# Progress of smart city towards global excellence

**[1]R.Selva Bhuvaneshwari, [2] J.Pushpa Jaculine**

Visiting Faculty
Department of Electronics & Communication Engineering
Anna University Regional Campus-Tirunelveli, India

***Abstract*- Due to human population increasingly urbanized, economic and environmental success will hugely depends on the occurrences within the cities and the management of their resource constraints. According to the UN World Urbanization Prospects, today 55% of the world's population lives in urban areas. By 2050 that proportion is expected to increase to 68%.'Smart Cities' rely on the Internet of Things (IoT) to collect data, cellular networks such as 4G/LTE and 5G to transfer the real time data, big data to analyze the collected data and AI to perform the tasks associated with intelligent beings. Smart city consists of Smart home, smart government, smart education, smart transportation, smart energy, smart parking system etc., this paper focuses on some major essentials of smart city for global excellence.**

***Index Terms*- Smart city, IoT, Big data, AI**

## INTRODUCTION

A smart city uses info-communication technology to enhance city functions and promote economic growth in order to improve the quality of life for citizens by using smart technologies and data analysis. And the technologies include Internet of Things (IoT), Artificial Intelligence (AI), Blockchain or geospatial technology is the key to the growth of smart cities around the world.

The core infrastructure elements in a smart city include- adequate water supply, assured electricity supply, sanitation including solid waste management , efficient urban mobility and public transport, affordable housing especially for the poor, robust IT connectivity and digitalization, good governance especially e-governance and citizen participation, sustainable environment, safety and security of citizens, particularly women, children and elderly and health of education.

According to urban planners, the major challenges of urbanization for India in the years ahead are the inability of the cities to provide basic needs such as safe drinking water, clean air, good quality public transport and roads and pavements for their residents and material to move from one place to another, while also providing both social infrastructure (schools, hospitals, public parks) and economic infrastructure (bridges, flyovers, markets).The Smart City project focuses on offering an elevated lifestyle and environment to all the sectors of the community. Smart cities are based on smart technology solutions to connect different aspects of life and improve overall human life quality and sustainability.

This is essential for the future, especially with research saying that 68% of the earth's population will live in urban cities by 2050, so smart cities are no longer an option, with all their sustainable solutions and development for life quality clean energy.

The major goals of Smart City India are going to implement for growth with its features.

1. Providing housing choices to everyone is another major goal of the Smart City projects. Living quarters are the building blocks to achieving smart development goals. Hence, more housing construction projects will be taken out to provide shelter for lower-income groups.
2. The mission is set to give the people relief from congestion. New pedestrian streets are also being constructed for cyclers and walkers to avoid accidents.
3. Developing recreational spots like gardens, parks, open gyms, playgrounds, and more are other major goals of the mission.
4. Government-related services are gradually going digital to promote transparency and accountability in the system and the people. Therefore, now citizens can simply go to the portal instead of visiting the municipal office for requesting a service or assistance.
5. More transportation choices are also being promoted throughout the country including public transport and transit-oriented development (TOD).
6. Each city is also given identification in several areas like education, local cookery, health, arts, sports, fashion, culture, and many more.
7. Smart technologies are brought and implemented in services and infrastructure for the development of the area.

**SMART HOME**

Smart Home is defined as a residence that uses a control system to integrate various automation systems in the home. A home should be smart and secure and it must contribute to the energy and water conservation. Using IoT, a home can be made smart. Tasks can be done without human intervention using IoT devices and various sensor units can be controlled remotely.

Smart home is an advanced technology that makes the lives of people smart. The devices present in the home are made smart using the technologies like Internet of Things, Machine Learning, Big data, cloud computing, artificial intelligence and others. There is a necessity to control the home and the appliances present in the home remotely when people are not present. This can be achieved using the applications. The detection of hazards in the kitchen like fire can be detected using the sensors and people can be alerted. The water level in the tank can be monitored and the supply can be cut down upon water exceeding the certain level in the tank. Similarly, switching off the unnecessary lights and other tasks that require the humans to be involved can be automated using the technology. As people cannot always be involved in conserving energy, technology can be used at its best to conserve energy.

