International Journal of Advance and Applied Research
www.ijaar.co.in
ISSN – 2347-7075 Impact Factor – 8.141
Peer Reviewed Bi-Monthly
Vol. 6 No. 42 November - December - 2025

IoT in Smart Cities

Bankar Priyanka Pavan[1] & Prof. Cholekar Arati Sanjay[2]
[1]*Department of Computer Science,*
Tikaram Jagannath College of Arts, Commerce and Science Khadki Pune-3
[2]*Department of Computer Science,*
Tikaram Jagannath College of Arts, Commerce and Science Khadki Pune-3
Corresponding Author – Asst. Prof. Pooja Kamble
DOI - 10.5281/zenodo.17910519

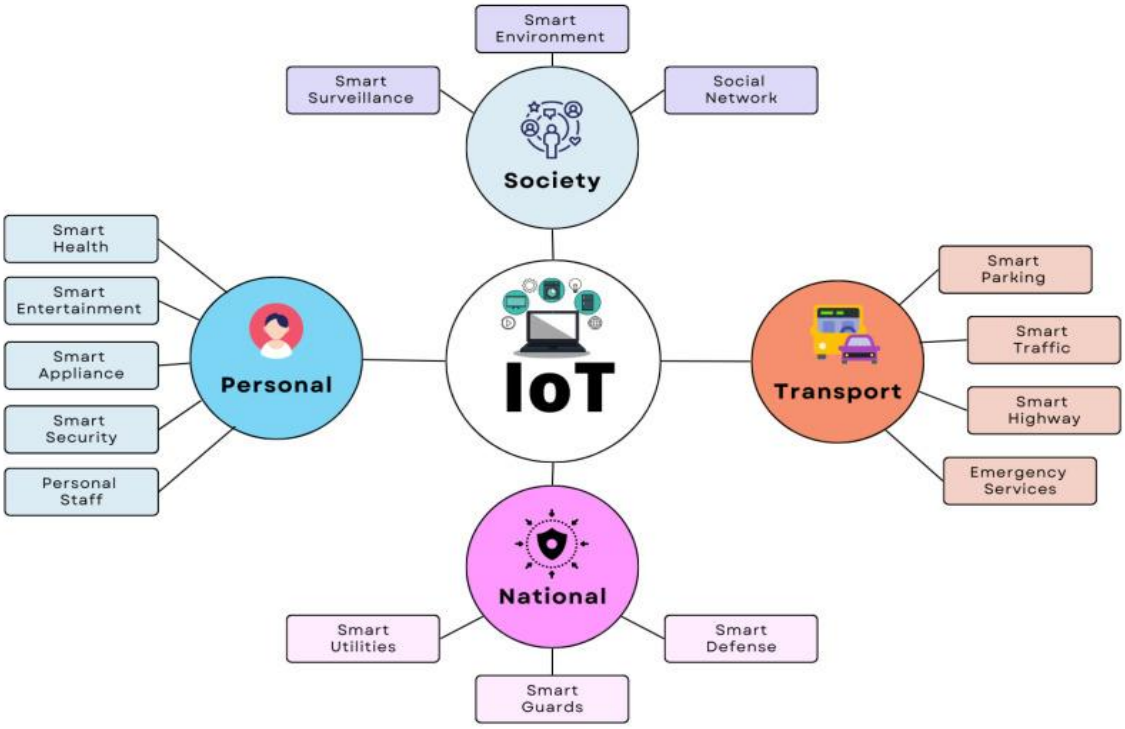
Abstract:

The internet of things and use of new technology plays an important role in maintenance, Construction and implementation in smart cities. As the name smart city indicates efficient control of cities by use of latest technology, electronic IoT based devices and advanced communication techniques. Basically IoT is Internet of Things i.e. physical devices connected with sensors, microcontrollers, network connectivity and software for sharing and collection of data. IoT system consist of Unique identifier (UID) are used to transfer information to any network securely. The human efforts in controlling and monitoring the system are also reduced by the use of IoT in smart cities. Olden time we were used manual method for manufacturing, controlling traffic system, transport, healthcare system. Now a day's IoT improves the quality of life, decreases efforts and time. The applications of smart cities like smart healthcare, smart traffic system, smart waste management, smart parking, smart environment monitoring, smart homes, smart public transport, smart parks etc. The main purpose of this paper is that it provides proper assessment about smart city, challenges of IoT and implementation of real time application in development of smart cities.

