The Role of 5G Technology Combatingcovid-19 Pandemic and Challenges for Adoption.

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ABSTRACT

5G technology is the key technology that was deployed in 2020 first time in China and other developed countries. COVID-19 outbreak happened in the Wuhan, China in the year of 2020. The disease declared as pandemic and up to now millions of people passed away due to covid-19. There is lot of myth regarding outbreak of COVID -19 and 5G technology deployment. Directly there is no correlation between two but the 5G technology help the humanity to fight with COVID-19. 5G is the emerging technology that use advanced artificial intelligence features, big data analytic, wireless sensor network and IoT device infrastructure to control the COVID-19 pandemic. This paper discusses about the role of 5G technologies and their challenges for adoption in medial health care system to fight with COVID-19.

Keywords
5G, COVID-19, FANET, 2019-NCoV, BAN.

I. Introduction

5G technology deployed by many countries in the year of 2020 with limited capacity and technology, means it was not fully deployed in all cities of the country. 5G technology is using millimeter wave technology for transferring data at high rate and provide eMBB (extremely mobile broadband service), mMTC (massive machine type of communication), URLLC (ultra-reliable low latency communication)(Osseiran, Monserrat, & Marsch, 2016). The first case of novel Coronavirus (2019-nCoV) virus detected first time in the Wuhan, China in November 2019 (R. Kumar, Pandey, Ibsa, Sinwar, & Dhaka, 2021). Due to 2019-nCoV millions of people lost their live in the entire world (A. Kumar, Sinwar, & Saini, 2021). There are various impacts of COVID-19 in various sectors including manufacturing industry, hotels, tourisms, education that suppress the economy of various nation due to lockdown imposed by government. 5G technology working on the higher frequency bands have ability to travel shorter distance, hence dense cell infrastructure required by 5G network has a strong electromagnetic filed. (RF-EMF) (R. Kumar, Geleta, Pandey, & Sinwar, 2021). There are various rumors in the market that COVID-19 is spreading through the 5G network that is absolutely denied by telecom authority and scientist. There is no link in-between 5G network and COVID-19 transmission. 5G use the electromagnetic wave to carry the data, these electromagnetic waves cannot carry object (virus), hence the transmission is not spread due to 5G network (Meese, Frith, & Wilken, 2020). However, some adverse effects notified by scientist that are related to electromagnetic field, kumar et al.(R. Kumar, Geleta, et al., 2021)discuss about the adverse effect of 5G technology. 5G network service provide ubiquitous digital medical health care service to patients and doctors, effectively management of the health care resources is required in the pandemic situation where everywhere is sacristy of the medical aid and medical resources. 5G technology usage in medical sector is associated to IoT, machine learning, AI technology that can combat against COVID-19 pandemic and better predicts future crisis (Webinar, Muluk, & Romao, 2020). Smart health care systems transform the technology to the next level and provide to the patient's various care and