***How smart home works***

The smart devices such as smart phone, tablet, laptop etc., in the home are connected with each other and it can be accessed via central point. Home automation systems include door locks, TVs, home monitor, cameras, lights and even home appliances like refrigerator can be controlled. The system can be installed on the mobile or any other networked devices. The users can access and they can also create time schedules for certain changes to take place.

Since the smart home appliances are equipped with self –learning skills, it has the ability to know about the owner's schedules and make adjustments accordingly. For example, the home alert systems are enabled in the smart home systems and the alerts will be intimated to the owner immediately if any abnormal function occurs. Suppose if the owner is far away then it has to send the alert to the other in case of any emergency situations

***Examples of smart home technologies***

Nearly every aspect of life where technology has entered the domestic space -- including light bulbs, dishwashers and other appliances -- has seen the introduction of a smart home alternative:

- **Smart TVs.** These TVs connect to the internet to access content through applications, such as on-demand video and music. Some smart TVs also include voice or gesture recognition.
- **Smart lighting systems.** In addition to being able to be controlled remotely and customized, smart lighting systems can detect when occupants are in the room and adjust lighting as needed. Smart light bulbs can also regulate themselves based on daylight availability.
- **Smart thermostats.** Smart thermostats, such as Google Nest, come with integrated Wi-Fi, letting users schedule, monitor and remotely control home temperatures. These devices also learn homeowners' behaviors and automatically modify settings to provide them with maximum comfort and efficiency. Smart thermostats can also report energy use and remind users to change filters.
- **Smart door locks and garage door openers.** Homeowners can use smart locks and garage-door openers to grant or deny access to visitors. Smart locks can also detect when residents are near and unlock the doors for them.
- **Smart security cameras and systems.** With smart security cameras and doorbells, such as Ring, residents can monitor their homes when they're away. Smart motion sensors can identify the difference between residents, visitors, pets and burglars and can send notifications to authorities if suspicious behavior is detected.
- **Smart pet and lawn care.** Pet care can be automated with connected feeders. Houseplants and lawns can be watered using connected timers.
- **Smart kitchen appliances.** Brands such as LG, GE and Samsung offer smart kitchen appliances of all sorts. These appliances include smart coffee makers that can brew a fresh cup automatically at a programmed time; smart refrigerators that keep track of expiration dates, make shopping lists or even create recipes based on ingredients currently on hand; slow cookers and toasters; and, in the laundry room, washing machines and dryers.
- **Smart household monitors.** Household system monitors can, for example, sense a power surge and turn off appliances, sense water failures or freezing pipes and turn off the water so the home doesn't flood.
- **Smart plugs.** These connect to wall sockets to transform simple home devices, such as lamps and ceiling fans, so they can be controlled remotely via mobile apps and voice assistants such as Alexa

***Smart Home systems***

To automate home and buildings, there are various automation systems and architectures are available. According to the characteristics of the system, these can be:

- **Wireless home automation systems:** A wireless home automation system does not require any wiring hence it is easy to install and it works with radio frequencies.

- **Wired home automation system:** In wired home automation systems, the signals are transmitted through dedicated cables, which guarantee security and reliability. The installation of cables may require some work.
- **Hybrid system:** Hybrid systems uses both wired and wireless media


***Smart home pros and cons***

Smart technology offers numerous advantages, ranging from the convenience of running household appliances such as the washing machine while at work, to the comfort of remotely adjusting the thermostat on a chilly winter day.