***Keywords**: Smart City, Iot Technology, Security, Smart Homes, Traffic System.*

Introduction:

The internet of Things (IoT) expresses the physical objects that are embedded with software, Sensor, and other technology which connects and exchanges the data over internet or other communication network. Internet of Things interacts in various situations like including environmental, social and medical. Things are operated automatically with the help of internet without human interference. Smart city concept is very useful for urban area. Urban areas are developing faster and creating new jobs on the basis of various platforms. The facilities and new technology must be expanded to support the population growth. The smart city concept has been discovered to address these problems. IoT applications are aim to design for critical links of smart cities, preferably the regular operations of city system such as electricity supply, water supply, fire alarm and the operation of specialised processing. The following figure shows the interconnection of IoT in smart city.



This study offers the overview of application, concepts, and challenges opportunities of smart cities in the context of utilising the latest technology development such as Block chain(BC) and Machine learning(ML).Above figure shows that uses of IoT. This paper covers incorporate privacy and security features.

IoT Technology for Smart City:

1. **Communication Network:** Wi-Fi, Bluetooth and 5G networks are essential for connecting a number of sensors and devices for fast and reliable data transmission in smart cities.
2. **Data analytics and AI:** Artificial intelligence and machine learning's are very useful to analyze huge amount of data gathered from sensor which helps to improve city services and automate the processes.
3. **Smart sensors:** Smart sensors collect the real time data like noise level, air quality, water quality, temperature and humidity, providing insights for environmental monitoring, traffic management and smart building.
4. **RFID tags:** Radio frequency identification (RFID) is used to tag movements of assets, location, equipments and even people to optimize the operations. Radio frequency identification is portable that is network connected component.
5. **Digital twins:** These are the virtual models of city infrastructure that uses real time IoT data to monitor, plan and simulate the changes without impacting the physical city.

IoT and Data Processing:

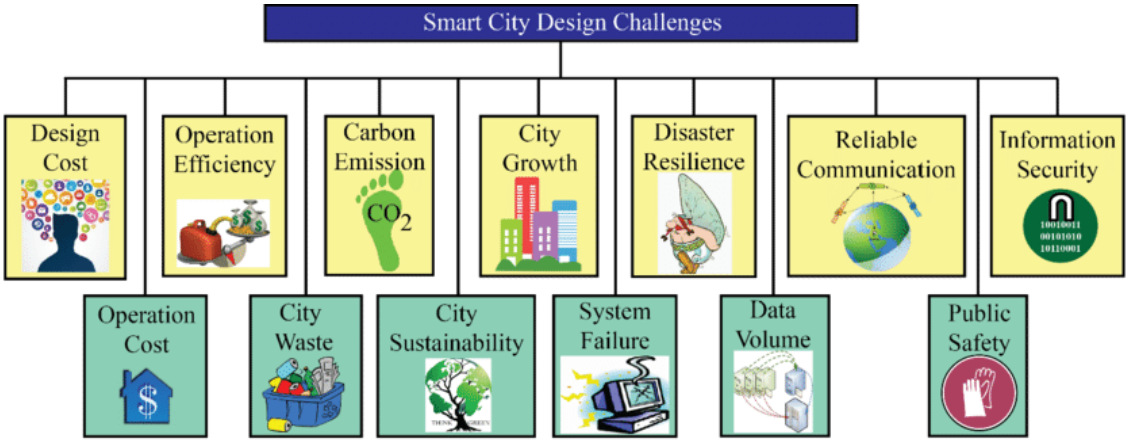
City is considered 'Smart' if it is incorporate the modern latest technology to facilitate the daily work task. Automation is

essential elements of city and primary purpose of automation is to release the human efforts. Now a day's remote-controlled systems are highly recommended. The use of wireless technology in automation that gives a variety of advantages that is not available with usual network.

Machine learning techniques are implemented in various applications such as virus detection, authentication, speech reorganisation, fraud detection, bioinformatics, employee machine learning methods and techniques. Artificial intelligence involves creating sophisticated machines capable of performing task autonomously. IoT device creates huge quantity of data to develop cutting-edge AI models. The combination of AI and IoT holds the potentials to significantly improve the quality of human life. Machine learning algorithms construct predictive models by employing statistical methods on extensive datasets. These models then form the foundation for making future prediction, driven by the incorporation of new information. These models used as basic for future estimate based on newly added data.

Challenges of IoT for achieving Smart City:

IoT in India's smart cities faces more problems including data privacy issues, high implementation and maintenance cost and cyber security risk, Carbon emission, waste management, sustainability of city, handling huge data etc.



1. **Security and Privacy issue:** Security is one of the important challenges, given how quickly IoT connected devices growing. All the devices are connected to internet; the smart grid is allowing to serve attacks. Many devices are worked with wrong credential making it easy for hackers.
2. **High Implementation and Maintenance Cost:** IoT requires the various sensors and installations of devices, data transfer, integration with outdated system, efficient communication and needs constant updates. Requirement of continuous investment for software maintenance, network infrastructure.
3. **Data Management and Processing:** Smart city generate huge amount of data, requiring advanced and proper

system to store, process and analyze it effectively. Secure consistency, low latency and high capacity connectivity for all the device is a crucial technical challenge.

