6G-NEXT GEN MOBILE WIRELESS COMMUNICATION WITH DEEP LEARNING TECHNOLOGY, APPROACH: OPPORTUNITIES AND CHALLENGES

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***ABSTRACT**: Ubiquitous, automotive and intelligent character of this digital world which made a vital flow of data. Everything from people and other electronic and automotive devices should be connected to form an intelligent digital world where mobile wireless networks behave as Highways. Compared to the 4th generation 5G communication system has more features. The next generation in the mobile communication system has been considered the most. In the communication system beyond 5G some fundamental issues are needed to be solved like low latency, high data rate and better QoS.6G which can be expected to be deployed by 2027 and 2030 which can be a new paradigm for wireless communication with the support of artificial intelligence and deep learning. Machine learning and deep learning involvement in the communication system have been considered as the main part of 6G. The main driving force behind 6G along with expected key features are has been showed in this article. Evolution of technology from 1G to 6G, its advantages, and comparative study have been discussed.*

I. INTRODUCTION

In our new modern generation, way of communication between people is more and most convenient and flexible to get the information because of the wireless communication air as the medium. For the next generation of the wireless communication network system, the frequency ranges between 100GHz to 3THz because of the unexplored and unused wide swaths in the system[8]. Potential for revolutionary applications that will offered by the frequencies and made a new way of possible thinking and creating a new advanced in electrical devices, software's signal processing, circuits, and systems[3]. This 6G wireless communication creates many technical challenge and opportunities, and sending application above the range of 100GHz, and produces number of promises of discovering new invention's, novel approaches, that results will be added to the development and implementation of this new generation i.e 6G (Sixth generation) of communication network that will be described in this paper. In the present situation, users will get satisfaction because of the high speed of data and less network interruption for the usage of data[5].

6G wireless communication network system provides the data speed range of 10-300 Mbps and extension of data up to 10-11 Gbps. Full-duplex radio-wave transmission methodology is used in this 6G wireless communication network system so it is considered as the fastest and efficient network[3]. 6G network involves radio technology and fiber network underlying architecture and to enhance the high-speed data capability to their distance and the mode of connectivity of communication[2]. Data interruption and buffering are eliminated in this 6G wireless communication network system when compared to the previous network systems[11]. A low cost and high-speed data can be achieved by this 6G communication through all over India research is implemented for this emerging communication technology. This paper deals with the distance communication i.e how far the mobile communication will be support for the users above the frequency range of 800Hz and the antennas gain can be overcome by the air induced attenuation and to reduce the signal processing and computational complexity of the signal by the adaptive antenna that can be explained by the Special Theory of Relativity to create a over-sampled antenna to create a cone of silence that to improve the performance of the digital phased antenna array's[13].

II. LITERATURE SURVEY

Transferring the information between the users without any physical connection is achieved by the way of wireless communications. Communication between television and remote is a short distance and even for deep-space radio communication distance is high this also includes wireless communication. Evolution of technology and applications, advantages and compare the relation and overview of 3g, 4g, 5g, 6g communication technology[1].

Existing and future wireless mobile communication network generation will be discussed in this paper. A new vision is shared by major analyst and industry groups for the edge contribution to a bright future for the 3G network system. In a 6G mobile communication network systems satellite network is used[6]. In this 6G communication system, the cost for the normal mobile call is comparatively high but it will be overcome in the advanced level of communication called 7G communication and lower-level users will get better satisfaction and benefit from this communication. The automobile industry and television changed our lives but 3g,4g,5g,6g,7g, services will change our lives [5].

Our present wireless communication technology (1G to 4G) is met the need and requirements of the users. But in the current scenario, every user feels they need fast network facilities so for this purpose they thought about the broad and fast boundary efficiency of the network [4]. For this reason, we are thinking and creating a new next generation of wireless communication network called 6G. The demand of the present and next-generation users will be fulfilled by this 6G network technology. Research is going on the network for demanding issues in the mobile network while traveling one place to another place because satellite is also traveling or moving from one place to another place in constant speed in the particular orbit and protocol for the cellular to satellite communication between the satellite to satellite communication system this will be overcome and researching for the advanced level of communication network is 7G. 7G network will become true when all the standards and protocols are defined and explained. This is possible after the next generation of 7G and named 7.5G[6].

Our present wireless communication technology (1G to 4G) met all the needs and requirements of the users. Every user feels they need fast network facilities so the people are thinking and creating a new broad and fast network facility in the present generation[12]. So that only we are thinking about the new next generation of wireless communication network 6G. Most of the demand will be fulfilled by the 6G communication system.

