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5G and Next Generation Wireless Network in Bangladesh: Trends, Opportunities, and Challenges

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Abstract

As a consequence of tremendous traffic demands for modern networks and to fulfill these expectations, cellular systems are placed within a wireless Local Area Networks (WLAN) system. Bangladesh has entered very recently a new era of wireless connectivity with the launch of fifth-generation (5G) mobile internet connectivity by mobile phone operator Teletalk. According to the UN's Least Developed Countries (LDC) list, Bangladesh is a developing country with a large rural population and Bangladesh's Internet connectivity rate is only 28.8%. This research paper represents the actual user data of existing 3rd & 4th generation networks in Bangladesh and the possible opportunities and challenges in Bangladesh for implementing the 5G model and next-generation networks based on those findings in Bangladesh. The primary goal of this research paper is to identify the maximum benefits of cellular communications, wireless optical technologies, integrated sensing and communication, and other technologies in Bangladesh that can support the proposed launched 5G architecture. Due to the lack of sufficient network connections in major rural areas in Bangladesh, the result data is from only a small network-covered area. This paper illustrates that the mean 4G network coverage of four major mobile operator companies is 52% only. For this experiment, the network coverages of all operators are measured in mobile phones in different areas in Bangladesh. This experimental result indicates that the existing connections need to be implied and developed for all areas in Bangladesh before implementing the 5G architecture.

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1.0. Introduction:

Revolutionary advancements in wireless communication technology have made huge waves around the world in recent years. The 5G is more than traditional cellular networks which are mostly to the rapid expansion of the internet of things (IoT), machine-type communications wireless optical technologies, and other sectors in modern society. It thrives to achieve a 1000x boost in capacity compared to 4G networks, delivering gigabits per second against megabits per second in 4G, among a few other key performance indicators (Andrews et al., 2014). We are evolving towards a civilization of totally automated remote management systems due to enormous improvements in communication systems. The covid 19 epidemic has shown that we can only cope with it through automated remote management systems from late 2019 until now. To support this condition, a high data transmitting and receiving rate with dependable connectivity is required. 5G wireless networks have been started to use practically in some regions of the world by 2020.

Despite the enormous gains of the 5G communication system over present fields, the expectations of future emerging intelligent and automation systems will not be fully met after ten years (Giordani et al., 2020). In 5G networks, multiple new techniques are introduced, such as new frequency bands with millimeter-wave (mmWave) and optical spectra, enhanced the practice and management of spectrum, and it can combine approved and abandoned bands (Giordani et al., 2020). Furthermore, with 5G reaching its limits in 2030, designers are already looking for design goals for the next phase. As a result, researchers all over the world are starting to think about 6G in ten years. 5G has launched in Bangladesh very recently. We're still having trouble getting complete coverage on 3G and 4G networks. Bangladesh's government is working on a Tk 200 crore initiative to launch a limited-scale 5G mobile network in the capital Dhaka by the end of 2021(The Daily Star, 2021). Existing 5G's architecture is cutting-edge, and its network parts and various terminals have all been changed to accommodate a new circumstance. Similarly, service companies can simply incorporate value-added services using advanced technology. This paper's purpose is to provide a perspective on the most popular 5G network support in Bangladesh during this urgent pandemic emergency. The rest of this paper is organized as follows. Section 2.0. describes the few recent 5 G-related works and section 3.0. represents 5G network and next-generation networks. Spectrum & network support in Bangladesh are described in section 4.0. Section 5.0. & 6.0. present trends & opportunities and challenges based on research data. Finally, the conclusion of this article is in Section 7.0.

2.0. Related Works:

The recent advances and related works of 5G and next-generation networks are in massive multiple-input and multiple-output (Massive MIMO), non-orthogonal multiple access (NOMA), millimeter wave, IoT, and related technology are mentioned in this part. To address the difficulties with conventional MIMO, a variety of techniques have been proposed. Mae et al. (2020) proposed the MIMO multi-rate, feed-forward controller. Unlike traditional MIMO, which provides oscillated control inputs, the suggested approach generates smooth control inputs in the simulation. In terms of error rate, it also exceeded. However, for greater results, a combination of both multi-rate and single rates might be employed. Panzner et al. (2014) studied the performance of separate MIMO, disseminated MIMO with and without corporation MIMO. In addition, a concept for large-scale integration into 5G technology was given. Different MIMO setups are investigated in the experimental analysis.

