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Digital & Smarter Health Technologies for Pandemic Scenario

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Abstract

Unique Novel Covid is the latest pandemic, which has struck in excess of 210 nations and regions all over the world setting states in an unsafe position. Colossal examination is being finished on the infection recognition, giving medicines to help side effects, and fostering its immunization, which, as indicated by a gauge, could take one to two more years. There is an urgent need for a greater understanding of what roles information systems and technology researchers can play in this global pandemic. It provides insights and suggestions into how information systems and technology scholars can help fight the COVID-19 pandemic. Through this rapid review, we sketched an expansive, multilevel model of the current knowledge of how humans are using technology during the COVID-19 pandemic.

Keywords – Pandemic, technology, Covid19, Science, IoT, IoMT, Robots, Drones, digital scenario, GPS, bluetooth

1) INTRODUCTION

The Covid-19 pandemic has led to an inevitable surge within the use of digital technologies thanks to the social distancing norms and nationwide lockdowns. People and organizations everywhere the planet have had to regulate to new ways of labour and life. We explore possible scenarios of the digital surge and therefore the research issues that arise.

An increase in digitalization is leading firms and educational institutions to shift to work-from-home (WFH). Workplace monitoring and technostress issues will become prominent with an increase in digital presence. Online fraud is probably going to grow, alongside research on managing security. The regulation of the web, a key resource, are going to be crucial post-pandemic.

By the late of May 2020, over 200 countries and territories were affected by the Corona Virus Pandemic. This included the most urban clusters as well as rural ones.

With the spread of the pandemic, most regions have implemented lockdowns, shutting down activities that need human gathering and interactions - including colleges, schools, malls, temples, offices, airports, and railway stations. The lockdown has resulted in most people taking to the internet and internet-based services to communicate, interact, and continue with their job responsibilities from home. Internet services have seen rises in usage from 40 % to 100 %, compared to

pre-lockdown levels. Video-conferencing services like Zoom have seen ten times increase in usage, and content delivery services like Akamai have seen a 30 % increase in content usage. Cities like Bangalore have seen a 100% increase in internet traffic.

Though now, in late May 2020, the pandemic is receding and stabilized in certain countries, it's still on the rise in many others, and with serious threats. Experts in most countries are wary of the likelihood of the disease spread re-emerging, which lockdown norms could also be relaxed carefully and slowly with social distancing at the core of the new normal. It is during this context that we see the utilization of data systems to continue within the same vein for a few times within the foreseeable future as during the lockdown. We examine the possible scenarios in this surge in information technology usage during and post the pandemic in the next section, we examine the impact of the Covid-19 pandemic on the utilization of digital technologies, where we discuss some possible scenarios and research problems with the post-pandemic world.

2) TECHNOLOGY AND MEDICAL SCIENCE

Clinical science and mechanical development go together for a better future. Innovation has made significant and progressive commitments to the field of clinical consideration, which has in the end helped in broadening the life expectancy of

individuals all through the world. Moreover, it has additionally worked on the personal satisfaction by a productive method of infection diagnosisand treatment. Thermometer, magnifying lens, ophthalmoscope, stethoscope, laryngoscope, and X-beam are among the underlying creations in clinical technology.[1]

Figure 2.1: Modernization of medical industry

2.1) Electrocardiography

Electrocardiography is the method involved with delivering an electrocardiogram (ECG or EKG). It is a chart of voltage versus season of the electrical action of the heart utilizing terminals put on the skin. In electrocardiography (EKG), anodes are appended on the skin remotely, which screens the electrical action across the chest. The outcome is known as an electrocardiogram. [3]

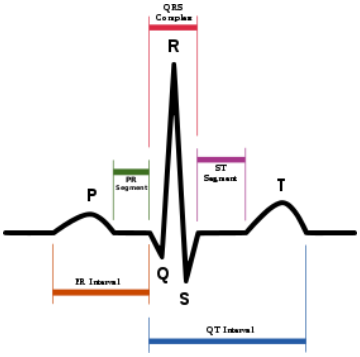

Figure 2.2:Electrocardiogram

2.2) X-Ray

X-rays are types of electromagnetic radiation probably most well-known for their ability to see through a person's skin and reveal images of the bones beneath it. Advances in technology have led to more powerful and focused X-ray beams as well as ever greater applications of these light waves, from imaging teensy biological cells and structural components of materials like cement to killing cancer cells. [4] This disclosure helped the doctors to see within human body and work with the course of illness analysis.