A comprehensive review is provided about the emerging technologies includes the ML, QC, and QML and forward vision of QC-and QML-assisted framework enable beyond the 5G wireless communication network [7]. Emerging 5G communication network offers target services and to open the research challenges for the B5G communication network is detailed below. Similarly the state -of -the -art quantum, ML-assisted, QC-assisted, QC-assisted ML, and QML based communications reviewed thoroughly[9]. QML based framework 6G communication has been proposed. New promising technologies, future research, and open research problems have been provided in this paper.

A 6G era is 2025-2035 times framed which are likely to be a part in it, and position location systems for the spectrum range of above 100 GHz, approaching to create a future with wireless and challenges and broad and deep look at fundamental opportunities has been provided in this paper. In this paper they are described as their regulatory and the body activities are aimed at fostering future wireless systems will be used with multi - GHz bandwidth channels above the range of 100ghz, which may support the data rates in excess of above 100 Gbps [10]. A large number of promising applications that will support the future, a power concurrently grows an approaching the process of the power of the human brain. THz wireless will enable the novel cognition, sensing, communications, imaging, and positioning capabilities and used by the automated machines, cars, autonomous, and human interfaces, and all this will be enabled by the ultra-wide bandwidth signals and ultra-short wavelength and which appears to promise for future wireless communications beyond the mmWave regime[13].

III. METHODOLOGY

Sixth generation technology is known as 6G technology. For global coverage, 5G technology is integrated and Proposed. This is used for monitoring resources; for high-speed Internet connection; weather information about multimedia video; and Earth imaging from satellite networks[12]. Telecommunication, navigation, and multimedia networks are the three kinds of satellites used to integrate and provide weather information service, internet connectivity for high-speed data for the users and global positions are the main objectives for the 6G technology.

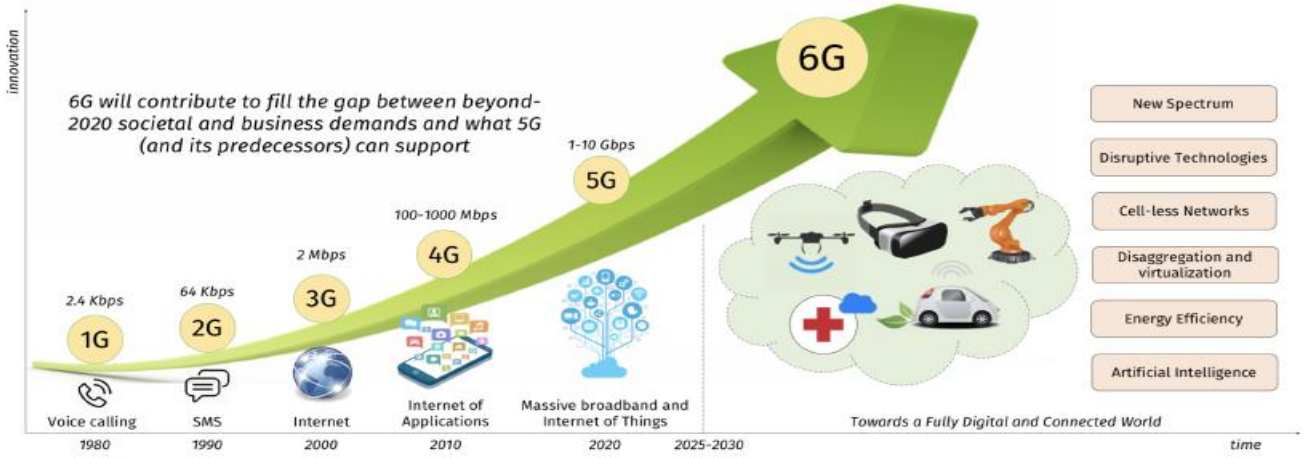

Fig. 1: In 6G network technology the cellular network generation evolution, for the 1G to the disruption level is expected. The most relevant/representative applications are represented in each of the generations. Future digital society will be enabled by the support of multiple applications that are the main target of the 6G.