facilities. In the figure 1 show the general architecture of the smart health care system based on 5G network. IoT device plays very important role in the smart health care system, where number of wearable devices are used by the user by BAN (body area network). The use of these medical wearable devices is transmitting the data to Base station and base station further transfer this data to cloud server or hospital server. Doctors can access that data by cloud server and treat patients accordingly. Machine learning plays important role in the prediction of the health of the patients and also provide number of prescriptions to doctors (Ahad et al., 2020). 5G enable health care system have various advantage as compare to previous technology because it provides ultra-reliable and low latency communication service to the user, through this service robotic remote surgery is possible (Mamun, Rahman, Khaleque, Hamid, & Ph. D., 2019).
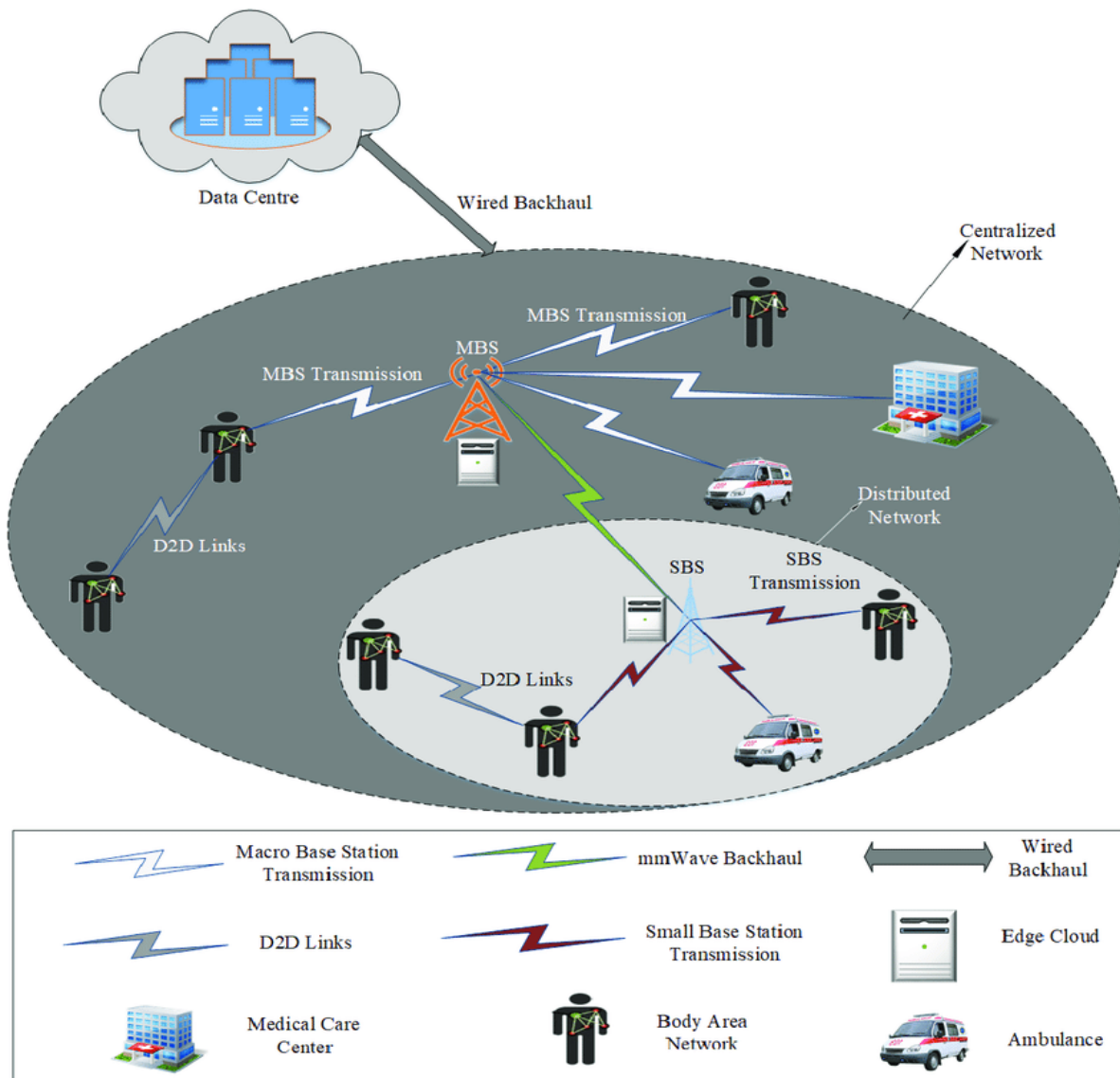

Figure 1. General architecture of smart health care System based on 5G Network(Ahad et al., 2020)

5G smart health care system provides various medical service to the user such as remote surgery, smart ambulance, remote patients monitoring through BAN, telemedicine and telehealth service

(Latif, Qadir, Farooq, & Imran, 2017). The rest of this paper organized as follows section II discuss about the role of 5G technology against COVID-19, section III discusses about challenge face by 5G technology in COVID-19 scenario, section IV concludes the paper.