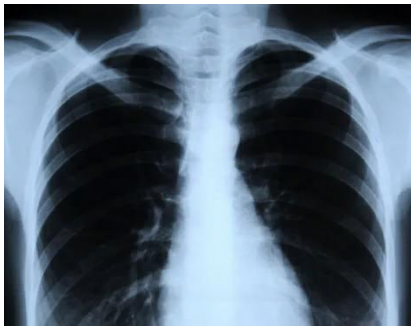
Figure 2.3:Chest X-Ray

2.3) Ultrasound

A ultrasound yields the photos of within body. It utilizes high-recurrence sound waves. As ultrasound pictures are taken progressively, they can show the construction and development of the organs. [1]

It is used during pregnancy to monitor the health of unborn babies.

1)External Ultrasound

The sonographer puts a lubricating gel onto the patient's skin and places a transducer over the lubricated skin. The transducer is moved over the part of the body that needs to be examined. Examples include ultrasound examinations of a patient's heart or a fetus in the uterus. [5]

2) Internal Ultrasound

If the internal reproductive organs or urinary system need to be evaluated, the transducer may be placed in the rectum for a man or in the vagina for a woman. To evaluate some part of the digestive system, for example, the oesophagus, the chest lymph nodes, or the stomach, an endoscope may be used. A light and an ultrasound device are attached to theend of the endoscope, which inserted into the patient's body, usually through the mouth. [5]

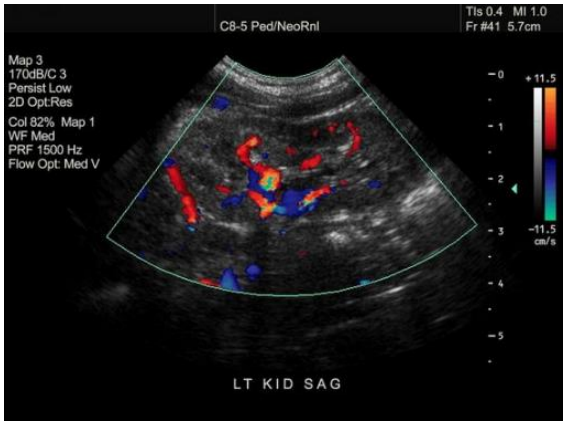

Figure 2.4:Ultrasound Image

2.4) MRI (Magnetic Resonance Imaging)

This innovation utilizes attractive field and radio waves to picturize organs inside the body guaranteeing least harm. It is being utilized widely for the discovery of neurologic and outer muscle problems and for the assessment of malignant growth patients. X-ray is better than other imaging procedures as it can show issues that remained invisible in any case [2].

In clinical and research MRI, hydrogen atoms are most often used to generate a macroscopic polarization that is detected by antennae close to the subject being examined. Hydrogen atoms are naturally abundant in humans and other biological organisms, particularly in water and fat. For this reason, most MRI scans essentially map the location of water and fat in the body.[3]

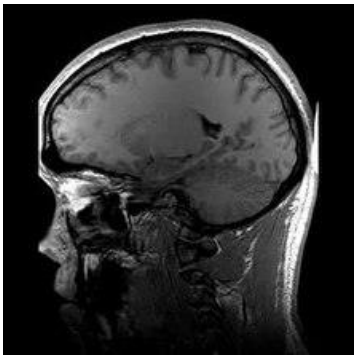

Figure 2.5:MRI of the head

3.1) Digital Divide

The pandemic and lockdown have affected 1.4m migrant workers and others working in the unorganized sector (90% of India's population is engaged in disorganized work). Most if the migrant workers who work on daily wages or low salaries have either moved back home along with their family or were unable to send remittances home this season due to loss of job, salary cuts or even the shutdown of services due to the lockdown. Not only the working population, but the children pursuing their education also faced a lot of difficulties to continue their education. Some did not have enough resources to continue their online education while some had to discontinue their schooling due to economic difficulties. Less than 15% of rural Indian households have internet access (as opposed to 42% urban Indian households). A mere 13% of people surveyed (aged above five) in rural areas — just 8.5% of females — could use the internet. [12]

3.2) Connecting People

Millions of people are moving their workspaces to their homes through teleworking and students taking online classes in the light of the COVID-19 outbreak. This has resulted to the extra costs to the IT infrastructure associated with meeting spiking demand. The pandemic is forcing a record number of employees and online education of students for an extended duration has led to the heavy traffic on remote connectivity networks.