Generation	Duration	Technology	Speed	Bandwidth	Characteristic	Frequency	Main network	handover	Sub-generation
1G	1980-1990	Analog Wireless	2Kbps	150/900MHz	First wireless communicatio n	Analog signal (30 KHz)	PSTN	Horizontal	1G
2G	1990-2000	Digital Wireless, GPRS, EDGE	10kbps-500kbps	900MHz	Digital	1.8GHz (digital)	PSTN, GSM, CDMA	Horizontal	2.5G, 2.75G
3G	2000-2010	Broadband IP tech	400kbps - 30Mbps	100MHz	Digital broadband increased speed	1.6 – 2.0 GHz	Packet, GSM, WCDMA	Horizontal and vertical	3.5G,3.75G
4G	2010-2020	LTE, Wi-max	200kbps-1Gbps	100MHz	High speed, all IP	2 – 8 GHz	Internet	Horizontal and vertical	4G
5G	2020-2030	NR eLTE	Higher than 1Gbps	1000x BW pr unit area	-	3 – 300 GHz	Internet	Horizontal and vertical	5G
6G	2030 and above	OFDM-RAT	11 Gbps	Up to 1Tbps	-	95 GHz to 3 THz	internet	Horizontal and vertical	-

. *Service Requirements*

The following key factors for 6G wireless system are as follows,

- Tactile internet.
- High network capacity.
- Enhanced data security.
- High energy efficiency.
- Low backhaul and access network congestion.
- Massive machine-type communication (MTC).
- AI integrated communication.
- Ultra - reliable low latency communications(URLLC).
- Enhanced mobile broadband (eMBB).
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B. Advantages of 6G over others

- Access the Internet with Ultrafast.
- Data rates range from 10-11 Gbps.
- Home automation & other related applications.
- Home-based ATM systems and devices.
- Smart Cities, Villages, and Homes.
- It is used for the production of Energy from the galactic world.
- Defense applications and space technology applications will be get changed or modified with the 6G network technology.
- Communication from sea to space.
- 6G network controls the Natural calamities.
- To develop the mankind satellite to satellite communication is used

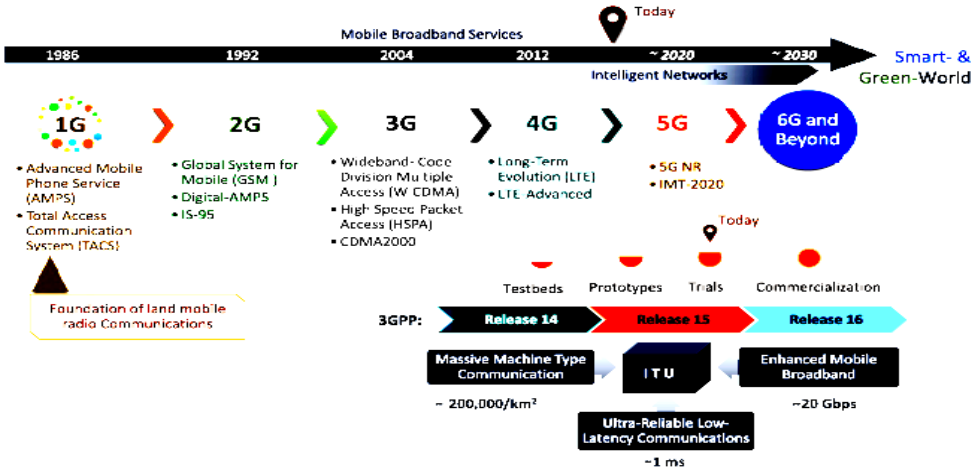

Fig 2. Communication networks across several generations of land mobile radio.

i. ML In Communication

ML conventionally thought the applications justified in the particular situations, when and where there is no exact mathematical model for the system available, a very large amount of data for training is available, along time the system /model under study is stationary(Varying slowly), numerical analysis is acceptable. ML techniques are gained significant attention recently for the data-driven solutions for provisions to the various challenging problems in the communication systems[10]. ML develops communications by gaining popularity rapidly; particularly to build the self -sustaining for the adaptive networks to meet dynamic reconfigurability about the demands for future services and for the devices. For further more ML have a strong potential for the conventional to replace mathematical model-based algorithm solutions, to the availability of computational power and the adequate data. The basics of ML discuss the scope of developing ML at the different layers, types of communication and ends[14].