For next-generation wireless communications, NOMA is a key radio access technology. NOMA has several advantages over preceding orthogonal multiple access techniques, including high-speed massive connectivity, great efficiency of the spectrum, and low rate of latency with high

dependability. Code-domain NOMA, which improves the overall connectivity in 5G wireless communication, may improve the spectral efficiency of MIMO. Some of the more code-domain NOMA techniques include code division multiple access, lattice-partition multiple access, multi-user shared access, and pattern-division multiple access (Shental et al.,2017). Because it works well with a variety of wireless communication techniques, such as massive MIMO, beamforming, space-time coding access, network coding, full-duplex, and cooperative communication, power-domain NOMA is widely employed in 5G wireless networks (Islam et al., 2016). The authors (Islam et al., 2016) investigated a power-domain NOMA that uses superposition coding (SC) along with sequential interference cancellation (SIC) at both the transmitter and receiver ends. Abundant investigations have shown that NOMA is capable of meeting user data rate demands as well as network-level 5G technology. The study provided an in-depth look at current advances in the 5G NOMA system. It contained, among other things, a comparison of allocation procedures, user fairness, cutting-edge efficiency evaluation, and user pairing patterns. The behavior of NOMA is also investigated when combined with other wireless communication techniques such as beamforming, massive MIMO, cooperative network connections, space-time coding access, and so on. Millimeter wave is a very high-frequency band suitable for 5G wireless networks.

The user frequency of millimeter wave is between 30 GHz to 300 GHz for transmission. This frequency spectrum range is known as mmWave because the wavelengths of these waves. The authors (Niu et al., 2015) gave a study of mmWave communications for 5G. mmWave communications have the advantage of adaptability, which implies that architecture and protocol changes for integrated circuits, systems, and other components are possible. The authors examined the available options and ranked them according to their efficacy, performance, and complexity. They also looked at open research issues in mmWave communications in 5G, such as network architecture of software-defined, network information, efficient regulation of devices, and the mixed system. The authors (Wei et al., 2014) discuss the design challenges and requirements of mmWave 5G antennas for all cellular devices, as well as contemporary 5G research. They then developed a 60 GHz array of antenna modules with tiny and low-profile 3D planer mesh-grid type antenna elements. Forthcoming antenna components will be utilized to run cellular handsets on mmWave 5G smartphones, according to a framework being developed. They also double-checked for any potential hardware difficulties with the mesh-grid array of antennas with the polarized beam. To tackle IoT difficulties, a variety of approaches have been developed (Khurpade et al., 2018). Akpakwu et al. (2017) focused on 5G mobile systems, which led to exponential traffic increases in IoT, due to rising trends and evolving technologies. The author looked at the issues and requirements that arise during the deployment of large-scale IoT systems, focusing on mobile networking in particular. Basic IoT infrastructure was reviewed, as well as cellular-based technology, low-power wide-area types of machinery like eMTC and extended coverage (EC)-GSM-IoT, as well as noncellular, low-power wide-area technologies like SigFox and LoRa. The authors (Khurpade et al., 2018) have demonstrated how 5G technology can alleviate today's IoT issues. It provides a rapid overview of present and future 5G network architectures. The report emphasizes the importance of a 5G network based on the IoT-related ecosystem. IoT and 5G may easily be coupled with the enhanced implementation of wireless technologies to form a unified ecosystem capable of meeting current IoT device requirements. 5G can revolutionize the world, and it will help IoT devices develop. As the 5G process progresses, global associations will uncover fundamentals for developing a cross-industry involvement in defining and expanding the 5G system.