4.1) Internet of Things (IoT)

IoT is otherwise called the Web of Everything or the Modern Web. It is another innovation worldview, which involves an organization with machines and gadgets that can productively interface with one another. IoT has assembled significant consideration from numerous enterprises all around the world and is expected to be an indispensable piece of future innovation [6]IoT is becoming famous for some reasons. The most significant reasons being the wide accessibility of broadband Web, the decreased expense of equipment, and a huge measure of individuals utilizing cell phones, wearables fit for gathering information, and other "shrewd" items.

Figure 4.1:IoT in current era

IoT might potentially influence each and every area of our life. In any case, the fields that will be essentially impacted by this innovation include:

•Assembling and creation.
•Wellbeing and medication.
•Transportation.

The various IoT devices and applications including wearables, drones, robots, IoT buttons, and smartphone applications that are mainly utilized in the forefront of combating COVID-19.

TECHNOLOGY	DESCRIPTION
Wearables	An app-enabled technology for receiving and processing data that is worn on or sticks to the body
Drones	An aircraft equipped with sensors and cameras, GPS, and communication systems, which is flown with little or no human interactions.
Robots	A programmable machine that can handle complex actions like a living creature.
Smartphones and Applications	An application software designed to do limited tasks within a mobile device.

4.1.1 Wearables

Wearable technologies can be defined as the combination of electronics with anything that is able to be worn [7].The definition presented by Juniper Research describes them as app-enabled computing technologies that receive and process input while they are either worn or stick to the body such as bands, glasses, and watches. These smart wearables were designed for different purposes in various domains such as healthcare, fitness, lifestyle, and so on. Patient's wellbeing is observed by gathering the information in view of his proactive tasks by utilizing worked in sensors.

Figure 4.1.1:Smart Wearables

"Clinical grade wearables", this class incorporates the IoT gadgets, which have been affirmed and endorsed by the administrative power. These are generally endorsed by specialists and utilized at a facility or in home to screen and work on persistent circumstances in unambiguous illnesses. Models incorporate shrewd belts (Dynamic secure), which are particularly intended to identify falls in old patients and chest lashes (Qardio Center), which can record the ECG.

(A) Active protect (B) Qardio core

Figure 4.1.2 Active project and Qardio code

4.2) DRONE TECHNOLOGY

An automated elevated vehicle (UAV) or uncrewed flying vehicle, generally known as a robot, is an airplane with next to no human pilot, group, or travelers ready. The trip of UAVs might work under controller by a human administrator, as remotely guided airplane (RPA), or with different levels of independence, for example, autopilot help, up to completely independent airplane that have no arrangement for human intervention.[8]

An autonomous drone itself is a UAV but can operate without human intervention. So, in autonomous drones, any ground control system or communications management software plays an important role to carry out operations; thus, such drones are also considered part of UAS (Unmanned Aircraft System). To deploy such control, drones also employ host of advanced technologies such as cloud computing, computer vision, artificial intelligence, machine learning, deep learning, and thermal sensors

Figure 4.2: Drone

Classification:

Based on the weight

Based on their weight, drones can be classified into five categories — nano (weighing up to 250 g), Micro air vehicles (MAV) (250 g - 2 kg), Miniature UAV or small (SUAV) (2-25 kg), medium (25-150 kg), and large (over 150 kg).[9]

Based on the degree of autonomy

Robots could likewise be grouped in light of the level of independence in their
flight tasks. ICAO groups uncrewed airplane as either remotely guided airplane or completely independent. Some UAVs
offer transitional levels of independence. For instance, a vehicle that is remotely directed in many settings yet having an
independent re-visitation of base activity. Some airplane types may alternatively fly monitored or as UAVs, which might incorporate
monitored airplane changed into uncrewed or Alternatively Directed UAVs (OPVs) [9]

4.2.1 Use of Drones during Covid-19

The contribution of robots in military tasks has expanded since late 1990s. In any case, non military personnel drones with business grade minimal expense innovation are likewise getting well known and has previously been utilized for different salvage errands and cataclysmic events all over the planet. In this segment, we will introduce the potential ways that can be useful in battling and debacle, or illness spread explicitly during Coronavirus 19.The first country to confront the rage of Coronavirus has utilized drone innovation to counter its spread. Accepting that as a motivation, nations all over the planet have united with various scientists and trend-setters to track down clever approaches to utilizing robots to battle any future or current pandemic at the best.

