5g Based Network Management for Smart Cities

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Abstract: The Evaluation of network technology from 4G to 5G network has introduced a most promising faster transmission of data and high level of security. The implementation of 4G networks for the development of the smart city project has many challenges like speed, reliability, data transparency, scalability and network security. The update of 4G to 5G network increases the data speed and reliability of data and also provides high data security .In the proposed system the network management is maintained by the 5G network for smart cities to provide more efficient data network. The simulation of new network technology even with high mobility scenarios and more densely populated areas new ideas of the smart cities and an approach of high intellectual transportation system are used. For that the 5G based networks will be more efficient and their application will be more than the 4G network. 5G technology is based on (IoT) internet of thing. Smart grid system is used to meet both traditional and new electrical and electronic applications .smart grid system are developed by LTE (Long Term Evaluation) and 5G network which provide high opportunities for critical infrastructure utilization to build the advanced smart cities. but some limitation has defined to improve LTE and 5G service availability and to perform with latency. The cellular network used for the smart city in the proposed system will also provide high level of security.

Index Terms: 5G network, cellular network, Hyper connected network, Internet of Thing, Long Term Evaluation, smart cities.

1. INTRODUCTION:

The Evaluation of the 5G Fifth Generation network is the fastest new wireless technology that has been developed to employ the challenges in the old 4G network and their devices. There is a great improvement from smart sensor to the fastest self-driving cars which can work and communicate with low latency and they are using wireless and not connected to the Ethernet cable with high efficiency and resources. The more advanced technology that designed with less weight high scalability with more machine based model is employed to develop smart cities from normal traditional cities. Specific at looking for the efficiency of energy and also the facility owners will look after how energy is used being across the building. The 5G access and the smart cities scenarios are most wanted studies in the year 2022 and the most discussed topics in smart city development is transportation, public safety, traffic control and monitor, healthcare system, education, defense and tourism and entertainment. The 5G related technology that e4volved for smart city management are Network Slicing, Radio Access Technology, Edge computing. The certain challenges which have to overcome for building efficient 5G smart cities are Development of network, complex context, requirement challenging. The proposing 5G related technologies for the smart city architecture composes these challenges.

1.1 EVALUTION OF MOBILE COMMUNICATION NETWORK:

Network development has become a great topic for the modern lifestyle and introduction of wireless network. From 1870 to till now the development of first generation network to fifth generation network.

1G: The first generation was introduced in 1870 and has been come into action in 1980s. The capability of transmitting voice call from one end to another end by using analog signal has been characterized by 1G.in that time it's an advanced technology though it has certain limitations and challenges like not having data service to convert the voice to digital signal and also has very poor quality of voice not availability of global roaming.

2G: The second generation network the digital technology is introduced and it has been developed in late 1990s. the improved voice quality and increased rate of data capacity is developed . Short Message Service (SMS) and Multimedia Message Service (MMS) are provided by the Global System for Mobile service (GSM).The devices with color screen is introduced and also the Wireless Application Protocol (WAP) also introduced for accessing mobile technology. Even though the multimedia technology is efficient it is energy consuming, hence the 2G mobiles are the devices which can rechargeable battery lasted longer time devices and the devices which are using radio signals are consuming less energy.

3G: Third generation is a first true wireless technology for wide internet access which is developed and come into action in late 2000s. It has high data rate of transmission and allowing advanced application of multimedia development. Broad range of application has made the 3G application for the consumer market. New frequency bands and also the information about the location allowed the network to movable mobile application such as e-mail access, video conferencing, TV streaming, GPS (Global Positioning System). But drawback of 3G technology is increased cost and low reliability.

4G: The fourth generation is mainly based on internet protocol (IP) and developed in 2010. The main aim of the 4G technology is to provide low cost with high efficient, high quality and security devices by using multimedia and internet protocol (IP).In The video games, High-definition mobile streaming, 3D television which delivered by high-speed wireless broadband technology. Devices are provided with high data rate with megabytes, millisecond latency, more than 2000 devices can are connected for per square kilometer. New technology inter of Thing is developed in this era.

5G : This new Fifth generation network services is introduced after 2020 and also provide ubiquity of network all over the world and give high speed data rate, continuity, low latency, and massive network wireless connection. It's a key for real IoT transaction. Smart cities are developed and managed by these neural wireless technologies.