II. The role of 5G technology combating COVID-19

1.AI enable Unmanned Aerial and Ground Vehicle

UAV plays very important role in the fighting with COVID-19, most of the countries followed lockdown in their cities depending on the number of cases. Lockdowns are partially or fully depending on their infrastructure and susceptible to risk. In the full lockdown scenario, it strictly needs to monitor the people using drone whether they are inside their home or roaming outside. Those countries who don't have enough UAV infrastructure they were doing that monitoring through security forces, limited to manpower for monitoring entire area. It is almost impossible to monitor the people manually, instead drone technologies play very important role in monitoring every street, corner, building, locality. UAV provides real time live video and live images of every corner of the city. The role of 5G is that these UAV needs high speed data connection for sending the real time video and image to the monitoring station. Artificial intelligence based FANET network enable clustering technique to communicate number of drones each other and technology work according to swarm intelligence behaviors (Khan, Aftab, & Zhang, 2019). Drones uses FANET to form a cluster between nodes and while flying each node can communicate with each other. Manisha Devi *et al* 2021(Devi, Maakar, Sinwar, Jangid, & Sangwan, 2021) discuss various application of the drones in the COVID-19 pandemic, these applications are related to inspection and surveillance, communication messages broadcast, spray (disinfection of surface), delivery of essential items, temperature monitoring and traffic monitoring. The research going on by the Canada based company Dragonfly to develop an intelligent drone that is able to find the infected person and sends their details to the central station, so that without human interaction an infected person can identified easily ('Draganfly is developing a "pandemic drone" to help fight COVID-19 - DroneDJ', n.d.).

2. Contact tracing and self-isolation

Self-isolation is mandatory for the person, if the patient is infected with COVID-19, because of its spreading nature. Patient is frustrated some time to live in a closed room, some patient may breakdown their self-isolation that leads to infection to other person. It is necessary to monitor the self-isolation of the patient. Various GPS enable applications are available in the market, that will continuously share their location to the monitoring station or data store in the cloud. The authority can utilize these data location and continuously monitoring the patient's weather patients follow strictly self-isolation rules. If some person moves outside, using drone technology we can capture the image of the person and can be identified using face recognition algorithms to trace of the patients (Klar & Lanzerath, 2020). Contact tracing is referred to identify a people who has history of exposure with infected person, such person needs continuous monitoring because COVID-19 outbreak happens between 2 to 14 days after exposure. Wearable device plays very important role in the case of self-isolation and contact tracing, 5G provide mMTC (massive machine type communication) to millions of the IoT device to trace patients and monitoring their isolation location.

Figure 2. UAV against COVID-19('Five ways drones are used to battle COVID-19 – Geospatial World', n.d.)

Instead of sending data using the ordinary mobile device, it is better to use IoT wearable device that provide fast communication to store data in the cloud. 5G provide Mobile Edge technology for reduced latency in the network and a user can store their data near to BSs or edge node instead to store in the cloud (Siriwardhana, Gür, Ylianttila, & Liyanage, 2020).

3. Telehealth for patients

Telehealth is the technology where a doctor can monitor the health of the patient remotely (Dorsey & Topol, 2016). The COVID-19 situation there is big risk for the doctors and nurses, who are operating patients, of getting infected. BAN (body area network) involves in the case uses the number of IoT enable device (wearable device) for the monitoring of the patient's health. To analyze and monitor the health of the patients remotely by the use of the Wireless Sensors enable body area network that continuously sends the readings to the central server and through the mobile application doctors can monitors and suggest prescription to the patients(Garhewal & Singh, 2018). 5G enable URLLC (ultra-reliable low latency communication) service to the user, here latency is the key concerned. Using URLLC remote surgery operation is possible by the use of wearable HCI enable devices. Biosensor patch leverage to detect cardiovascular problem by using cardiovascular monitoring to early detection of the COVID-19 infection. The name of the wearable is Patch1AX that fixed on chest area, it can record respiration rate, ECG trace, and the heart rate monitoring. The collected data sent to the user mobile device and can analysis and view data in the real time. The data also can be shared to doctors or it can transfer to the hospital

server, so doctors can-do real-time monitoring of the patients ('LifeSignals to roll out biosensor patch for COVID-19 monitoring', n.d.).

