EMERGING TRENDS AND INNOVATIVE APPROACHES IN 6G NETWORK

INTRODUCTION

Almost every ten years, a new communication system has been introduced, improving the QoS, providing new features and introducing new technologies. With the emergence of 5G network technology, data transfer rate has been increased 10 times than the rate with 4G networks. Many telecom companies and enterprises such as Nokia Bell Labs and Samsung are working to develop and implement 6G by around 2030. The advent of 5G networks has paved the way for many modern applications [3]. However, 5G still cannot fulfill the needs of future technological developments that require even faster networks, real time uninterrupted communication and data transfer rates. This can be understood with the help of self-driving cars [1]. In the coming future, it is inevitable that persondriven cars will be replaced by self-driven cars. The communication between cars on road will be essential to avoid collisions. But if the communication gets interrupted even for a second on a highspeed congested route, it can result in accidents. This can be prevented using 6G which is fast, low latency and satellite integrated network. Furthermore, the incursion of augmented reality (AR) in a person's day to day life would require real time connection to the world. 6G is roughly 100 times faster (1Tbps) than predecessing 5G network (100Gbps). End to end latency in 6G (1ms) is 10 times shorter than 5G (10ms). Moreover, the connectivity 6G mobile networks can be leveraged underwater and in the space. The advent of 6G communication technology will be helpful in healthcare as to establish electronic healthcare and remote surgeries [2]. Table I compares the main specifications and technologies in both 5G and 6G. 6G will be able to connect everything, integrate different technologies and applications, support holographic, haptic, space and underwater communications and it will also support the Internet of everything, Internet of Nano-Things and Internet of Bodies.

TABLE I
COMPARISON BETWEEN 5G AND 6G

Characteristic	5G	6G
Operating frequency	3 - 300 GHz	upto 1 THz
Uplink data rate	10 Gbps	1 Tbps
Downlink data rate	20 Gbps	1 Tbps
Spectral efficiency	10 bps/Hz/m^2	1000 bps/Hz/m^2
Reliability	10^-5	10^-9
Maximum mobility	500 km/h	1000 km/hr
U-plane latency	0.5 msec	0.1 msec
C-plane latency	10 msec	1 msec
Processing delay	100 ns	10 ns
Traffic capacity	10 Mbps/m^2	1 - 10 Gbps/m^2
Localization precision	10 cm on 2D	1 cm on 3D
Uniform user experience	50 Mbps 2D	10 Gbps 3D
Time buffer	not real-time	real-time
Center of gravity	user	service
Satellite integration	No	Fully
AI integration	Partially	Fully
XR integration	Partially	Fully
Haptic communication integration	Partially	Fully
Automation integration	Partially	Fully

The classical service classes of massive machine type communications (mMTC), ultra-reliable low latency communications (URLLC), and enhanced mobile broadband (eMBB) will be reshaped in next-generation 6G mobile networks to handle more demanding applications (like holographic telepresence and