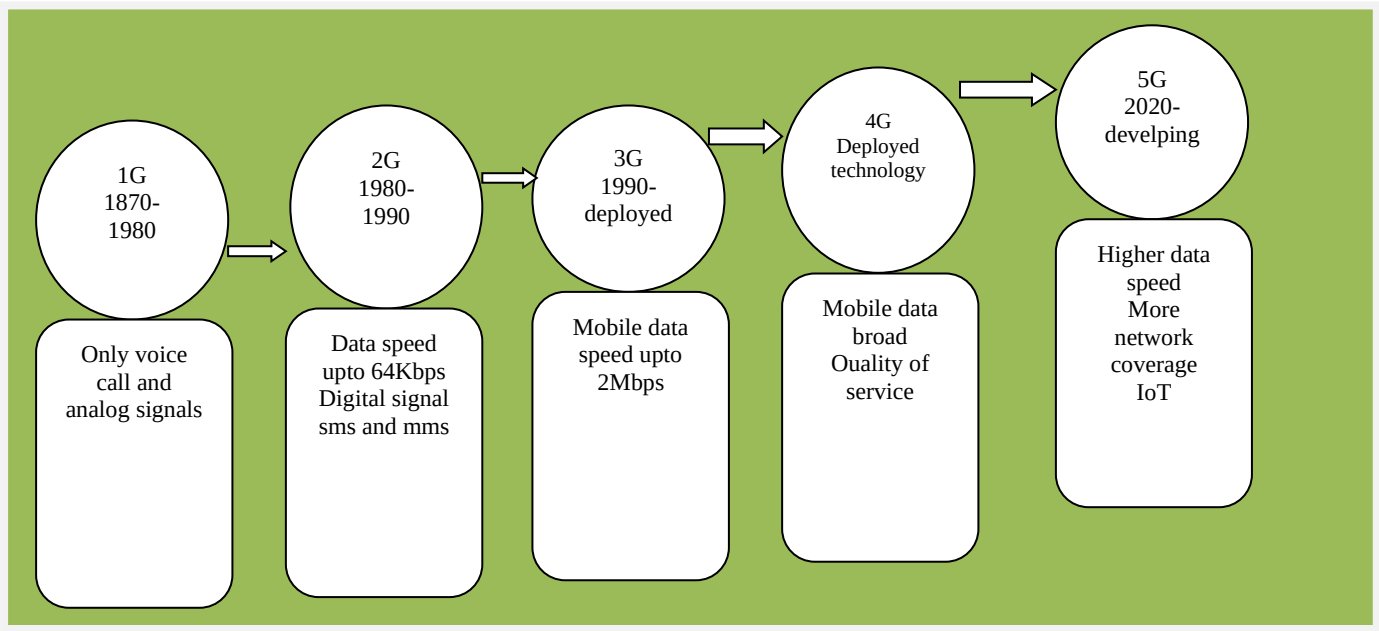


Fig 1.1 Evaluation of Mobile Network

1.2 Internet of Thing (IoT):

The Internet of Things (IoT) is a physical object or a set of such physical objects technology that connects and exchange data over internet service and communication devices with sensor, software and processing ability. This is a misnomer that can't be connected to public network and it will only connect to the individual network. The main aims of the IoT is to expand and enable easy interaction with vide variety of network for surveillance camera, home appliances, traffic efficiency. For creating more valuable device services cloud computing and Big data Integration is required for handling different types of data. The adaptation of Information and communication technologies (ICT) is empowered by government and other business development framework for public affairs and smart city management. In the vast data services they collect the valuable information context. The wireless IoT sensor cans also energy efficiency and health monitoring facility. But for securing data in the IoT process scale of security is employed and also the IoT security assessment are maintained by the network to make the security paradigm.

1.3 5G NETWORK:

The 5G network is a wireless neural developed technology for the advanced technologies that Providing high mobility in denser area like train, railway station, shopping mall, airport, traffic control. Specification of 5G network address the enormous data demand handled by the 4G network by unpredictable connectivity of more no of devices. The connection of million simultaneous connection per kilometer area is achieved by 5G system design and emerging concept of IoT services. The important aspect for the management of smart cities is intellectual 5G architecture with new high tech sensors and wireless neural network.

1.4 SMART CITIES:

The technologically developed urban areas with all modern equiptments and smart sensors are called smart sensors. Basically it will collect specific data using sensors and also uses different types of electronic methods. The main aim of smart cities is to provide the mission of economic growth and quality of the lifestyle of people is improved. The data collected is normally used to manage methods and the data is improved for gaining the higher operations across the city. The smart city observatory has coined 10 top most smart cities. They are 1. Singapore, 2. Zurich, 3.oslo, 4.Taipei city, 5.Lausanne, 6.Helsinki, 7.Copenhagen, 8.Geneva, 9.Auckland, 10.Bilbao.

1.5 THE IMPORTENCE OF 5G TECHOLOGIES IN DEVELOPING SMART CITIES:

The 5G technologies play a very important role in the development of the smart cities which satisfy the people modern lifestyle. They are

1.5.1 PUBLIC SECURITY AND SAFETY: In emergency situations the intelligent sensors which are placed throughout the cities will give emergency call. Emergency officials and Officers can locate and can also receive real-time information's regarding accidents.

1.5.2 MOBILITY: 5G network make it easier for autonomous or auto-driven vehicles and people to navigate cities. It will also provide lower latency and faster connectivity for public transportation system.

1.5.3 ENERGY EFFICIENCY: 5G helps in building the cities with better management of the energy supply, money savings, and sustainable development. It will create huge opportunities for connecting devices within the buildings and cities track, monitor, and controlling of the energy.

1.5.4 TRAFFIC MANAGEMENT: Intelligent tracking and managing traffic flows, monitoring road condition reducing traffic congestion are adopted by combining the both 5G and IoT network.

5G and smart cities Hyper connected Future: The future 5G network will develop in 2025 provide the advanced data network and number of connected devices worldwide will increase up to 75 million. The number of objects that interconnected will also

increases and generate unpredictable amount of data for the city management which in turn create Massive IoT. They will connect to the enormous no of IoT sensors and devices.

2. LITRATURE SURVEY:

In [1] The role of 5G Technologies: Challenges in smart cities and Intelligent Transportation Systems by Fernando auat cheein, Leanardo Guevara has been added to the developing system. Here they discuses about the evaluation of first generation (1G) mobile communication to fifth generation (5G) mobile communication and also used Internet of Thing (IoT) and smart grid and wireless sensor for developing smart cities. 1G network will process analog signal around the year 1981 to 1991, 2G network is processing Digital signal and simple data and they developed around 1991 to 1998, The third generation network 3G is processing mobile broadband network around 1998 to 2010, and the 4G network provide faster data rates and live broadcasting, video streaming. The Advanced 5G network using smart grid develop many advanced equipment like smart home appliances, Agricultural appliances, modern mobile appliances, Industrial appliances and in the great modernization in the transport system. Autonomous driving method identified by 5G network implementation with testing in six level of automation. Tele- operating driving method with high road safety measures also monitored along with intellectual navigation.

In [2] Integration of 5G Networks and Internet of Things for Future Smart City by Antonio Jara, Bo Rong, Michel Kadoch, Shuai Han, Xi Chen has been added to the proposed system. Here the method of 5G network integration in the developing future smart city by advanced management is taken for the developing paper. The all sorts of devices which are developed by using the IoT portfolio will contribute to the infrastructure of smart city. Each device from different cities will cover each and every corner of the society fall in the 5G coverage in a wide broadband network with ubiquitous accessibility for transmitting and accessing data. The trending equines which will impose unheard of demanding situations at the on-building and the 5G cellular community and effect the normative paintings of 5G.It is foreseeable lots of clever town services may be going for walks over 5G, pushing ahead the combination of 5G and IoT. The development through the harmonic metric in line with the geometric configuration of small antennas as a consequence its performance is evaluated with the related entropy.

