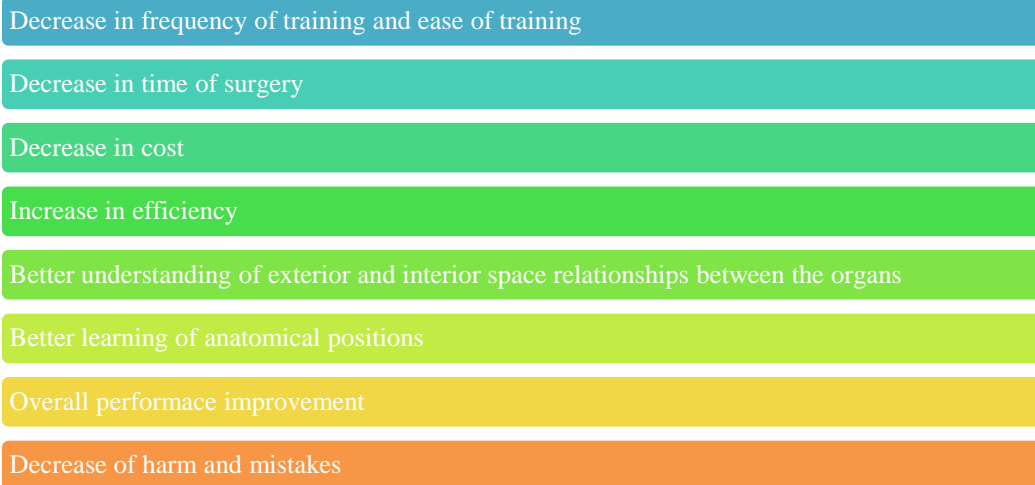


Chart: Functions of VR

7.3 How it works-

VR is beneficial for remote sites for exploring telemedicine, planning, treatment, and controlling of the infections by providing proper awareness to the people regarding this disease. VR technology develops a platform to reduce the face to face interaction of doctors with the infected covid-19 patients. Plus, through live video streaming, it helps to improve surveillance systems on the ongoing situation.

7.4 Suggestions- Virtual Reality is of great use as it provides better sense of place, one can learn by doing and it makes a person more creative. So, we should invest more on VR to improve efficiency and increase creativity.

8 Robotics

8.1 About- The global battle against COVID-19 is playing an extremely important role in assisting humans in containing the spread of the virus and dealing with the existing cases. One of the key technologies that has made a huge difference on the ground is robotics. Many hospitals across the globe are currently using robots to aid both the healthcare staff and patients.

8.2 Functions- From preparing meals at hospitals, doubling up as waiters in restaurants, spraying disinfectants to vending rice and dispensing hand sanitizers, robots were on the frontline to prevent the spread of Coronavirus. In many hospitals, robots were also performing diagnosis and conducting thermal imaging. Shenzhen, PRC based company 'Multicopter' is using robots to transport medical samples.

8.3 How it works- A study published in the 'Science Robotics', "Robots have the potential to be deployed for disinfection, delivering medications and food, measuring vital signs, and assisting border controls. As epidemics escalate, the potential roles of robotics are becoming increasingly clear."

"For disease prevention, robot-controlled non-contact ultraviolet (UV) surface disinfection is being used because COVID-19 spreads not only from person to person via close contact respiratory droplet transfer but also via contaminated surfaces," the study further says.

8.4 Suggestions- As time is changing, robots are also playing an important role in fight against diseases like COVID-19. In the case of an outbreak, the robotic technology can play a crucial role in not just assisting the patients but also keeping the doctor and healthcare staff safe. So, we should work on using advanced technology of robotics in health-care organizations.

9 Big Data

9.1 About- Big data is a term that describes the large volume of data – both structured and unstructured – that inundates a business on a day-to-day basis. But it's not the amount of data that's important. It is what organizations do with the data that matters. Big data can be analyzed for insights that lead to better decisions and strategic business moves.