Common advantages of a smart home include the following:

1. **Provides assurance.** Home owners can monitor and access their homes remotely.
2. **Accommodates user preferences for convenience.** For example, users can program their garage door to open, the lights to go on, the fireplace to turn on and their favorite music to play once they arrive home.
3. **Offers peace of mind.** With the help of IoT devices, members of the family or caretakers can remotely monitor the health and well-being of seniors. The seniors can remain longer at home safely than moving to an assisted residence.
4. **Improves efficiency.** There is no need to leave the air conditioning on all day. By having smart home system, the home owner can modify it as per his/her requirements i.e., if the homeowner wishes to ensure the house is cooled down by the time they return home.
5. **Saves resources and money.** With a smart irrigation system, the lawn is watered only when needed and with the exact amount of water necessary. With home automation devices and a smart system setup, energy, water and other resources are used more efficiently, which helps save both natural resources and money for the consumer.
6. **Manages tasks.** Smart virtual assistants, such as Google Home or Amazon Echo, can accomplish tasks through speech recognition and voice commands. For example, homeowners can use voice commands to turn on music, search the web and control their household smart devices.

However, home automation systems have struggled to become mainstream, in part due to their technical nature. Common disadvantages of a smart home include the following:

1. **Requires a reliable internet connection.** An unreliable internet connection or a network going down in the event of an outage can leave the devices and gadgets connected to a smart home inoperable.

2. **Perceived complexity.** Some people have difficulties or a lack of patience with technology. Smart home manufacturers and alliances are working on reducing complexity and improving the user experience to make it enjoyable and beneficial for users of all technical levels.
3. **Lack of standards.** For home automation systems to be truly effective, devices must be interoperable regardless of manufacturer and use the same protocol or, at least, complementary ones. As it's a relatively new market, there's no gold standard for home automation yet. However, standard alliances are partnering with manufacturers and protocols to ensure interoperability and a seamless user experience.
4. **Questionable security.** IoT devices introduce security challenges because most of them lack built-in encryption. In addition, they can serve as access points for the broader network's sensitive data, increasing the attack surface. According to a recent report from consumer IoT market research firm Parks Associates, 55% of consumers are concerned about the security of their smart home devices. If hackers can infiltrate a smart device, they could potentially turn off the lights and alarms and unlock the doors, leaving a home defenseless to a break-in.
5. **Lack of data privacy.** Many smart homeowners also worry about data privacy. According to the Parks Associates' research report, about 72% of consumers expressed worry or strong concern regarding the security of their personal data collected and transmitted by smart home devices. Likewise, they're equally concerned about the potential unauthorized access or control of smart devices without their permission. While smart home device and platform manufacturers collect consumer data to better tailor their products or offer new and improved services to customers, trust and transparency are critical to manufacturers looking to gain new customers.
6. **Expense.** Even though prices are coming down, many smart home devices are still expensive, and an entire house makeover could cost thousands of dollars.

**SMART TRANSPORTATION**

Transportation forms the arteries for modern society and economy. The transportation of goods and people has enabled business success and created new cities. While transportation is commonly viewed as a classical civil and structural engineering problem, it is increasingly becomes digitized and enabled with info-communication technologies. Current traffic problems in our society includes: (i) heavy traffic , (ii) accidents, (iii) pollution, (iv) fuel cost, (v) fuel scarcity, (vi) high insurance costs, and (vii) others. Due to increase in population in cities and in the number of cars, bicycles, motorbikes and road users have added to the risk of accidents, traffic congestion, etc. Hence, there are several advances made over the past decades to address some of these problems.

Smart transport includes: (i) smart roads, (ii) smart street lights, (iii) smart cars, and (iv) smart traffic signs. Electric vehicles (EVs) are commonly sighted on roads these days for zero carbon emissions and overcoming high gasoline prices. Also, with the push from large corporations like GOOGLE and UBER, self-driving autonomous vehicles (AVs) are actively being designed, created and tested. Some companies even go as far as designing and constructing flying cars . All these are further fuelled by companies working on advanced driver-assistance systems (ADAS), vehicle charging solutions and semiconductor companies producing powerful artificial intelligence chipsets.

Using sensors embedded to the vehicles, or mobile devices and devices installed in the city, it is possible to offer optimized route suggestions, easy parking reservations, economic street lighting, telematics for public means of transportation, accident prevention, and autonomous driving. As the IoT technology expands, new applications are created in order to make people’s lives better. Cities are getting “smarter” and smart city applications are developed to take advance of the latest technological improvements. With the introduction of IoT in the field of transportation, transportation systems begin to “feel” and “think”, leading to the development of Intelligent Transportation Systems(ITS).