In [3] Practical Aspects for the Integration of 5G Networks and IoT Applications in Smart Cities Environments by Benedict Occhiogrosso , Daniel Minoli has been added to the developing system. Here the formation of smart city paradigm has been integrated by real time data aspects. The proposed system uses the concept of mainstream process in which the 5G will assess the initial deployment of the urban areas. But in generally mainstream application of IoT will support small villages and cities for building smart campus and smart building with bandwidth that demand for a number of smart city applications. The new technique of enhanced mobile broad (eMBB)- based 5G technology is forwarded to enhance the data transparency. In this both the IoT and 5G technology have to give the expected widespread deployment in the future prediction. The pre-5G IoT technologies like NB-IoT and LTE-M proxies communication also used.

In [4] Performance evaluation and design of 5G communication -based millimeter wave antenna by Mustafa Shakir, M. Usman Sarwar, Muhammad Adnan, Muhammad Rafay Khan and Sohaib Aslam has been added to the developing system. Here the performance criteria are evaluated by using antenna frequency radiation. The signal processing system has the 5G performance evaluation which technique is used in the proposed system. The want for comparing multiplexing overall performance in 5G Ultra Dense networks for interference suppression charge as a relation of sign of interest (SOI) to sign now no longer of interest (SNOI) with initial angular separation has been taken into consideration. it feasible to synchronize packages in a range of fields in sign processing Have labored at the version of joint time-frequency-form control of discrete-time indicators the usage of discrete shapeliest transform (DST) which makes it feasible to comprehend the time assist of frequencies alongside investigating the form concurrently consequently making. The proposed system have advanced and verified a broadband planar special fractal antenna for multiband programs which in consistent with its defined dimensions outcomes in most excellent go back losses and radiation styles and advantage of the proposed antenna with the significance of investigating the overall implementation.

In [5] 5G Converged Cell-Less Communications in Smart Cities by Kyung Sup Kwak, Lijun Wang, Tao Han, Xiong Liu, Xiaohu Ge, Yujie Han has been added to the developing system. Here the 5G coverage cell-less communication for smart city management have been developed. by the cooperative grouping theme in 5G converged cell-less communication network Considering the readying of 5G ultra-dense wireless networks, 5G converged cell-less communication networks are planned to support mobile terminals in smart cities. to interrupt obstacles of heterogeneous wireless networks. The ubiquitous info service converged by differing kinds of heterogeneous networks is one amongst basic functions for sensible cities. In proposed system Simulation results indicate the coverage likelihood and therefore the energy saving at each base station and mobile terminals are improved and the 5G converged cell-less communication network is vertically converged in numerous tiers of heterogeneous wireless networks and horizontally converged in celled architectures of base stations/ access points, but the software system outlined network controllers are designed to manage the traffic planning and resource allocation in 5G converged cell-less communication networks.

In [6] Analysis of Key performance Indicators of a 4G LTE network based on experimental data obtained from a densely populated smart city by Agbotiname Lucky Imoize, Prof. Aderemi A. Atayero and Kehinde Orolu have been added to the proposed system for developing smart city management process. Here the proposed system has deal with the coverage of the 5G network and their key performance issues are calculated. The value of data and it experimental data are taken into account with the formal node of transmission.

A Survey on 5G and LPWAN-IoT for Improved Smart Cities and Remote Area Applications: From the Aspect of Architecture and Security by Adnan M. Abu-Mahfouz Adnan M. Abu-Mahfouz, Anish M. Kurien, and Emmanuel Ogbodo is added in the proposed system. Here the ubiquitous computing of 5G core devices is used. The level of computing in this strategies wuith the survey is defined in this methed and also wireless LAN (Local Area Nertwork) and the Enhanced mobile decvice broadband network is enabled to give a reliable throughput. Low-Power Wide Area Network (LPWAN) is employed along with the Software Defined Network (SDN) and Network Functioned Virtualization (NFV) is the key attributes used to analysis the network management.5G

Networks Towards Smart and Sustainable Cities: A Review of Recent Developments, Applications and Future Perspectives by Adeeb A.Kutty, Ihab Kassem, Muhammad Sheha and Murat Kucukvar has been added to the developing system. Here the sustainable city management is defined the two terms, that is Quality of service and Quality of expansion was defined hence the reported 5G network through the network sustainability with high scalability for the smart cities. The main recent development in the reported process will be analyzed using the performance algorithm.

Using 5G in smart cities: A systematic mapping study by ChenYang, GoruiCui, PengLiang, LimingFu, FeiHuang, FengTeng and Yawar AbbasBangash is added to the developing system. Here the effect of three main components of the 5G architecture is used in the proposed system. The main components such as the Massive mobile telecommunication, Ultra reliability and devised security network, Enhanced mobile broadband. The challenges with the complex content and 5G related methods can be proposed smart city maintenance of monitoring.

In Role of Artificial Intelligence in the Emergence of Smart Cities by Bibhu Dash, Pawankumar Sharma has been added in the developing system. Here the problem of efficient handling of the artificial intelligence system performance is used. The smart city management by artificial intelligence deep learning process and supervised learning process is equipped and transfer the process. The trained data is used to detect traffic monitoring and past accidental case and life threatening situation will be examined using the trained deep leaning architecture.

In IoT in Smart Cities: A Survey of Technologies, Practices and Challenges by Abbas Shah Syed, Adel Said Elmaghraby, Anup Kumar and Daniel Sierra-Sosa has been added to the developing system. Here the principle of the IoT (Internet of Thing) technology is used to survey the challenges and to build the smart cities is used for the developing system. The artificial intelligent is used to build the smart city empowerment and to study the challenges faced by the 5G and IoT in the improvement of technologies. The important components of the smart city is also defined they are agricultural smart application, industrial smart application, smart home appliances, smart hospital healthcare appliances, smart transportation, smart energy recourses, smart city grid information and in smart transportation the people safety is mainly considered.

3. EXISTING SYSTEM:

The existing uses the 4G Technology to develop and maintain smart city concept for evolving modern lifestyle and economical growth of country. The main impact of 4G and its development are discussed in the existing articles. LTE technology and its transmitting algorithms are used by developing 3G spectrum by analyzing the radio waves.