3.0. 5G and Next Generation Network System:

Many innovative ideas have been established and explored in recent years to make 5G and beyond networks a reality. Millimeter waves of networks, small cells technology, beamforming, device-centric architecture, full-duplex technology, massive MIMO, Terahertz wave, and visible light spectrum are some of the major essential enabling technologies that have been studied as the major elements for 5G and further generation systems, as illustrated in Figure 1.

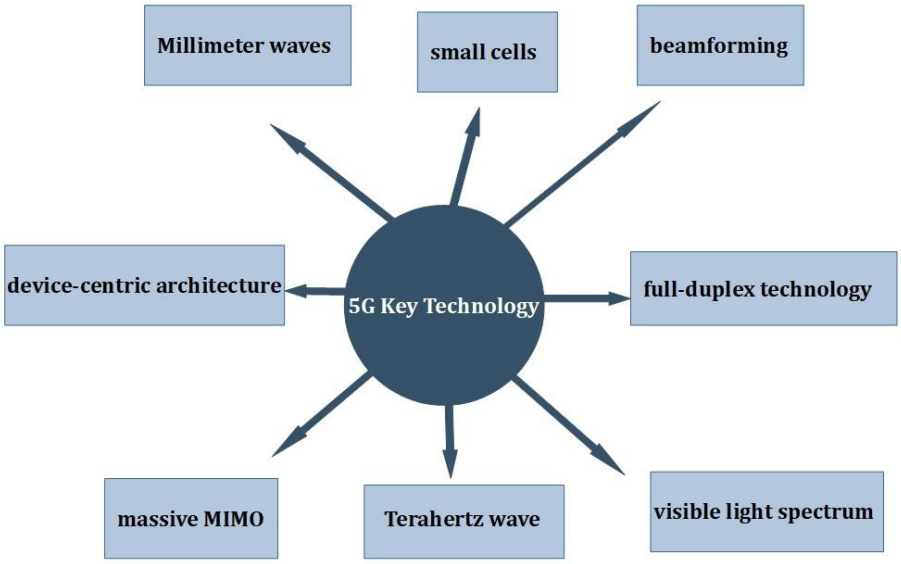

Figure1: Essential Enabling Technologies for 5G and Beyond

With the use of 5G networks, improvements in data transmission speed, latency of system, network resilience, and power consumption rate (Yunfeng et al., 2019) will have a huge impact on the technology world. The ability to transmit and receive data in millimeter-wavelength is a fundamental characteristic of 5G, which will increase speed by 1000 times over 4G. The size of the transmitting and receiving antennas can be reduced, providing technical assistance for the installation of large-scale antenna systems (Yunfeng et al., 2019). Many potential technologies for wireless communication are being investigated in the 5G network (Larsson et al., 2014). The primary obstacles and constraints faced by the 5G network, according to international demand for communication, are faster and lower power consumption. Shannon's formula ignores improving communication speed rate and lowering power usage,

$C = B\ log2(1 + \frac{S}{N})$ ..... (1)

In equation (1), B is channel bandwidth (Hz),
S is signal power (W),
N is noise power (W), and
C is the maximum transmission rate (bit/ S).

According to the formula, channel transmission rate C is proportional to channel bandwidth B, hence increasing channel bandwidth B is required to improve maximum transmission rate C. The major 5G option is the Cloud - Radio Access Network, which is a flat design with a combined base station and base station controller.

The next generation of wireless networks, also known as 6G, will meet the demands of a fully connected world by delivering ubiquitous wireless connectivity to everyone. The number of smart gadgets and innovative technologies is expected to rise as a result of transformative solutions. 6G networks are largely based on 5G design, surpassing the benefits of 5G, according to the history of mobile networks (P. Yang and et.,2019).

Several new technologies will need to be included in the implementation of 6G and next-generation networks, while several 5G technologies will need to be upgraded in 6G. The following elements may be required for the sixth-generation (6G) system:

(i) The improvement human-machine interfaces technology,
(ii) The development of the computing system among local devices and the cloud,
(iii) The multisensory data synthesis to create multi-verse maps and different mixed-reality experiences, and
(iv) The improved network with high-security maintenance.