Smart transportation has attracted the attention of many researchers since there are plenty of opportunities for further enhancements. One of the most significant areas of interest in smart transportation is navigation or route optimization. Using data from the users’ mobile devices,or with side units placed in specified locations on the road, applications try to estimate traffic congestion and propose optimal route options to minimize traveling times, and therefore reduce car emissions and energy consumption. Furthermore, to support the energy consumption reduction, street lights are proposed that can detect traffic conditions and operate accordingly, instead of being constantly on with a time schedule. IoT devices have been widely used to create smart parking systems too. Using cameras, or other wireless sensors like magnetic field or IR sensors, researchers have proposed new parking reservation systems that allow to maximize a parking lot’s availability and capacity and minimize the searching time. Moreover, systems that help detect road surface anomalies based on input data from sensors attached to cars or the driver’s phone have been proposed.

By detecting bad road conditions, accidents could possibly be avoided. There have also been efforts to detect or prevent road accidents using IoT devices. Finally, the IoT M2M communication option has given the opportunity to develop vehicle to vehicle communication and vehicle social networks, where vehicles can exchange useful information with each other and give many more possibilities for new applications

***Route Optimization***
As the number of vehicles increases, traffic congestion is a common issue in urban areas. Route optimization is a method to propose the best route for a specified destination, in order to minimize traffic congestion. By minimizing the traffic congestion, both the traveling time and vehicle emissions are reduced.

***Parking***
Parking applications are developed to effectively track availability in parking lots, and offer some reservation options to the users, and even some parking detection and notification mechanisms. Many IoT devices have been used to detect car presence in a parking spot and convey the information to a centralized system. A smart parking approach is suggested in, with the idea of an IoT supported parking lot and a smart signboard to convey related information. The parking lot will use ultrasonic sensors to check the parking space availability and a WiFi module will collect and send the data to a cloud server. At this point, a user can check the parking availability through a mobile application, or the smart signboard. The signboard consists of an LCD or LED screen driven by a raspberry pi that will collect and display information about parking availability, weather conditions, distance to certain destinations, etc.

***Lights***
The Smart Street Lights (SSL) are the part of smart transportation services. Smart lights can reduce energy consumption and offer dynamic operation and manageability. An SSL implementation based on the IoT infrastructure is implemented in. Street lights obtain smart characteristics by adding a light sensor, an IR sensor, GPS and a wireless communication module. In this way the lamps can be aware of crowded areas and adapt their light intensity dynamically, making areas with dense population safer and also saving energy. The GPS can help a centralized system to monitor the lamps, location and state, and speed up maintenance processes in case of a broken lamp.

***Accident Detection/Prevention***
Road accidents can be prevented if the drivers stay more focused throughout the traveling period. An accident prevention system can notify the driver about critical situations and allow them to act in a timely manner. Accident detection can also reduce the accidents number and the traffic congestion, by identifying accident prone areas or accidents that have taken place in the live traffic network. ML has been proven very useful in detecting road accidents, or detect patterns that could lead in new accidents and notify drivers in order to avoid them.

***Road Anomalies Detection***
Road anomalies detection has a significant role in smart transportation since the road conditions have an immediate impact on many aspects of transportation. The main purpose of a road anomaly detection system is to detect bumps and pot-holes on the roads and the notification to the drivers. Bad road conditions can lead to vehicle damage, road accidents, and traffic congestion. The problem of detecting road anomalies is a task very suitable for some ML techniques.

***Infrastructure***
The rise of IoT technology has benefited modern transportation in many ways. It has created not only new applications, making transportation smarter, but also novel ways of thinking. Changing the infrastructure of Intelligent Transportation Systems widely expands the systems' capabilities. A Vehicle to Vehicle (V2V) communication is based on the IoT principle of Machine to Machine (M2M) communication. The vehicles will be aware of their position using GPS and will exchange information about their speed, movements, location with the vehicles near them, and, at the same time, uploading the data at a server. In that way, accidents can be avoided by early notification following vehicle about a sudden speed change, or traffic congestion information could be distributed to other vehicle to enable better navigation services.