4. **Power Requirement:** In smart city IoT based device require their own power resources managing this for big city deployment is logical challenge.

Applications of IoT in development of Smart Cities:

1. **Air Pollution:** Air pollution is the major problem in urban city where the particular factors in the air is so high it is very harmful for human health. But in IoT air pollution can be reduce using Machine learning. This is done by collecting data related to air pollution factors in cities such as emission of carbon dioxide (CO2) from vehicles, air flow direction, weather, traffic levels etc. Using IoT from various source and it calculating air pollution forecast to see the inclination in pollution that can be controlled. This improves the air quality, detecting the issue and solve automatically over the network.
2. **Healthcare:** Healthcare is very important factor of life especially in current time non spreadable diseases like cancer and heart problems are day by day increasing in big cities, where there are lot of death due to communicable diseases in poorer area. In this situation IoT is very helpful to enhance the better healthcare so that best healthcare services are received by everybody. Use of IoT and sensor in healthcare to monitor patient remotely where the patient can be monitored 24 hour. In emergency responder called if there are any problems.
3. **Water Management:** Water is very finite resources which are reducing at an alarming rate. Sensor is used to monitor water level, tank pressure, Pipe conditions, proper flow of water etc. In Municipal corporation water pipelines and tanks to enhance water management. Sensor monitors water quality, flow of water, detecting leakage and usage of water across network. The problem like leaky pipes and high pressure can be handled without any loss of water through pipes. This will ensure that water is not wasted using smart sensor. Sensor can also be monitor ground water levels so that it can be renewed if there is water shortage or leakage. This is helpful for conservation of water, early detection of issue and better water quality.
4. **Public Transport:** Public transport is heart of city. In urban city traffic jam is big problem. The Metro and train is life saver. Smart public transport can streamline traffic and also make urban peoples life easier. Use of Public transport is main source of reducing pollution due to vehicles. In public transport it is very convenient when buses and trains are connected with single app so that people will know exactly when next service arrive and how much you need to wait. Public transport which provide maximum benefits and minimum cost. Use of Smart sensor and IoT is very helpful in public transport management.

5. **Traffic Management:** It is important to control traffic in urban area there is huge traffic jam in many place. Using IoT and smart sensor traffic should be controlled automatically according to the volume of the traffic. It can also adjust the duration of Green light, Red light and yellow light to solve the traffic issue of particular area by accessing the inputs from sensors. Sensors can be implanted on roads and bridges to monitor their conditions and automatically solved using IoT techniques. Sensors and camera captures real time traffic flow and adjust the signal timing and provide proper information of route via mobile app. It improves the road safety, fast emergency response time and lower CO2 emission
6. **Waste Management:** Waste management is the big task for city. The collection of waste and disposal is very easy due to IoT. Sensors are installed in bins it gives the information about fill level. Bins having Global Positioning System (GPS) tracker so collection operator Schedules collection routes. This system will save the money, improve the efficiency of work and streets will better clean.

Conclusion:

IoT research paper on smart cities typically conclude that IoT serves as a foundational technology for enhancing urban sustainability, efficiency, and responsiveness by integrating sensors, AI, data analytics, and networking to address challenges like traffic congestions, energy waste, and infrastructure strain. In this study smart sensor based IoT architecture that implements various issues like cyber security, real time decision-making, scalability, energy efficiency. In this work we present technology of IoT in the context of smart city. Papers emphasize IoT's role in real-time data collection and decision-making across domains such as smart mobility, energy management, waste handling, and healthcare. As our future work, we plan to research and survey the IoT based smart city facing the many challenges. Using latest technology to solve these issues, challenges and implementation of IoT based smart cities.

References:

1. Rida Khatoun and Sherali Zeadally. Smart cities: concepts, architectures, research opportunities. Communications of the ACM, 59(8):46–57, 2016.
2. Gartner Says By 2020, More Than Half of Major New Business Processes and Systems Will Incorporate Some Element of the Internet of Things. Technical report, Gartner, Inc, 2016.
3. Rehan, H. (2024). Internet of Things (IoT) in smart cities: Enhancing urban living through technology. Journal of Engineering and Technology, 5(1), 1–15.
4. Mante, S. (2023). IoT data processing for smart city and semantic web applications. arXiv preprint arXiv:2306.16728.
5. Atzori, L., Iera, A., & Morabito, G. (2010). The Internet of Things: A survey. Computer Networks, 54(15), 2787–2805.