3.1 4G NETWORK AND ITS IMPACT:

4G is the stage of broadband mobile communication and International Telecommunication Union defines the 4G cellular network has a defined Standard of mobile communication with data speeds and transmission technology as key characteristic evolution. In each and every development of technology generation in cellular network bandwidth speed and network capacity is increased and in 4G the band width is increased up to 100 Mbps. 4G network also enable wireless broadband network connectivity. The 4G techniques used in data transmission are

- MIMO- Multiple Input and Multiple outputs.
- OFDM- Orthogonal Frequency Division Multiplexing.

These two technologies will increase transmission and receiving capacity of 4G and also enable high bandwidth and capacity which is lacking in 3G using TDMA and CDMA. 4G development scenario are development of technique with software independent, with autonomous network, user driven devices access and provide fully area coverage system . 4G network will also access fixed broad cast communication system with the latency lower than the 3G network and allow Ubiquitous mobile access.

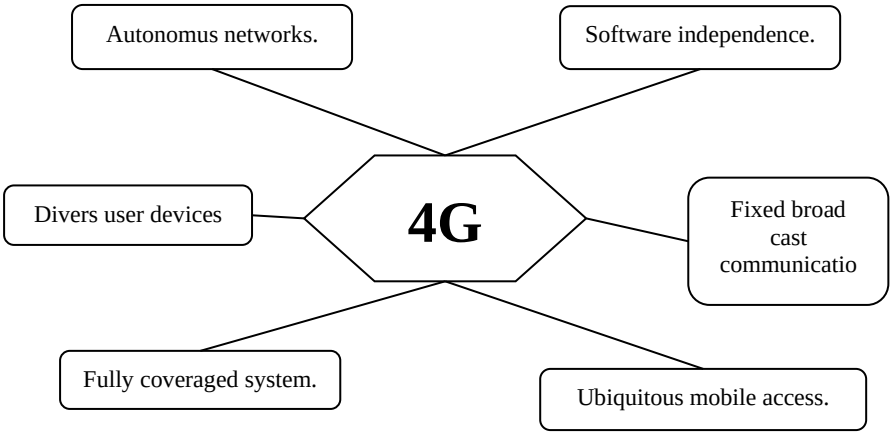


Fig 3.1 4G network development scenario

4G technology offers improved mobile access and greater data transfer speed though it has certain complains like unlocking the option of video conferencing but resolutions is low and the high prevalence of old copper style telephone is compared to it. The main features of 4G technology are

1. Cost of implementation of data per bit is low.
2. Multimedia, voice, video, wireless internet, broadband services are supported by 4G wireless network.
3. High speed and high capability is provided by 4G than 3G.
4. Support Ad hoc network and multi hop network.
5. Call admission and scheduling are handled efficiently.
6. Provide Global mobility for the wireless technique.
7. Provide service portability and scalability for mobile network.

8. Allow seamless switching and provide services based on Quality of Service (QoS).

3.2 CHALEENGES OF 4G NETWORKS:

The main challenges based by 4G network coverage are solving the different security threats like Internet Protocol spoofing, Intrusion or hacker attacks, theft of user ID, Denial of services and these factors can affect transaction by leakage of information. The main challenges are

1. SECURITY:

In cellular network integration security of the information transferred is main objectives of all types of mobile communication. The security of information is ensuring that the security policy and data speed both have to be achieved and the security features are compatibility available world-wide. The British information technology user the system which cannot hack by any other country. Multiple level of security is needed for 4G network because it uses a cellular level of network that incases the attack percentage by vast number of connections. In single network more wireless devices are used with same electronic or digital signal transmission which in turn will increase the level of threats.

2. IP DEVICES INTEGRATION:

4G technologies provide the communication system will need to be rebuilt from the ground up, running off of data packets instead of voice information. However, given the current pace of technological development, most consumers buy new phones every six to twelve months, and providers are constantly rolling out new equipment to either meet expanding demand or to provide new or high-end services. All networks will be compatible once the switch is completed, eliminating roaming and areas where only one type of phone is supported. Because of this natural pace of hardware replacement, a mandated upgrade in a reasonable timeframe should not incur undue additional costs on cellular companies or consumers. The technological disadvantage of using packets is not really a disadvantage, but more of an obstacle to overcome. As the voice and data networks are merged, there will suddenly be millions of new devices on the data network. This will require either rethinking the address space for the entire Internet or using separate address spaces for the wireless and existing networks. The integration infrastructure will allow higher devices connection. The software that will allow the user to adapt various wireless devices with providing higher data rate and signal processing and also it will always be upgraded with the new developed system.

3. CUSTOMER EXPECTATION:

In 4G network the customer expectations are not fully satisfied. The future 5G network or the Internet of Things sensors are enabled to satisfy customer requirement. By using multi-mode software customer expectation of meeting more devices are fulfilled.

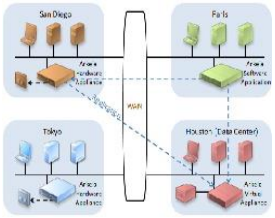


Fig 3.2 Multi –mode software accessing

4. AFFORDABILITY OF IMPLEMENTATION COST:

The promising 4G network implementation is needed cellular tower extension, and the positive idea of creating the wireless and broadband environment to provide high transmission speed and network congestion affordability is reduced. The cost of the high speed data transmission is high and equipment charges are also high.

5. USER ACCOUNT MANAGEMENT:

Managing the user account enable cloud storage system which is used to store data in the cloud storage which can be accessed by user any time. The transmission of user details and creation of user account all are processed by TCP protocol. In 4G network user account managing has become very complicated and challenging.

3.3 COMPARISION OF 3G, 4G AND 5G:

The evaluation of 4G to 5G network has many key differences they are Latency, OFDM Encoding, and Potential download speed, goal for cell density and base station. The 5G New Radio (NR) frequency is replaced by 5G LET (Long Evaluation Term). 5G can provide high frequency spectrum of millimeter wave that is mmWave of wavelength between 30 GHz to 300 GHz, but in 4G LET the wavelength is less than 6 GHz and because of the wave spectrum small base station is needed in 5G network operation.

3.3.1 Latency, speed and Bandwidth in 4G and 5G:

- **Latency:** The great differences between 4G and 5G development is latency. In 5G Latency ranges decreases to under 5 ms but in case of 4G latency ranges is from 60to 98ms hence download speed ids decreased.
- **Base station:** The Base station requirement is the most common factor in the transmission of data from one network to another network. 5G will use small cell to transmit data, for implementing that small cell station is frequently located in 5G –capable areas. Usage of Small cell technology wills faster the data transmit rate and mmwave frequency band so the carrier wave frequency is increased. But in 4G the common cell tower station is required to transmit data in 4G coverage.