4. Online education

In this pandemic situation one of the most of the affected sector is education sector, where all the universities, schools, coaching instructions, training institutions are closed due to lockdown imposed by government authority. Online education plays very important role in this pandemic situation, there are number of applications like MS-TEAM, Zoom, Google Meet etc. thar are used for creating virtual class room scenario. These applications need high speed internet connection for communication of the large number of users (students and teachers) with each other. Here 4G technology is not that much effective because real time Audio and Video transmission is required. 5G technology enable eMBB servicesprovide real time high-definition video transmission to the users (Xiang & Xuemin, n.d.). AR/VR (augmented reality/virtual reality) is another application using 5G supports service that plays important role in virtual conference, virtual convocation in the university and virtual class room. AR/VR technology enable human computer interaction technology to minimize the interaction between user and computer, here it shows real time scenario to students, they feel like actual class rooms. AR/VR needs high transmission of the data at high speed, because 3D model spaceconsumes high bandwidth (Chunming & He, 2020).

5. Blockchain technology

COVID-19 scenario requires distributed ledger technologies to secure and handle database transactions efficiently, blockchain is one of the enabler technologies to tackle this pandemic situation, using that we can connect to any network and sharing valuable information in the network in secure manner. It includes various methods to tackle pandemic situation such as testing and reporting, taking reading of the patients securely, manage the lockdown situation, enable secure platform for donation (Chamola, Hassija, Gupta, & Guizani, 2020).

6. Retail and supply chain

COVID-19 has brought storm in the healthcare management system because of large number of infections per days. There are shortage of beds, ventilators, hospitals, medicine, oxygen and life cure equipment in almost every country, in this situation managing supply of medical devices and medicines is big challenge, because exact data in not updated on time what amenities are free or busy. 5G technologies enable efficiently manageof the supply chain management system so that hospitals have up to date information about the availability of the medicines and equipment's. 5G using cloud infrastructure for storing the real time data of the medical heath care system can be accessed easily by the concerned authority by mobile application. Drones that are operated by 5G technology also used to deliver medicine in the remote areas where total lockdown is imposed. 5G enable advanced machine learning prediction to identify the future needs of the medical equipment supply(*Pwc-5G-in-Healthcare.Pdf*, n.d.). Big data analytics is another key technology used by 5G network to efficiently analyze the patients monitoring data quickly and gives result report to the doctors. Millions of IoT devices gathered so much amount of the data from various sensors to manage this data various data analytics algorithms and machine learning technique are involved (Ahad et al., 2020).5G also help in factory atomization to improve the production

quickly, using automatic assembly line. 5G automatic guided vehicle help in product handling, equipment manufacturing, mass production of the medicine and medical equipment's. it also controls the quality using various machine learning quality control technique to increase testing efficiency(Chunming & He, 2020).

7. 5G enable Mobile Ambulance

5G enable mobile ambulance play very important role in transferring the patient from home to hospital. 5G enable technology uses mobile vehicular network for connectivity and sharing the information to the cloud, here mobile ambulance directly connected to the BSs at effectively low latency handover occur when vehicle is moving on the road with the high speed. 5G enable mobile ambulance have inbuild facility for the patient's isolation and we can also perform various test of the patient for monitoring his health like ECG, ultrasound, CT-SCAN inside ambulance. Patients' health monitoring can be done before reaching the patients to doctors, all the reading regarding his health already available in the hospital(Rehman, Nasralla, Ali, & Philip, 2018).

8. Robotics

5G uses robotic technology to fight against COVID-19, here robots are used for body temperature scanning, automatic hands sanitization, entire body sanitization and the robotic based teleultrasound and CT-SCAN of the patients(Wu et al., 2020). SK telecom, a Korean company,has launched 5G enable robots in street and public area, robots will do disinfection of the surface, remind the people about social distancing, screening guest temperature and alert will be sent to the main station. The robot is best example of AI, IoT and unmanned ground vehicle technology utilize 5G network for communication('5G-Powered Robot Used to Fight COVID-19 | IEEE Computer Society', n.d.).
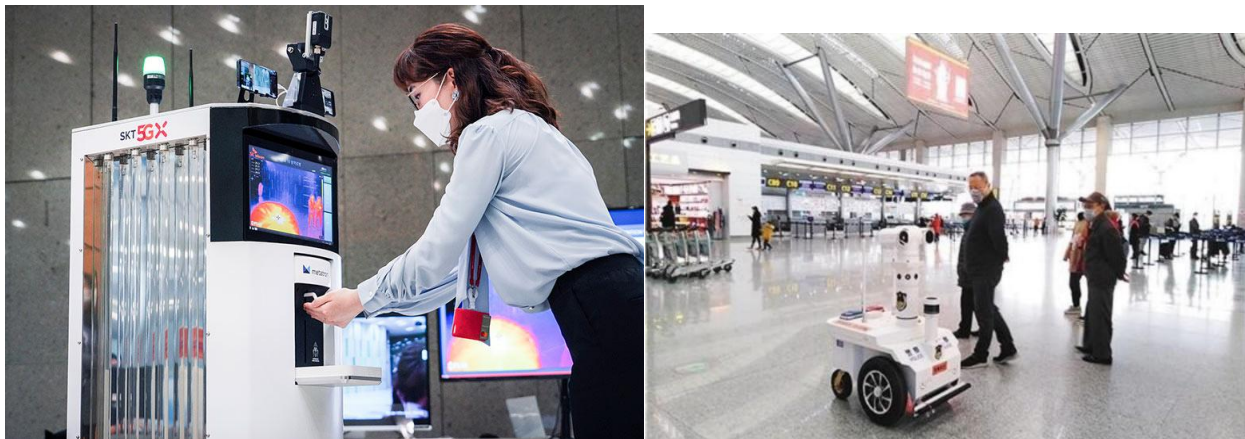