4.2.1.1 Transportation

Up to this point, eighteen nations have conveyed drones for conveyance and transportation purposes during Coronavirus pandemic. Some of them did it as a piece of trial and error and tests, while others kept up with their standard robot conveyance tasks. Three nations in Sub-Saharan Africa, specifically Rwanda, Ghana and Malawi detailed the utilization of robots to convey customary clinical wares, Coronavirus supplies, and clinical examples starting from the start of the pandemic. Every one of the three nations previously had drone activities preceding the Coronavirus pandemic, in this manner, drone tasks were adjusted in each of the three nations torespond to the expanded interest of clinical wares and Coronavirus supplies. The benefits that drones could offer in the context of COVID-19, are the speed of delivery, extended transportation network reach to the last mile, limited physical contact and reduced risk of transmission during the delivery. [10]

4.2.1.2 Aerial spraying

There have been several media reports on the use of drones for aerial spraying of disinfectants in public outdoor spaces to contain the spread of the virus. Attempts took place in China, UAE, Spain, South Korea, and other countries. Some companies claim that they managed to cover 3 km2 of an area with spraying. However, scientific evidence suggests that this application has little to no evidence for efficiency and effectiveness. [10]

4.3 ROBOT TECHNOLOGY

Robots are brilliant machines and stayed supportive during current Coronavirus pandemic. Robots can without much of a stretch be conveyed as cutting edge fighter in clinical units because of less gamble of infectious illness spread from the patients who are languishing. Furthermore, bright (UV) sterilization strategy (technique to clean the regions from infectious sicknesses) is effortlessly accomplished with robots through pre-customized methodology; consequently, restricting the exchange of the illness by means of sullied surfaces in emergency clinics or segregation focuses. The independent sanitizing robots with very little or no human contact are prescribed when contrasted with the manual purification, which includes the

cleaning staff and may put their lives in extreme danger [34]

4.3.1 Droid Team

A squad of robots serves as the first line of defence against person-to-person transmission at a medical centre in Kigali, Rwanda. Patients walking into the facility get their temperature checked by the machines, which are equipped with thermal cameras atop their heads. Developed by UB Tech Robotics, in China, the robots also use their distinctive appearance—they resemble characters out of a Star Wars movie—to get people's attention and remind them to wash their hands and wear masks.

Figure 4.3.1: Thermal camera attached at the top.

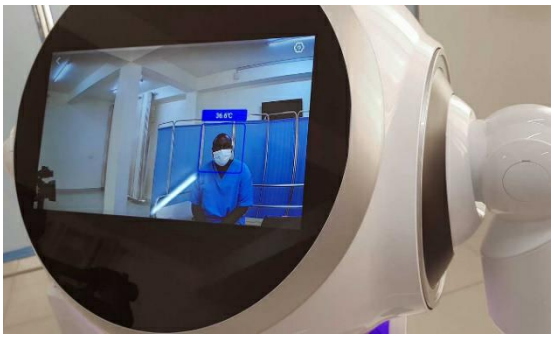

Figure 4.3.2: Temperature scanning

4.3.2 Germ Zapper

After six of its doctors became infected with the coronavirus, the Sassarese hospital in Sardinia, Italy, tightened its safety measures. It also brought in the robots. The machines, developed by UVD Robots, use LIDAR to navigate autonomously. Each bot carries an array of powerful short-wavelength ultraviolet-C lights that destroy the genetic material of viruses and other pathogens after a few minutes of exposure. Now there is a spike in demand for UV-disinfection robots as hospitals worldwide deploy them to sterilize intensive care units and operating theatres.

Figure 4.3.3:UVD Robot

technology organization has fostered different sanitization robots, which clean affected region or gear by UV light radiation. The UV beams destroy strands of infection's DNA, hencemaking it innocuous. The organization named UVD has conveyed its robots in China, medical services markets in Europe, and US. Their case is that the robots can work for around 2.5 h and clean around nine or ten rooms on a solitary charge.

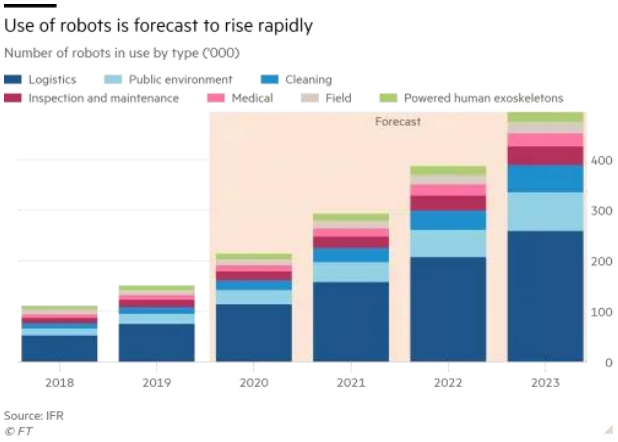

Figure 4.3.4:Graph of the usage of robots

4.4 Internet of Medical Things (IoMT)

This section highlights the IOT in the medical and healthcare sector.IoMT is the combination of technology and medical applications. It is the use of technological systems relating to healthcare applications using various technologies. IoMT is making growth at a rapid phase with a large margin as many large healthcare organizations are already making use of it globally.