The coefficients of the supervised learning to the intermediate stages are used to learn the prior exploring available in the set of inputs pair with the desired outputs. It can exploit the knowledge domain to the training data to learn the performance requisite operations and the required behavior. An application of ML is supervised that can be pronounced to the scenario which is true distribution of input and output parameters that are available, it is extracted from the available knowledge of the domain. A mathematical model may be scenarios or true distribution is not known; e. g., propagation of accurate channel model for the Body Area Networks (BANs) are not available. Learning problems gives the data test examples, for different classes of models (generative or discriminative) that can be exploited by the approximate the distribution of performing learning process. Supervised learning is typically used to the classification and nature problems; the typical examples for implementation can be started as an ANKs, k-Nearest Neighbour (kNN), and (SVM) Support Vector Machine.

In the semi-supervised learning method, a small amount of data is available for most of the data's are unlabeled; but in unsupervised learning, non annotated training data are available. Unsupervised learning, collection of input data samples are exploited to train the system with the low prior information for the system response are available. The physical layer, that is received with noise data are used to

train the clustering system at the sample points for generating nonlinear boundary of mapping according to the symbols of constellation maps. Clustered and natured problems are typically used in the semi - and unsupervised learning methods. The structure of implementation learning methods are named as k-Means Clustering (kMC), Principal Component Analysis (PCA), and the maximum likelihood learnings, etc[11].

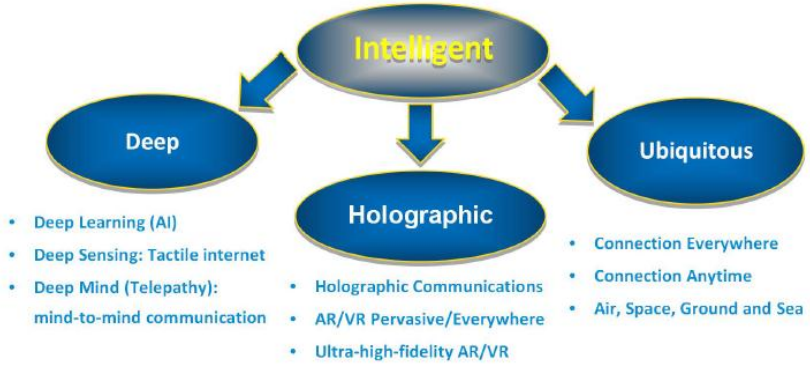

Fig 3. Vision 6G with Machine Learning, Deep Learning, and Artificial Intelligence

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ii. DCNN in 6G

An intensive system of Deep learning (DL) structure for representing correlational learning in data by proceeding a supervised, unsupervised, reinforcement or hybrid fashion. An Artificial Neural Network (ANN) with the multiple (deep) transmissive layers are referred to as Deep Convolutional Neural Network (DCNN). Processing of data and training through the ML algorithms which are executed by the Central Processing Units(CPUs)with a limited number of cores, and it has a minimum of large processing delays. In parallel computing distributed learning methods and capabilities are enabled the data-driven DL approaches the conventional based approaches. The revisited learning algorithms for exploiting the number of available cores in advanced Graphics Processing Units (GPUs) and a remarkable performance gain. Tensor Processing Units(TPUs) a tremendous parallel potential with the manifold speed power efficiency in ML algorithms. A profound impact DL-based various multidimensional processing applications, e. g., natural language processing, medical image processing, and wireless communication.

The goal of the DL in mobile and the wireless communication networks are presented in various architecture, DL platforms, libraries for the application network are indicated. The motivation behind the DNNs and operating future wireless is extensively discussed. Accuracy is estimated or prior-available in radio propagation channels of the vital enhancing capability of wireless communication network links. Concept of the auto-encoding by the end-to-end communication system in the DNN to optimizing both the transmitter and the receiver to the best counter channel impairments with strong potential[12]. The DNN-based end-to-end learning system is proposed, a channel-agnostic based system is proposed for the learning about the channel output through the Generative Adversarial Net (GAN)[12].

By applying the filters in the inputs, a normal batch is followed by a ReLU for the non-linearity. The normalization batch renormalizes the data to make fast learning with the Gradient descent.

Apply the batch normalization of the equation to input :

$$z = \frac{z-\mu}{\sigma} \qquad (1)$$

The spatial dimension of 10x10, for feature map of the batch samples of 100 means and the 100 variances. e. g., if the batch size is 16 means, the mean for the feature location is (i, j) is computed by the :

$$\mu_{i,j} = \frac{\sigma_{i,j}^{(1)}+\sigma_{i,j}^{(2)}+\cdots+\sigma_{i,j}^{(16)}}{16} \qquad (2)$$

( )that shows batch samples result $k \in (1,16)$

To a linear equation feed z with trainable scalar values γ and β for each normalized layer.

$$\text{out}=\gamma z+\beta \qquad (3)$$

If gamma =σ gamma=σ and β=μβ=μ. Initialize γ=1 γ=1 and β=0β=0, the input is normalized therefore learns faster, and during training, the parameters will be learned.