- **Potential download speed:** In 4G various VoIP capabilities is used which enhances download speed of 1Gbps, but in case of 5G the potential download speed is tremendous than 4G that is 10Gbps.
- **OFDM Encoding:** Orthogonal Frequency Division Multiplexing is the digital signaling process used to split the different types of wireless signals into separate channels for avoiding interference in the signal transmission with higher Bandwidth. OFDM Encode and Decode different frequencies that help to increase download speed in both 4G and 5G network. In case of 4G it is 20 MHZs channel and in 5G it is 100 – 800 MHZs channel.

➢ **Cell density:** The cell density is higher for 5G network than the 4G network because of using small cell technology and enables more network capability. Hence more no of users can be connected with the 5G network.

Key differences	3G network	4G network	5G network
Latency	*212ms*	*60-98 ms*	*Less than 5ms*
OFDM encoding	*10 MHZ channel*	*20 MHZ channel*	*80 – 100 MHZ channel*
Potential download speed	*56 Mbps*	*1 Gbps*	*10 Gbps*
Goal for cell density	*Less than 200 users*	*200 – 400 users per cell*	*100 times greater than 4G*
Base station	*Network node*	*Cell Tower*	*Small cells*

3.4 4G IN SMART CITY DELELOPMENT AND MANAGEMENT:

Smart city development is the important budget by today's government, by using 4G LET it has already evaluated in many countries. 4G LET is more essential part in building India's smart city project. Smart cities are build by using IoT Integration and smart devices. IoT uses Mesh technology and IP based technology for developing smart cities.4G LET is essential for an IoT integration in other metropolitan cities for transforming them into smart cities. More of the developing nations are willing to integrate 4G and IoT technologies. The accessing of urban resources are becoming limited day by day hence developing modern equipped smart cities using wireless network and sensor integration for land, services and security is essential. Centralized smart city management process is developed by implementing small poles. For example Smart Street light is integrated for enabling smart city application. In The 4G Utilus platform the light poles are equipped to communicate with the one another and establish a network that will provide a range of applications used in the smart cities.

4. PROPOSED SYSTEM:

The proposed system uses the next generation 5G network for developing new smart cities and management them in an efficient ways which are compatible for people. The LTE evaluated IoT sensors are used for the building the smart neural network smart connections. 5G networks will provide great network potential and opportunities to build the infrastructure of organization that need to made improvement of Long term Evaluation for latency and service availability software. Analysis of interference with potential points of LTE with some utilities to connect encode and their critical traffic with e-nodeB (evolved node B) with the 5G is a combination of mm-Wave, beam forming, massive MIMO, Radio access, software defined network.

4.1 SMART CITIES MANAGE MENT BY 5G NETWORKS:

The deployment of new generation network communication is a high rate of challenging for high capital expenditure. The existing system is used by most of the network operators and investors will utilize the most out of current assets and will wait for the repaying of investment (ROI) and the players such as digital players and other software's devices like OTT (Over- The- Top). First the potential of the smart city verticals will be calculated and deployed using the 5G driver devices. The digital transformation in the 5G network has smart city verticals shifted from equilibrium of detecting new digital forms.The smart city value chain consists of 4 main attributes which manage the transfers of data in 5G network. They are sensing, connectivity, digital service, and End user

- **SENSING**: This is the first step in the development of the smart city management where the physical data is sensed and accessed from the physical media.
- **CONNECTIVITY:** The device connection problems are defined in this field in which the connectivity is based on the posses of the old collected data.

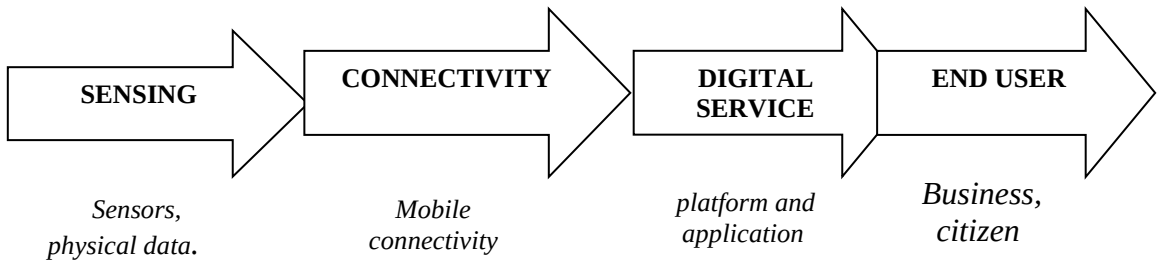


Fig 4.1 smart city chain value

- **DIGITAL SERVICE**: In this layer the collected data is processed and digital signals are carried by them in the varying process unit. Security of the data collected is deployed in this layer of sensing. Digital signals encryption and key generation also instructed in this platform.
- **END USER:** Client or the business processing system which will be processed in the client side module .

5. MODULE DISCRIPTION:

5G modules will connect the IOT devices to the edge of cutting area network that will enable high data rate and low latency by developing the applications with remote surgery, autonomous driving, virtual reality gaming, AI artificial intelligent based smart driver and robots are manufactured. By the end of 2050 2/3 of the urban population will be adapted to 5G smart cities.