Figure 3(a).5G robot in Korea('5G-Powered Robot Used to Fight COVID-19 | IEEE Computer Society', n.d.). **3(b). 5G robot in China**('How 5G-powered robots are helping China fight coronavirus - Smart Cities World', n.d.)[27]

IV. Challenges for the 5G technology against COVID-19

1. Fully 5G infrastructure is not available

The 5G technology is adopted by many countries but almost more than half of the world countries, 5G infrastructure facility is not available. Those nations still utilizing old technology and therefore lack of technology-oriented benefits in these regions. Due to COVID-19 spread in most of the countries, government imposed lockdown, so the testing of 5G were stopped or delayed in many countries. So, the lack of 5G infrastructure is big challenge to fight against COVID-19 (Chamola et al., 2020).

2. Robotic technology is expansive

The use of robotics is very expansive for many nations in fight against COVID-19. Due to pandemic almost all nation economy is down. To spend so much money to make robots is not easy and it is also time-consuming process. So, it is a big challenge for any nation to deliver huge number of robots in the workplace or crowded area (Wang & Wang, 2021).

3. Interoperability and scalability

5G infrastructure is uses large number of IoT device for patient monitoring and supply chain information and communication with in the medical health center central server. To achieve connectivity in the heterogenous network where different frequencies areused is a big challenge. Another research challenge is the scalability in the network, in the COVID-19 situation large number of patients are admitted to the hospital, there is sacristy of the hospital beds, ventilators other valuable resources, in this situation number of wearable devices that patient is going to use will increase, so network should adapt scalability feature to handle sudden situation (Ahad et al., 2020).

4. Security and Privacy

Privacy and security issue is the main concern in maintaining the medical health care data, various key technologies enable to provide security such as block chain technology and cyber security. Attack on the medical data of the patient, attacker can modify his medical reports or reading, so it is a key concern, because doctor operate the patient on the basis of the reports. It is big open research challenge to form security and secure transaction of the record from server to mobile or edge devices(Carim, 2020).

5. challenges in UAV technology

UAV technology faces various challenges due to environments and lack of regulatory licenses for the use of drone in some country. Vulnerability in the drone technology such as signal jamming, hacking and security is another key concerned. The present drone technology faces various challenges regarding total load capacity and battery life. It also needs some testing depending on the location where drones has tofly for monitoring the people (Chamola et al., 2020).

Conclusion

5G wireless technology uses M2M communication over millions of IoT devices. The use of smart health care system through 5G network is the revolutionary era in the medical health care system. It provides resource management, store data over the cloud, access patients record thorough mobile application, remote surgery using robotics technology and mobile 5G ambulance to use vehicular network technology for providing medical care to patients in ambulance. COVID-19 spreads from person to person at very high rate, so during this time 5G plays very important role to fight against COVID-19. 5G technology provides seamless mobile connectivity to wearable IoT device, support for medical aid, medical supply chain management, industry automation, drone technology for monitoring and disinfection the surface and use of robotics technology for remote surgery and monitoring the patients. This paper has also focused on open research challenges faced by the 5G technology in the medical heath care system.

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