- ❖ With more convolution layer small filters are used like 3x3 or 5x5.
- ❖ Small stride works get better by with the convolution filter.
- ❖ Fill with 0 use of padding.
- ❖ Sacrifice the first layer with the largest filter like 7x7 with stride 2, if GPU memory is not large enough for usage.
- ❖ If maximum pooling is needed use the filter size 2, stride 2.

iii. Network design :

- ❖ With small filters 3x3 or 5x5 and no pooling, it starts with the 2-3 layers of convolution.
- ❖ To reduce the spatial dimension want to add the 2x2 maximum pool.
- ❖ A desired spatial dimension will be reached for a fully connected layer by repeating 1-2. This will be the try and error process.
- ❖ For fully - connection layers use 2-3 hidden layers.

Communication systems can empower and bring intelligence to the physical layer and smart estimation of parameters, management of resources and mitigation of interference. DL capabilities will be used for the channel estimation and for symbol detection in the Orthogonal Frequency Division

Multiplexing (OFDM) system. For more DL also received the significance research interests in dynamic allocation of radio resource management for vehicular communications(i.e., vehicle-to-vehicle (V2V), vehicle-to-everything (V2X), etc), high dynamicity in channel characteristics imposes the mobility of the high nodes. For example, a (DRL) Deep Reinforcement Learning based decentralized allocation mechanism is utilized to support a highly dynamic application of communication.

Millimeter-wave (mmWave) spectrum and the Massive Multiple -Input Multiple -Output (M-MIMO) exploiting the very high spatial resolution and the multi-gigahertz bandwidth, believed to have the important role in the addressing capacity needs and demands for the future communication network system. DL method employees the potential application in mmWave M-MIMO system is estimated the radio channel frequency quality, it is essential for the design of the transmission techniques such as beamforming. The potential for deploying the DL for other tasks across the overall communication layers and also received note able attention, such as the channel tracking, intelligent location, radio identification, routing and caching. Integration of DL capabilities with smart cities infrastructure that can help the effective utilization of big data and for accomplishing the dream of the smart future world.

DL method lacks in the efficient mechanism for the prior evaluation for the best choice of algorithm training, and it deals with the size and structure of DNN, parameters setting suits with the model/problem under consideration. Along with a very large set of possibilities in the structure that hit-and-trail snooping the size, algorithms, parameter-values that make the deployment of DL but it can also lead to the losses of balance between overfitting and underfitting. This paper provides a review of the existing works, identifies the potential issues and discusses the emerging DL methods includes DNN, deep unfolding, and deep transfer learning.

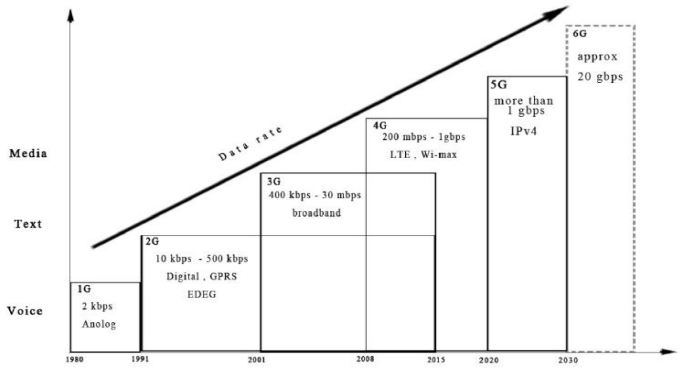

Fig4. 6g wireless mobile networks

IV. DISCUSSION

The present wireless technology (1G to 4G) deals with the requirements of users. But the current generation needs everything that should be fast so that only thinking about wide broadband and fastest across all the boundary and requirement and efficiency. So the next-generation wireless network 6G is introduced. 6G will satisfy the user's demands and needs of the present and next-generation users. most of the demand for the present and next-generation user.

To satisfy the requirements, we must search and investigate the 6G cases, technological evolution, and society, the world view in the 2030s when 6G is introduced. Cases and problem solutions are expected in the 5G network it will be actualized in the 2020s and get expand. Wider and deeper diffusion will be considered and required as the type of further development in the 2030s. There's a need for advanced services, integration of multiple users and new cases along with the acceleration of signal of the signal processing evolution of the various devices.