To achieve the 6G target and overcome the limitations of 5G, it will be critical to developing B5G wireless systems with enticing new qualities to solve new difficulties. By introducing new synthesis of future ambient intelligence sensor systems and new human-human and human-machine interaction technologies, a pervasive introduction of artificial intelligence, and the addition of new technologies like terahertz (THz) frequency networks, 3-dimensional (3D) networking technology, quantum communications, holographic beamforming devices, backscatter communication, intelligent reflecting surface, and proactive caching, the lagging of 5G and further generation networking devices will be supported through 6G (Strinati et al., 2019). Nevertheless, the most significant requirement for 6G networks will be the ability to handle large amounts of data and very high-data-rate connectivity per device (Mumtaz et al., 2017). Table 1 below provides an overview of the 4G, 5G, and 6G networks.

Table 1: **Overview of the 4G, 5G, and 6G networks:**

Description	4G Network	5G Network	6G Network
Peak Data Rate per Device	1 Gbps	10 Gbps	1 Tbps
End to End Latency of Network	100 ms	10 ms	1 ms
Maximum Spectral Efficiency	15 bps/Hz	30 bps/Hz	100 bps/Hz
Mobility Supporting System	Up to 350 Km/hr	Up to 500 Km/hr	Up to 1000 Km/hr
Services	Video	VR, AR	Tactile
Architecture of System	MIMO	Massive MIMO	Intelligent Surface
Maximum Networking Frequency	6 GHz	90 GHz	10 THz

4.0. Spectrum & Network Support in Bangladesh:

In Bangladesh, according to the government, the announced project for 5G, at the primary stage, 5G services capable of delivering data transfer internet speed rate up to 50 times faster than 4G networks and serve as critical usable infrastructure for various industries, will be installed in the country's capital, Dhaka. Formerly, the 5G network will be expanded to divisional cities and district levels after the capital. According to govt., the main pursuit of the project is to set up 500 private base transceiver stations (BTS) and 2,500 shared towers, upgrade the capacity of the existing 2,000 BTS, install 200 mobile BTS, and enhance the existing 1,000 2G and 3G BTS to 4G (The daily star, 2021).

4.1. Existing 3G & 4G in Bangladesh:

According to the ITU Radio Regulation and Bangladesh National Frequency Allocation Plan, the frequency bands 698–806 MHz, 2500–2690 MHz, and 1920–1980 / 2110-2170 MHz are earmarked for 3G/ 4G/ LTE services in Bangladesh. Along with the cell station, 3G/4G systems rely on phase-shift keying and high order quadrature amplitude modulation for weak signal areas near the cell edges. Even though this results in poorer data bandwidth and spectral efficiency at the cell's edge, a constant bit error rate must be maintained in the face of noise. The peak on average power report is also a downside of these schemes. Another featured option in 5G is amplitude and phase shift modulation, which is based on maximum amplitude and phase changes for dynamic selection under specific noise situations. The network's spectrum efficiency is improved by combining several modulation methods. The 9 kHz to 1000 GHz frequency band has been set aside for a variety of services. In 2013, the country offered its first 3G services, and in 2018, it launched its first 4G services. Users in Bangladesh can obtain 4G coverage of 52% only. Table 2 compares the expected and actual performance of the present 4G network.

Table 2: The expected and actual performance of the present 4G network:

Description	4G Network (As expected)	4G Network (Avg. experience)
Peak Data Rate per Device	1 Gbps	7 Mbps
End to End Latency of Network	100 ms	72.5 ms
Maximum Spectral Efficiency	15 bps/Hz	1.24 bps/Hz
Mobility Support System	350km/hr	20 km/hr
Services	Video	Video
Maximum Frequency	6 GHz	2100 MHz

4.1.1. Experimental Data:

The experiments were the measurements of network coverage of mobiles in different places in Bangladesh using different mobile operators. Here, the results of user data of the mobile network experiences of the four main mobile operators in Bangladesh — Airtel, Banglalink, Grameenphone, and Robi are shown in the following tables 3, 4, 5, & 6 accordingly:

Table 3: Airtel Network Coverage:

Description	4G Network (Airtel)
Peak Data Rate/ Device	6.8 Mbps
End to End Latency	46 ms
Maximum Spectral Efficiency	1.36 bps/Hz
Network coverage	58%
Service level (upload)	5.7 Mbps
Maximum Frequency	2100 MHz

Table 4: Banglalink Network Coverage:

Description	4G Network (Banglalink)
Peak Data Rate/ Device	4.0 Mbps
End to End Latency	72 ms
Maximum Spectral Efficiency	0.67 bps/Hz
Network coverage	31%
Service level (upload)	27.0 Mbps
Maximum Frequency	2100 MHz

Table 5: Grameenphone Network Coverage:

Description	4G Network (Grameenphone)
Peak Data Rate/ Device	15.0 Mbps
End to End Latency	74 ms
Maximum Spectral Efficiency	2.5 bps/Hz
Network coverage	61%
Service level (upload)	11 Mbps
Maximum Frequency	2100 MHz

Table 6: Robi Network Coverage:

Description	4G Network (Robi)
Peak Data Rate/ Device	2.1Mbps
End to End Latency	98 ms
Maximum Spectral Efficiency	0.42 bps/Hz
Network coverage	58%
Service level (upload)	1.5 Mbps
Maximum Frequency	2100 MHz

This data is taken using the device: iPhone 12, IOS 14.7, and frequency 4G LTE B3(1800 MHz)
This study shows the actual picture of 4G network experiences in Bangladesh. It is important to develop the existing network coverage in Bangladesh. According to table 2, the maximum frequency needs to be 6GHz but in Bangladesh, it is only 2100 MHz. In this paper's experiments, the frequency was 1800 MHz only.

4.2. Proposed 5G Network in Bangladesh:

Bangladesh has started the first journey of 5G in 2021. The country's first commercial 5G network launched only a few weeks ago. Teletalk Bangladesh Limited is rolling out 5G with Huawei's technical support, which will speed up Bangladesh's digital transformation and make a wide range of innovative technologies available to everyone. During the initial deployment phase, Nokia which is a 5G provider company will provide equipment from its latest ReefShark System on Chip-powered AirScale equipment range, including its 5G AirScale Digital baseband unit with a plugin capability to expand capability where it is needed. The 5G network, according to Huawei, is cloud-native based. In the 5G future technology, a single network design can accommodate a multitude of service requirements. A Cloud-Native E2E network architecture has the following characteristics which are implemented in Bangladesh: The system theoretically independent network slicing technology on a single network infrastructure that meets a variety of service requirements, as well as DC-based cloud architecture, supports a variety of application scenarios. The cloud-based system, CloudRAN is used to reconstruct radio access networks (RAN) to provide large connections for different standards and to implement the on-demand deployment of RAN functionalities for 5G. The Separation of the control and user planes along with component-based functionality, and centralized database management simplifies basic network architecture to enable network operations configuration on demand. The whole technology is the implementation of automatic network slicing service generation, maintenance, and termination for a variety of services using agile network O&M to save operational costs.
The key technology of the proposed 5G in Bangladesh is depicted in the diagram below:

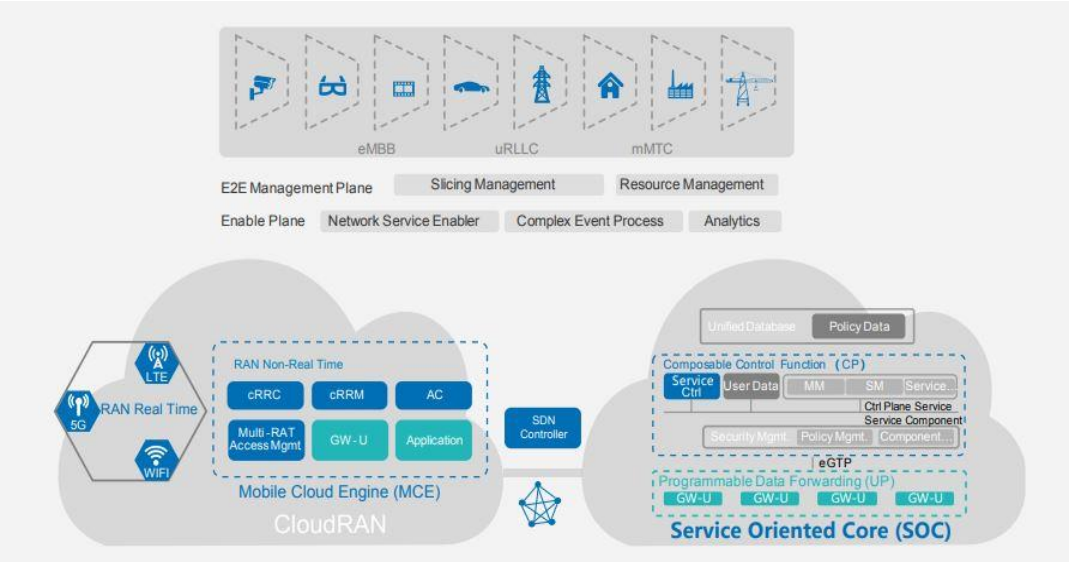

Figure 2: Key Technology of 5G in Bangladesh (Huawei Technology, 2016)

5.0. Trends & Opportunities in Bangladesh:

Since the introduction of the first analog communication system in the 1980s, nearly every 10 years a new generation of communication systems has been developed. The quality of metrics is improved when moving from one generation to the next, which includes new services and capabilities. According to BTRC, the total number of internet subscribers at the end of March 2021 was 116.14 million. According to the International Telecommunication Union (ITU), the percentage of Bangladeshi users has increased over time:

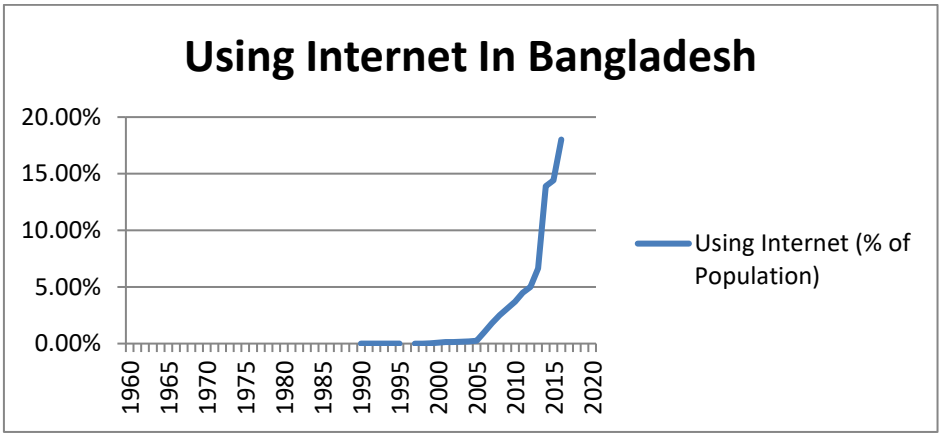

Figure 3: Population Percentage of Internet Users in Bangladesh

According to the graph, the data shows that after 2015, the use rate is growing rapidly. The opportunities are increasing along with the user rate. The following opportunities may come with 5G and the next-generation network in Bangladesh.

High-speed Networking System:

5G is a significant advancement over previous mobile network technology, allowing for extraordinarily fast download speeds of up to 20 Gbps. A fiber optic internet connection works in the same way as a 5G wireless network. 5G is unique among mobile transmission technologies in that it efficiently delivers both voice and high-speed data. With a latency of less than a millisecond, 5G connectivity is suitable for autonomous driving and mission-critical applications.

Smart City Application:
The smart city concept mainly stands for the concept of improving quality of life. IoT is capable of making us realize the smart city concept, and it is one of the main 5G intentions to make a smart city a reality.

Updated technologies in Industry and Agriculture:
Introducing 5G can open the door to new technologies in industries. Our garments industries have great roles to impact on the economy in Bangladesh. 5G and the next-generation network can change the plot here. We are suffering from using new technologies in our agricultural area too. The opportunities here are also massive.