The three main modules used in the deployment of 5G network are

- uRLLC- Ultra Reliable and low latency control
- mMTC- massive Mobile Type communication
- eMBB- Enhanced mobile broadband

i)uRLLC: Ultra- Reliable low latency communication uRLLC is the main components of the 5G architecture which enables more efficient scheduling of data transfer and also will carry larger subcarrier for achieving shorter transmission. It's a new developing technology which is used to meet the requirements of the 5G 4G and Internet of Thing. its main requirements are a plan reliability of 1^{-5}-10 and the probability error of e 10^{-5} and latency of time equal to 1 ms for transmitting a packet of size D- 32 bytes and also scalability will be 1Tbps per $m^{3.}$ it can be explained by 9 R , they are

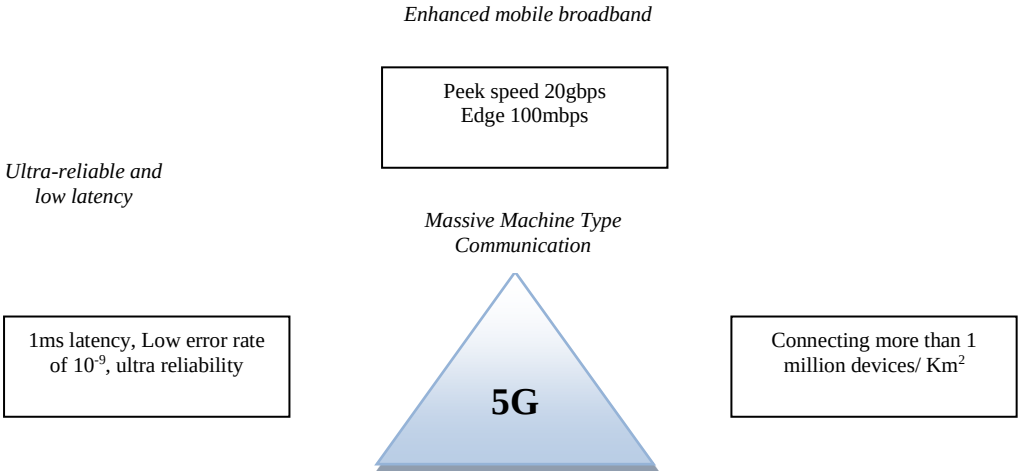


Fig : 5.1 main modules of 5G network

R1- sample complexity
R2- Reliable prediction
R3-controller connectivity
R4- stable control
R5-scalable control
R6-perception-aware prediction
R7- beyond visual modality
R8-Non-RF overload
R9 multimodal functions

Applications of uRLLC:

1.Smart factory/ industrial automation: In industrial application uRLLC is used in developing industrial control, process control, machine to machine process and robotic control.

2. Entertainment industry: In the television and entertainment industry is mainly used for online gaming and immersive entertainment.

3. Manufacturing Industry: Mainly motion control, AR and VR as applications and accessing remote control process in the manufacturing industry.

4. Health care industry: The important application by uRLLC in the field of healthcare is remote diagnosis, emergency response, remote surgery, robotic nurses.

5.Energy management: Smart energy and smart grid are the main applications of energy sectors.

6. Transportation industry management: The applications like autonomous driving, traffic monitoring and management, Enhanced safety and other driver assistant application.

ii)MASSIVE MACHINE TYPE COMMUNICATION:

The main aim of mMTC is to provide greater internet access for sensor applications like monitoring, censoring, tracking, metering devices. It's a technology for the development of new 5G to support extremely high volume of connection density in online services and also the main component of 3three core components of 5G architecture.

iii)ENHANCED MOBILE BROAFDBAND:

The eMBB is the use case device used to provide high data rate with faster speed for applications like virtual reality and large scale video streaming. The eMBB is mainly used for high bandwidth and low latency streaming of audio and video in the mobile technology. It's defines a minimum level of rate of transferring of data and will deliver with increased bandwidth and decreased latency. The main examples of eMBB are 8K video streaming, immersive gaming with AR and VR, video analytic, cloud and UHD, telemedicine immersive event experience.

6. ALGORITHM AND METHODS:

The 5G based smart city management system there are two main algorithms are used
1. Super Fluid Design Algorithm (SFDA).
2. Performance Clustered Design algorithm (5G-PCDA).

6.1 SUPERFLUID DESIGN ALGORITHM FOR 5G NETWORK BASED SMART CITY DEVELOPMENT:

The SFDA calculation by embracing a isolate et impera approach which will start with the T1-RRH RFBs are placed and after that the T2-RRH RFBs are introduced. The RRH RFBs are set, the calculation performs the assignment of the MEC RFBs and the BBU RFBs. The goal of SFDA is to decrease as much as conceivable the CAPEX costs, whereas guaranteeing an satisfactory Quality of services(QoS) to clients. The RRH key word used is referred as a remote radio head and BBU means Baseband Unit used for the transmission of 5G network. A RFP is a telecommunication service in which a request or a proposal is send to the

telecommunication system for seeking service to a telecommunication vendor, then the company will handle the request for their need and vendors proposal terms and re3quirements.
The most instincts behind this approach are the following ones:

- The main goal of the T1-RRH RFBs is to supply scope over the territory, and to guarantee the benefit to the biggest number of clients,
- the T1-RRH RFBs are really acting as macro cells; their number is lower compared with T2-RRH RFBs, which are instep utilized as little cells,
- T2-RRH RFBs are utilized to supply capacity to a subset of clients, i.e., the ones falling in their scope area, which is clearly lower than the scope region of T2-RRH RFBs, and
- once the RRH RFBs are set, the establishment of the BBU RFBs and MEC RF
- the t1 their 1 of the algorithm process definition and T2.

6.1.1 Pseudo code of the Super Fluid Design Algorithm (SFDA)

1: Input: N, U, aRRH r , aBBU b , aMEC m , CAPrun, t MIN , δ, order type
2: Output: yRRH nr , vBBU n1n2b, vMEC n1n2b, xun
3: tot cost best conf=Inf;
4: all conf=comp conf(N,aRRH r ,r = 1);
5: for curr conf in all conf do
6: tot RRH RFB=0;
7: u cand served= comp cand served u(curr conf, order type, U, t MIN);
8: n sorted=sort RRH RFB(u cand served, curr conf, r = 1);
9: curr u to serve=U;
10: for n in n sorted do
11: u assoc=associate u(n, curr u to serve, t MIN , r = 1);
12: curr u to serve=remove served u(U, u assoc);
13: end for
14: n sorted=sort RRH RFB(curr u to serve, N, r = 2)
15: for n in n sorted do
16: if check tot u served(u assoc,δ)==false) then
17: if (check conf(curr conf,n)==true)&& (tot RRH RFB< aRRH r=2) then
18: tot RRH RFB=tot RRH RFB+1;
19: curr conf=add RRH RFB(curr conf, n, r = 2);
20: u assoc=associate u(n, curr u to serve, t MIN , r = 2);
21: curr u to serve=remove served u(U, u assoc);
22: end if
23: end if
24: end for
25: MEC BBU RFB conf=assign BBU MEC RFB(curr conf, u assoc, aBBU b , aMEC m , t MIN);
26: tot cost=comp tot cost(curr conf);
27: if (tot cost

