Chapter 4
5G in Healthcare: Features, Advantages, Limitations, and Applications

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ABSTRACT

5G is a new universal wireless standard, a new form of mobile network engineered to bring everyone and everything virtually together. 5G is not only for mobile phones, but it is also the foundation for virtual reality (VR), the internet of things (IoT), and autonomous driving, connecting many electronic devices to the internet. Having good healthcare is very important as it affects all parts of human life and social well-being. Moreover, it is crucial to have a great healthcare system if we want economic growth, workforce productivity, and society to advance. Despite all the hard work done by scientists and medical professionals, today's healthcare is mainly inefficient, and a significant overhaul is required. This chapter discusses the primary advantages, including the 5G's main features in healthcare and their limitations and probable solutions and applications to the latest scenario.

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INTRODUCTION

5G is defined as the 5th generation technology for mobile networks. 5G is a new universal wireless standard, a new mobile network engineered to bring virtually everyone and everything together. This infrastructure is designed to bring consumers higher data rates of multi-gigabits speed, low latency, better network capability, enhance connectivity, and better reliability. A few decades ago, in the 1980s, the first generation of mobile wireless communications was initiated, and from that day, it continued to evolve gradually approximately every decade (Hossain, 2013; Jain, 2016).

The first generation of commercial cellular networks used analogue signals. However, it faced numerous issues as at that time, mobile phones had poor battery life and were more prominent in size and were inconvenient. 2G emerged in the early 1990s and used digital signals instead of analogue and introduced a new digital tool called Global System for Mobile (GSM) (Peersman, Cvetkovic, Griffiths, & Spear, 2000). GSM supports features like conference calls and SMS etc. In the early 2000s, 3G started to take over the scenario. 3G was developed to improve frequency capacity and data transmissions. With 3G features like sharing photos, engaging on social media platforms, downloading video, and many more became possible (Korhonen, 2003). 4G was introduced at the end of 2010, and with it came the introduction of Long-Term Evolution (LTE). Standards included in this generation are faster speeds and higher quality, better security, and lower costs for data usage (Cox, 2012). In 2018, 5G started to penetrate the market to improve standards and address the growing Internet of Things where networks can serve their communication needs for the billions of devices connected (Eze, N. O. Sadiku, & M. Musa, 2018). As more people are getting connected to the internet, 4G is starting to reach its peak, and it will not be able to handle a sizable quantity of users connected all at once. This technology will be capable of handling 1000 times more traffic and up to 10 times faster. 5G is not only for mobile phones, but it is also the foundation for VR, IoT, and autonomous driving, making many electronic devices connected to the Internet (Schulz et al., 2017).

Emerging technologies (Paramita, Bebartta, & Pattanayak, 2021) act as the backbone of 5G technology, including small cell, millimetre waves and Beamforming (Agyapong, P. K., Iwamura, M., Staehle, D., Kiess, W., & Benjebbour, 2014). With 5G, the spectrum is opened to shorter waves, known as millimetre waves which will support faster data speeds to more users at the same time due to the high-frequency waves. This will enable more data bandwidth, with a higher performance where people can send and receive concurrently immeasurable data volume. 5G waves are of shorter wavelength and, therefore, high frequency. These millimetre waves cannot travel very far or even through obstacles, and thus there is the need for small cell networks. These small cell networks use lower power small base stations instead of large high-power towers to cover large distances. These are closer together, transmitting signals like a relay team around obstacles (Qiao et al., 2015). The user's device can switch to different base stations closest to his device, which will enable him to keep the connection.

Moreover, Multiple-Input and Multiple-Output (MIMO) will have an increased capacity of around a hundred ports which will broadcast information in every direction at once. This could lead to interference. Hence, to avoid disruption, 5G uses beamforming technology to efficiently aim and focus precisely streams of data transmissions rather than transmitting signals everywhere. Base stations will be able to support more data at once. For this technology to succeed, devices would need a 5G radio chip to connect to the 5G network. Major Smartphone developers plan or have already released devices that support 5G connectivity (Lee et al., 2018). MIMO has become a promising technology for 5G systems because of its enormous spectrum capacity and low power consumption. On the other hand, Pilot contamination