Medical Sector:
From 2019 to the present, we are going through a covid 19 pandemic. We are facing challenges in the medical sector. 5G and the next generation can bring light here. We can observe the network unavailability from getting the helpline to registering the covid vaccine.

Working from Home:
The world is suddenly turning into a remote mode for a pandemic. We need to keep the wheel of the economy rolling and recovering. 'Work from Home' is the new solution. Online classes for the academic area are now the only solution to keep lives safe. Massive improvements in the network are now urgent in Bangladesh.

Satellite Internet:
Because ground-based stations are few in many rural locations, 5G will be important in bringing connection to these places. Satellite systems would be used to deliver connectivity in both urban and rural locations across Bangladesh as part of the 5G network. The satellite system will provide connection in both urban and rural regions by utilizing a constellation of multiple tiny satellites.

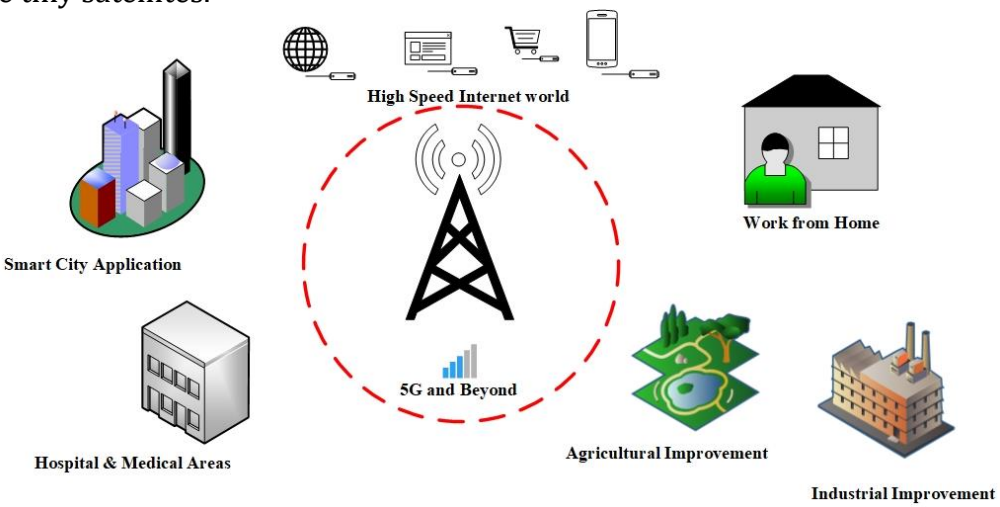

Figure 4: Opportunities of Next Generation Network

6.0. Challenges in Bangladesh:
Implementing 5G technology corresponds with many issues such as bandwidth, latency, energy efficiency, implementation costs, reliability, hardware complexity, etc. The challenges are discussed below:

Networking:
According to table 1,2, 3, 4, 5, & 6, it is clear that our network supporting system is still poor. The peak data rate should be 1Gbps but we experience only 7Mbps per device in Bangladesh. 5G is a new type of network and it is cloud-based. For data transfer, bands need to overcome several complexities and challenges for Bangladesh.

Structural Support:
We need towers and new infrastructures to deploy 5G and next-generation networks. Here, the cost can be huge. Considering the low user rate of the internet in Bangladesh, the cost of deploying a new networking system also can be less effective.

Security Issue:
We can face major security issues here. Any kind of new network system has its authentic security system. Here, the problem is that the implementation can be complex and for Bangladesh, it can be a huge challenge.

7.0. Conclusion:

This review paper covers all the possibilities and challenges for 5G and next-generation networks implementation in Bangladesh regarding the existing network's survey. In the communication field, each generation is introducing exciting new features. In Bangladesh, we are not privileged to enjoy all still. In our basics, we need great networking existing systems.
This paper represents the experimental outcome of the existing network coverage which is only 52% overall. Here, denser layout, increasing the number of base stations or small terminals per unit area, improving spectrum support can help us to experience better 3G and 4G networking in Bangladesh. 5G is great news for us and we should create wider opportunities to support the structure of 5G networks in different sectors. For future research works, new technology needs to be implemented to reduce the challenges in Bangladesh. After overcoming the challenges, it can ease our lives and introduce us to a new era.