Several on-going research, show the adoption of IoMT applications with the security are being implemented steadily. Other technologies like artificial intelligence, machine learning, big data, blockchain are merged with the IoMT.

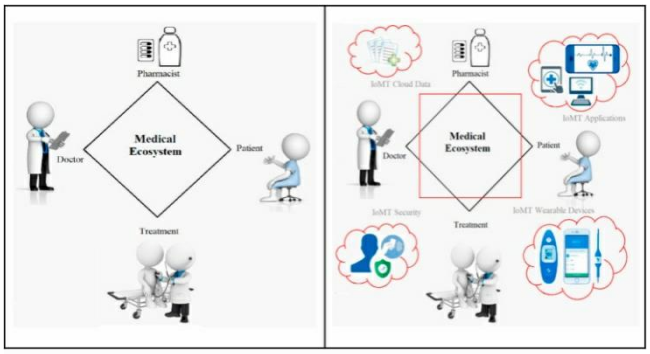

Figure 4.4: Traditional vs Modern Medical ecosystem

Research have been made proposing various idea to improve the traditional medical architecture.[14]
Different Solutions in the form of industrial manufacturing of ventilation tubes, masks, and other medical devices to increase the consultation quality of patients in comparison to the clinical consultations so that patients do not have to leave their house and stay safe with self-isolation in a secure manner.There have been many highlights in the advances in IoMT technologies, architectures, applications, and security. The security features include security requirements, threat models, attack, and risk management.[15].
IoMT in the cloud platform technology has advanced to multi-cloud completion in IoMT architecture to support large systems and to provide storage facilities and backup during system failure.[16]
The data collected by sensors using the hardware on the user end like health monitors, smart phones etc are transmitted through cloud platform for further analysis and decision making.[17]

4.4.1 Bluetooth and GPS technologies

Bluetooth is primarily used for wireless Personal Area Networks (PANs) communication. It is a one of the older, popular, and commonly used technology for sending data from one device to another device. It is used during the proximity calculations. Even though there are many advanced technologies which have been rising in the recent years, Bluetooth is still sometimes preferred over the other technologies because of its security features.[18]
Radiolocation tracking systems is an area with significance growth in the field of wireless communications. More precisely, the Global Positioning system initiated by US Department of Defence in 1978, is a navigation system that provides locations of devices, navigation, and similar services to its users.[19]

During the COVID-19, we have seen the government using the GPS technology and bluetooth technology for tracking the present and past locations of the covid positive patients. This helped government to track the areas with large number of patients with corona virus.

4.4.2 Telemedicine

Telemedicine is a technology with various devices which helps the doctors to remotely gain information about the patients' health status. It is example of both screen and diagnostic tool which has been of great importance due to the development of digital technologies.Doctors can check the health status of those patients who may have difficulty in travelling and may not be able to meet the doctor directly due to lockdown issues. Specialists can keep track of patients who require quick attention or have chronic diseases and need a quick follow-up.[28]
Doctors can even check-up on the outpatients who visit periodically dur to the preventive measure taken up by the local authorities like the lockdown.There are several potential benefits to implementing telemedicine, including[29]

6) CONCLUSION

To summarize, the digital revolution has been affecting and reshaping health care systems worldwide. It encompasses the changes of the fundamental principles and approaches of medical service and education. It was shown that the application of novel digital innovations can improve the accessibility, quality, and flexibility of healthcare for the public not only in Western countries but also in developing countries as well.
The current pandemic has drastically affected every aspect of our life. It has changed peoples' way of viewing different things. The whole world is on the lookout for best alternates of the available technological solutions.

IoMT,drones, and robots have joined hands together for the advancement of telemedicine field, which can be used for spreading limited clinical resources across a wide geographic area. It improves quality of care and access during the ongoing pandemic. All these technologies are on the way of maturing to help us fight against the deadliest pandemics.

New evidence and technological improvement of devices have made telemedicine a useful solution for diabetic

retinopathy screening. These advancements could be useful to widen the number of individuals screened and monitor progression of retinal disease, both in conditions of pandemics/urgencies and in routine clinical practice.

The future of public health is likely to become increasingly digital and the need for the alignment of international strategies for the regulation, evaluation and use of digital technologies to strengthen pandemic management, and future preparedness for COVID-19 and other infectious diseases.

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