6.1.2 PERFORMANCE OF THE SUPERfLUID DESIGN ALGORITHM:

The OPT-5GD detailing and the SFDA algorithm over the considered situation can encode the problem formulation by receiving the optimization libraries provided by CPLEX point and run the definition on a high performance computing cluster given by the Purplish blue Cloud. The centers of each of them double strung and 56 [GB] of the RAM expansion. The code of the SFDA calculation in Matlab, and can run it on a scratch pad prepared with 2 centers Intel Core i7 at 2.8 [GHz] and 8 [GB] of RAM. The assess the effect of changing the minimum amount of activity t M IN between 1 [Mbps] and 50 [Mbps] set the rate of 5G clients δ break even with to 95%. The full costs vs. the variety of t-Min . As anticipated, the costs are expanding when t M IN is increased, due to the fact that more RFBs and 5G-nodes ought to be installed in arrange to fulfill the activity prerequisites. However, the costs encounter an increment of less than three times when t M IN.

6.2 THE 5G PERFORMANCE CLUSTERED DESIGN ALGORITHM (5G-PCDA):

In the performance clustering design algorithm group of clusters are used and number of related clients of the current configuration is the same as the number of related clients within the previous iteration. The final calculation of the covetously chooses nodes will be set to not introduce the current RRH RFB and the current RRH RFB is kept with the number of clients served by the current configuration and is stored Within the moment portion of the algorithm. By the introduction of the T2-RRH RFBs the client and the clustered group will access in order to serve the remaining clients. Then , a lattice of regular square measure is applied to the domain beneath consideration within the node for each cell within the lattice, the cell thickness is computed as the number of clients falling interior the current cell. By following the related network to each candidate, the T2-RRH RFB and thickness esteem of the cell that incorporates the position of the current RFB. Both the two steps are performed in the comp lairs RRH work of line will be given the values of RRH thickness. The main objective of this clustered network is to produce security and reduce the no of nodes selected at that point to choose the candidate T2- RRH RFBs possibly able to serve the most noteworthy number of nodes and gaining the high performance rate.

6.2.1 ANALYSIS OF THE OF THE 5G PERFORMANCE CLUSTERED DESIGN ALGORITHM (5G-PCDA):

The main goal of 5G-PCDA is to ravenously emphasize over the set of users and the set of candidate T1- and T2-RRH RFBs. For each user and each candidate RRH RFB, a check on the current RFB is performed in a specific node of calculation on

the off chance that the current RFB can serve the client and it is as of now introduced, at that point the user is related to the current RRH RF Band all the calculations have been coded in Mat lab on the off chance that the current RFB can serve the client but it isn't introduced, a check on the compatibility with the as of now introduced RRH RFB is performed. In case of the performance of the clustered nodes the conceivable cable is introduced by the current RRH RFB at the point the client is related to channel. The BBU and MEC RFBs are set concurring to the same run the show of SFDA and 5G-PCDA.

6.2.2 Pseudo code of the 5G Performance Clustered Design Algorithm (5G-PCDA):

1:Input: N, U, a^{RRH}, a^{MEC}, CAP^{run}, t^{MIN}
2: Output: yar
3: u.cand served comp.cand served.u(curr.conf, order_type, UIMING
4: RRH sorted-sort.RRH.RFB(u.cand.served, curr.conf, r =1);
5: n.users.prec.conf-0
6: users.to serve U
7: for i=1; i <aRH; i++ do
8: if check.conf(curr.conf, RRH_sorted[i], r = 1)=true)
then
9:curr.conf-install RRH(RRH sorted[i], r = 1); [u.assoc users to serve]-associate.u(curr.conf.
10:users to serve, MIN,r=
11: if size(u.assoc)=n.users.prec.conf then = 1);
12:curr.conf uninstall RRH(RRH sorted[i]);
13:else
14:n.users.prec.conf size(u_assoc);
15:end if
16: end

7. EXPERIMENTAL ANALYSIS:

The experimental analysis of 5G based network management of the smart city network. The 5G transactional pattern with the smart city efficiency is run through the different module execution system. The main advantage of the system is that the execution of the various transaction and each customer feedbacks taken. These experimental values are defined by the chart and graphical representation.

a. uRLLC - ULTRA- RELIABLE LOW LATENCY COMMUNICATION:

The Reliability of 5G network is high with the usage of Ultra Reliable Low Latency Communication methods. The bar graph is used to calculate the efficiency of the latency processing. The first bar is the conservative single-shot process which has very low latency. The second bar is the hybrid blind and the shared data classification process which will defied the little higher than the conservative model. The third bar defines the feedback or the past history products reliability checking bar which shows higher latency and not used by 5G network.