References:

1. Andrews, J. G., Buzzi, S., Choi, W., Hanly, S. V., Lozano, A., Soong, A. C. K. and Zhang, J. C. (2014). What will 5G be? , *IEEE J. Sel. Areas Communication,* 32, 1065–1082.
2. Giordani, M., Polese, M., Mezzavilla, M., Rangan, S., and Zorzi, M. (2020), Toward 6G networks: Use cases and technologies, *IEEE Communication Magazine,* 58 (3), 55–61.
3. Yunfeng, N., Jiahao L., Xiaohong, S., Dongdong, B. (2019). Research on Key Technology in 5G Mobile Communication Network, *International Conference on Intelligent Transportation, Big Data-Smart City (ICITBS).*
4. Mae, M., Ohnishi, W., & Fujimoto, H. (2020). MIMO multi-rate feedforward controller design with a selection of input multiplicities and intersample behavior analysis. *Mechatronics,* 71, 102442.
5. Panzner, B., Zirwas, W., Dierks, S., Lauridsen, M., Mogensen, P., Pajukoski, K., Miao. D. (2014). Deployment and implementation strategies for massive MIMO in 5G. *In Proceedings of the IEEE Globecom Workshops (GC Wkshps),* 59, 346–351.
6. Shental, O., Zaidel, B.M.,& Shitz, S.S (2017). Low-density code-domain NOMA: Better be regular. *In Proceedings of the 2017 IEEE International Symposium on Information Theory (ISIT),* 2628–2632.
7. Islam, S.R., Avazov, N., Dobre, O.A., & Kwak, K.S. (2016). Power-domain non-orthogonal multiple access (NOMA) in 5G systems: Potentials and challenges. *IEEE Commun. Surv. Tutor*. 19, 721–742.
8. Wei, L., Hu, R.Q., Qian, Y., & Wu, G. (2014). Key elements to enable millimeter wave communications for 5G wireless systems. *IEEE Wirel. Commun*., 21, 136–143.

9. Niu, Y., Li, Y., Jin, D., Su, L. & Vasilakos, A.V (2015). A survey of millimeter-wave communications (mmWave) for 5G: Opportunities and challenges. *Wirel. Netw*. 21, 2657–2676.
10. Khurpade, J.M., Rao, D., & Sanghavi, P.D. (2018). A survey on IoT and 5G network. *International Conference on Smart City and Emerging Technology (ICSCET),* 1–3.
11. Akpakwu, G.A., Silva, B.J., Hancke, G.P., Abu-Mahfouz, A.M. (2017). A survey on 5G networks for the Internet of Things: Communication technologies and challenges. IEEE Access, 6, 3619–3647.
12. Larsson, E. G. et al., (2014), Massive MIMO for next-generation wireless systems". *IEEE Communication Magazine.*
13. Yang, P., Xiao, Y., Xiao, M. and Li, S. (2019). 6G wireless communications: Vision and potential techniques, *IEEE Netw.., 33* (4), 70–75.
14. Strinati, E. C. et al., (2019). 6G: The next frontier: From holographic messaging to artificial intelligence using sub terahertz and visible light communication," *IEEE Veh. Technol. Mag.,* 14 (3), 42–50.
15. Mumtaz, S. et al. (2017). Terahertz communication for vehicular networks," *IEEE Trans. Veh. Technol., 66 (7),* 5617–5625.
16. Li, B.; Fei, Z.; and Zhang, Y. (2019). UAV communications for 5G and beyond: Recent advances and future trends*," IEEE Internet Things J., 6 (2),* 2241–2263.
17. The daily star (2016), Govt plans 5G for Dhaka this year, Available: https://www.thedailystar.net/business/telecom/news/govt-plans-5g-dhaka-year214962nces.
18. Huawei Technology (2021). 5G Network Architecture-A High-Level Perspective. Available: https://www.huawei.com/en/technology-insights/industry-insights/outlook/mobile-broadband/insights-reports/5g-network-architecture.

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