9.2 Functions- Big data is the accumulation of all the data points related to this disease being received from around the world. Mathematical modeling has taken that data and used it to identify geographical hotspots, make death prediction provide estimate for testing supplies, and guide decision-making among policymakers, health care providers and other key stakeholders.

9.3 Suggestions- Big data is powerful. But with great power comes great responsibility. While we have access to this huge database of information, there will always be some blind spots and missing variables of data that prevent us from having the full picture. In the proper context, big data can be incredibly useful. But in order to harness its full power, we need to have both people who are familiar with data models as well as people who understand the epidemiology and the medical implications of the virus to work together. It is important to keep in mind that existing big data models may be incomplete due to variables that remain unaccounted for (such as population density), either due to statistical or methodological limitations, or because the relevant variables have not yet been identified. This means that despite our best efforts, we may still be missing the entire picture on COVID-19.

10 Facial Recognition

10.1 About- A facial recognition system is a technology capable of verifying a person from a digital image or a video frame from a source. There are multiple available methods in which facial recognition systems work, but usually they work by comparing selected facial features from given image with faces within a database. It is also described as a Biometric Artificial Intelligence based application that can uniquely identify a person by analyzing patterns based on the person's facial texture and shape.

10.2 How it works- Facial recognition technology involves the processing of biometric data for the purposes of uniquely identifying an individual, which constitutes a "special category" of personal data.

10.3 Suggestions- Facial recognition technology is preferred because it has highly invasive potential and can infringe individuals' rights to privacy and the protection of their personal data. The use of facial recognition technology should also be fair, lawful and transparent and the purposes for which it is used should be limited.

11 Cloud Computing

11.1 About- Cloud computing is the on-demand availability of computer system resources, especially cloud storage and computer power, without direct active management by the user. Cloud computing is the delivery of on-demand computing services from applications to storage and processing power, typically over the internet and on a pay-as-you-go basis.

11.2 How it works- Rather than owning their own computing infrastructure or data centres, companies can rent access to anything from applications to storage from a cloud service provider. One benefit of using cloud computing services is that firms can avoid the upfront cost and complexity of owning and maintaining their own IT infrastructure, and instead simply pay for what they use, when they use it. In turn, providers of cloud computing services can benefit from significant economies of scale by delivering the same services to a wide range of customers.

11.3 Examples- Cloud computing underpins a vast number of services. That includes consumer services like Gmail or the cloud backup of the photos on your smartphone, though to the services which allow large enterprises to host all their data and run all of their applications in the cloud. Netflix relies on cloud computing services to run its video streaming service and its other business systems too, and have a number of other organizations.

11.4 Suggestions- Increase security, Optimized storage environment, Optimize end-user experience.

VII. RESULTS

This study provides a window to think about the technologies which are used to decrease the impact of pandemic. Presently, various technologies are being used or going to be used in various sectors including health as well as other industries.

Hospital Care	Hospital Robots
	Clinical Algorithms
	Protective Gear
	Advanced Ventilator Valves
Remote Healthcare	Remote Monitoring
	Telehealth
	Digital Stethoscope
	Wearable Sensors
	Chatbots
Diagnostic Solutions	Mobile Diagnostics
	Tele Health
	Remote Patient Diagnosis
	Disease Detection Kits
	Temperature Monitoring
Preventive Measures	Air Filtration System
	Disinfectants
	Spit Disposal
	Masks
Public Safety during Pandemic	Drone Delivery
	Specialized Isolation Units
	Mobile Support Application
	Outbreak Prediction
	Patrolling and Disinfecting Robots

Lockdown Management for Individuals	OTT
	Remote Work
	Online Learning
	Indoor Workout Platforms
Lockdown Management for Industry	Real-Time Supply Chain Monitoring
	Augmented Reality
Lockdown Management for Cities	Smart Surveillance
	Location Based Systems
	Sickness Mapping

VIII. DIGITAL ETHICS

Citizens may face several issues when using Digital Technology in response to current pandemic crisis. For example- issue of privacy.