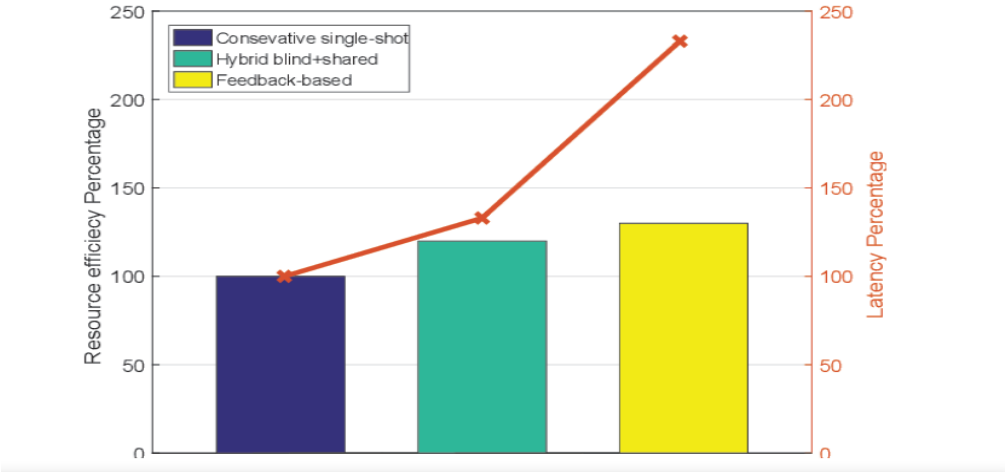


Fig 7.1 uRLLC bar chart for latency checking

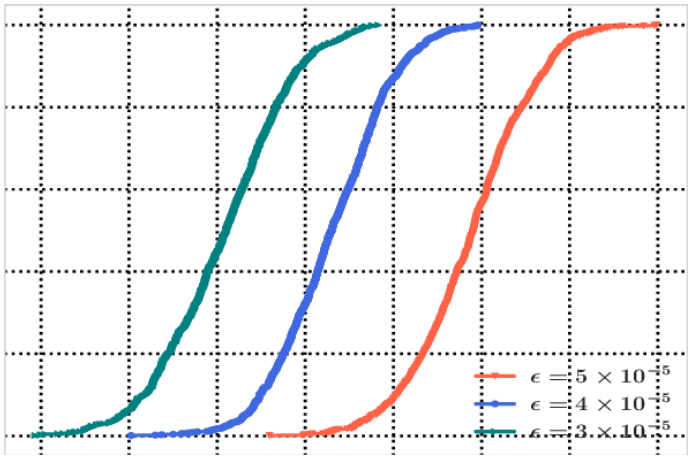
b. MASSIVE MACHINE TYPE COMMUNICATION:

mMTC or massive Machine Type Communication is the 5G network based communication with high scalability rate and it is mostly used for stock market for prediction of past and the new trading details. In this graph the trading details of the stock market products are evaluated.

Fig 7.2 Evaluation graph of mMTC

c. ENHANCED MOBILE BROADBAND:

The eMBB is the device that enhance the mobile broadband technology for the 5G speed network and also has a high speed use cases. The peek speed will be upto 20 Gbps in the 5G network and also at the edge it will be 100 Mbps. In this graph the data rate of ECDF network is evaluated.



ECDF OF THE TOTAL DATA RATE OF ALL EMBB USERS (MBPS) WITH DIFFERENT VALUES OF AT A = 1

Fig 7.3 Evaluation of eMBB data rate

d. PERFORMANCE OF THE SFDA ALGORITHM:

The super fluid design algorithm and OPT-5DG that is optimal 5G data search algorithm efficiency is compared with each other. The first bar diagram shows the total cost of implementation of these two algorithms and their data rate. The cost of implementation is higher for the super fluid design algorithm. The second bar diagram shows the Computational cost and the third chart shows the maximum achievable traffic per user.

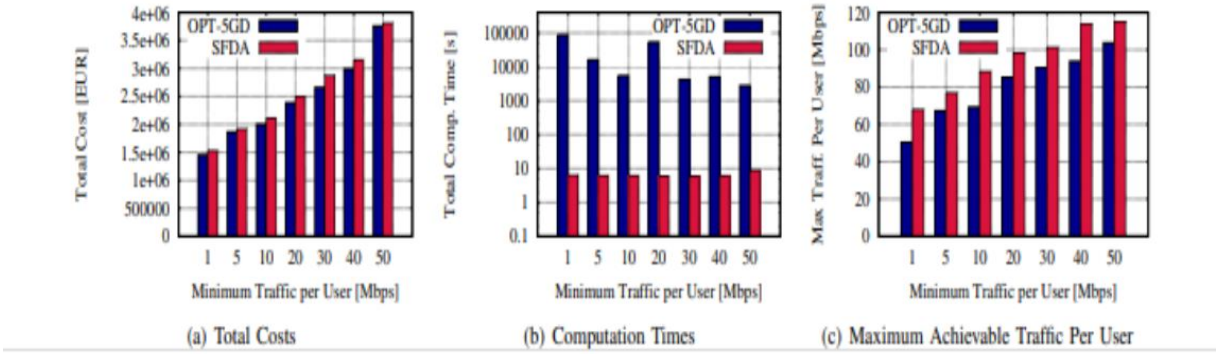


Fig7.4 Graphical comparison of the SFDA algorithm

8. FUTURE ENHANCEMENT:

The challenges of very high speed with connecting more than 75 billion systems will be developed in near future 2025 and also this will enhance a high level data connectivity and interpretation in the top level system architecture. These new technologies will be very helpful for the development and management of the new updated version of technologies in smart cities like smart

home, smart traffic monitoring appliances, smart transportation, smart energy management, smart navigation. In mere future next generation 6G network will give a high coverage area of network with Extreme high data rate or capacity, extreme coverage, extreme low energy and cost efficiency, extreme low latency, extreme high reliability, extreme massive connectivity and sensing capacities with high-precision positioning. This new generation is already built in Japan smart city management, but in India it's a future technology. They are affordable with mmW/THz NW network and devices, and they devices which are free from battery charging will also be evolved. The 5g-based smart cities built are very effective in the sensor management and traffic and public security equipments, but some of the data and devices are not cost efficiency and build in rate is also high. There will also be congestion free network is build with data rate of 1Gbps to 1Tbps, reliability rate will also increased, the latency rate will be less than 100 nano second, localizations precision is less than three dimensions. The development of hyper connected cities with artificial network can also be developed.

9. CONCLUSION:

The advanced smart cities development and managing their network is deployed by using 5G network to lead a modernized infrastructure.5G network and Internet of Thing is the major keys used to develop smart cities. In the proposed system high speed 5G wireless data network which work through IOT sensors facilitate the energy efficient traffic monitoring system for smart cities. The building owners, managers, automation and remote management systems can access various devices across cities to capture the real-time data about the information of buildings to function and empower their building operation with unparallel view. By using IoT in the smart cities is mainly for transformation of old to advancement of how people connect and operate. 5G technology has incredibly high speed and low latency and IoT has unlimited potential and by using these two technique building the future critical infrastructure connected communities can be adapted with more intelligent machine-to- machine technology and interconnected network.5G based network management system can also provide endless opportunities to communities that will harness the edge of power computing, data and their abstained network. 5G network not only provide low latency it also provide greater reliability, higher data rate up to 20Gbps and low power consumption which are very vital resources to build the real-time smart cities.

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