Fig 5. Image of the worldview in 6G era

Some specific views of the world,

Social issues and needs of expected in the 5G network communication that will be resolved in the 2020s. Various solutions such as teleworking, remote control, telemedicine, distance education and etc.,

1) Cars will be provided by high speed and low-latency communication networks for social problems such as regional creation, low birth rate, labor shortage, aging in the 2020s. More advanced solutions in the year 2030s that will require complete problem solving and development.

2) Wearable devices with advanced functions include XR(VR,AR, MR) devices with very high definition images and holograms exceeding the 8K, five sense communications like tactile sense and communication between humans and human things and become ultra-real and rich. Innovative entertainment services and services for games, watching sports, etc.,

3) The air around us as vital electricity and water. Users don't need to be aware of the communication service area and communication settings. The communication environment will be required in the location of all places with the expansion of the activity area of people and things.

4) Service uses the cyber-physical fusion and created in the 2020s and it will be used in particular in all the environments, more advanced cyber-physical fusion required in the 2030s. A large amount of information is transferring and processing between cyberspace and the physical space without any delay, and tighter co-operation between the space and the ultimately, fusion of gap between the space will get actualized. It will become possible for the cyberspace to

support the human thoughts and actions in the real-time wearable devices and micro-devices which are mounted in the human body.

The above diagram shows the exponential growth of mobile connectivity. Global mobile traffic volume will get increased by 670 times in the year 2030 when compared with the year 2010. International Telecommunication Union (ITU) will forecast that at the end of the year 2030, the overall traffic volume of mobile data will exceed 5ZB per month. A number of mobile subscriptions will reach a range of 17.1 billion as compared to 5.32 billion in the year 2010. The use of the M2M connection will also get an increase. Mobile device traffic volume in the year 2010 was 5.3GB per month. This volume will get increased by 50 times in the year 2030. M2M subscription will get increased 33 times in the year 2020 and 455 times in the year 2030, when compared with the year 2010. Few comparisons of the use of mobile network connectivity in the year 2010,2020,2030 are presented in the table.

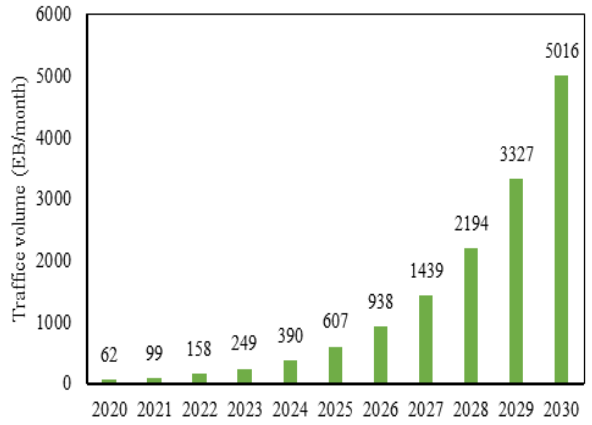

Fig 6a. Total global traffic volume

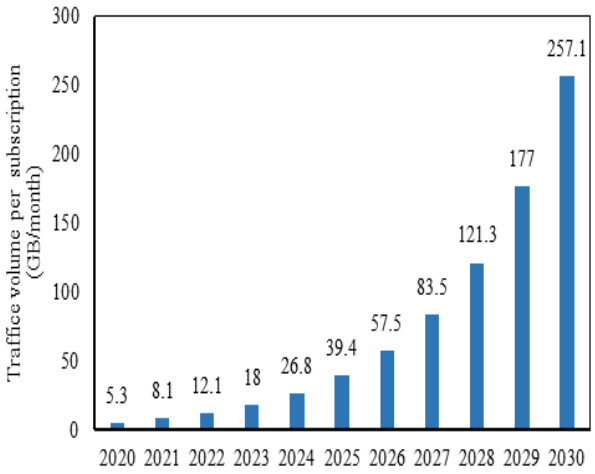

Fig 6b.Traffic volume per subscription

V. CONCLUSION

In this paper, various challenges and characteristics of wireless communication have been discussed. The evolution of wireless communication starting from 1G to 6G has been discussed along with their data rate, period, technology, speed. Also, the involvement of Artificial intelligence along with Machine Learning and Deep learning may increase the QoS given by the 6G network. The application of Deep CNN (DCNN) as a part of 6G for improvement has been achieved.

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