Privacy is the main issue in maintaining information of users as during the process of tracing and tracking, for example in Arogya Setu app, with the help of navigation system and Bluetooth, system stores user's information of patterns and movements. When we see this from the lens of privacy, it is controversial and seems to infringe the rights of privacy. When we see it beyond the lens of privacy, it is effective measure to rapidly control and limits the spread of crisis.

Also, we must be aware about the content we received through online channels as they are regulated by AI without human in the loop. These kinds of contents are managed by automated systems. All of us should do what we can to maintain the level of solidarity during this pandemic period.

IX. CONCLUSION

As we know that Digital technology can be of great help in pandemic but there is another side of current world also. When we talk about digital health initiatives, it amplifies socio-economic imbalance and disparities.

Government of India is focusing on tracking and tracing with use of smartphone. However, the facility of internet is still not the thing of pocket for everyone, which is far reaching the masses of lower-class people. Those who have cell phone provided by state or central government are not even having money to buy food in this pandemic period. Although, public hotspots installed by the government, that can be a temporary option but it's not feasible at all, as person can't go and remain seated on main road to access internet.

Technologies in healthcare can help doctors by providing various kind of advanced facilities which will further help them to assess the situation and handle it accordingly. With the availability of technologies, Covid-19 as well as other diseases can be eliminated by fighting misinformation, finding drugs, increasing traceability and transparency by sharing data, tracking people with facial recognition and big data, contactless movements and deliveries through autonomous vehicles, drones and robots; technology supported temperature monitoring, remote working technologies to support social distancing and maintain business continuity. Also, it can be helpful in reducing inequalities, minimizing the risk of virus spread and easy access to public services during the pandemic crisis.

In nutshell, it is concluded that in today's situation, the greatest risk is not the weapons, instead a worldwide covid-19 pandemic. If not cared properly it is able to kill people at large. In the line, the researchers with great dedication are working to find every possible solution available to fight Covid-19 and digital technology is the fascinating road in this research. Covid-19 made us to realize that we have all advancements but actually, we are not even geared-up to tackle a virus. Presently, India is fighting Covid-19 with around 60% rate. But as the lockdown lifted, cases started increasing at surprising rate. We should understand that lockdown is not the ultimate solution. We should move towards working on technological advancements as well as on research. After Covid-19 outbreak, it is proven that, from Artificial Intelligence to Big Data to IoT to Robotics, technological innovations are helping to manage the pandemic and better equip to fight future public health emergencies in perfect and timely manner.

X. RECOMMENDATIONS

Strict monitoring and surveillance with tracking and tracing at society level with apps like Arogya Setu and robotics at health-care organization level for procedures which involves interaction with Covid-19 patients.

Careful balance between data privacy and public health in AI as AI uses user's data, better data processing in IoT and better data quality in deep learning to provide enhanced care.

Drones are being used in major cities to supply medicals in outbreak affected area. We should use them in rural areas also where we can found issues of electricity and proper roads; monitoring through camera is already happening in areas where people are not following lockdown rules. Along with this, drones can be used to check temperature of patients in outbreak affected area; for inspection of areas to know the status of lockdown or curfew rules in narrow, affected streets and to broadcast notification released by government or local authorities.

Increase efficiency and creativity with blockchain in retail management and patient management and in Virtual Reality which provides facility in which one can learn things by actually doing it.

Cloud Computing should have Increased security, Optimized storage environment, Optimized end-user experience making the platform more user-friendly, so that it attracts more number of people.

Remote healthcare can be provided in form of telehealth, wearable sensors and remote monitoring and diagnosis in the areas where direct medical facility is not available or visiting health-care facility for regular check-up is not possible because of distance factor.

Lockdown management at different levels in the form of remote working with cloud networking; online learning through e-learning platforms like Edx, Coursera and Swayam; mapping and real-time supply-chain monitoring with navigation based system and technologies.

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