**SMART BUILDINGS**
Smart buildings are structures equipped with advanced technologies and interconnected systems that optimize energy efficiency, enhance occupant comfort, streamline operations, and provide intelligent automation and control. They operate by installing sensors on essential building systems like power, lighting, security, water meters, heating, cooling, and alarms. These interconnected sensors create a network that empowers building managers to monitor and control the environment effectively, acting as vigilant eyes and ears. While every smart home is a smart building, not every smart building is a smart home.

***Types of Smart Buildings***
***Smart private homes***
Smart homes are designed to improve residents' security and comfort, enable the remote control of many home appliances, automate home maintenance schedules, monitor energy usage, and control home security systems.Central

to the development of smart homes is the concept of assistive technologies. Assistive technologies traditionally described aids, like wheelchairs, designed to help people with disabilities in their daily lives.In the IoT era, the concept of assistive technologies is extended. Examples of assistive technologies are devices that enable the automated scheduling of when appliances like lights and washing machines are switched on or off. Smart medical and health devices are assistive technologies used in smart homes for the remote monitoring of elderly or sick residents, and children. Wearables sensors in smart homes automatically open doors, maintain an ambient temperature, and monitor and analyze energy usage in the home.Security sensors in smart homes can detect and report gas leaks, water leaks, and security vulnerabilities.

***Smart offices and commercial buildings***

A smart office building or commercial complex enables the automated, centralized control of the structure's water and electricity, lighting, heating, ventilation, security, parking spaces, waste management, elevators and emergency exits, access control to computer systems, and garden and equipment maintenance over an IoT network. In the retail industry, IoT sensors around stores can help businesses collect data such as at what time a customer entered a shop, what they showed interest in, and what they bought. Smart commerce helps marketing and product teams to optimize a store's layout, maintain optimal stock levels, monitor staff behavior, improve product tracking like return rates, monitor wait times in queues and foot traffic, and automate checkouts.

Commercial IoT applications deployed at supermarkets, malls, hotels, healthcare facilities, museums and exhibitions, and leisure complexes aim to create an enjoyable consumer experience outside people's home environments. To create a comfortable environment, sensors monitor and automatically adjust air quality, lighting, and temperature in public buildings. Commercial IoT applications manage access control and security, monitor inventory in retail stores, gather data about people's behavior in public places, and provide location services for visitors to hospitality venues.Commercial IoT is not to be confused with consumer IoT, which is concerned with personal wearables and smart home devices.Edge computing is a growing trend in commercial IoT. Edge computing provides capabilities for devices to collect, process, and act on data gathered close to its source, for example foot traffic in a supermarket, without having to backhaul to a data center.Communication in commercial IoT solutions is effected by numerous connectivity types, including Bluetooth, wifi, LoRa, 4G LTe, and ZigBee, depending on the application.

***Smart workplaces***

Smart workplaces feature hardware and software for improved communication and collaboration like video conferencing. In smart workplaces, sensors can keep track of business assets like company laptops. Smart workplaces enable automated monitoring of IT security vulnerabilities and remote management of off-site employees and contractors. In smart workplaces, many mundane tasks like scheduling a suitable conference room or catering for a meeting can be done remotely or by digital business assistants. In smart workplaces, new employees may receive push notifications to guide them around their new offices, for example notifying them where they are in the building or what security clearance they need to enter a particular office.

In a smart workplace, the coffee never runs out, toilets are always flushed, and visitors never have to circle the block for a parking space.

***Smart factories and warehouses***

In the industrial sphere, smart factories and warehouses are managed over industrial IoT (IIoT) networks. The IIoT is a combination of smart factories and warehouses, smart supply chains, smart logistics, and smart industrial machinery, creating a smart industrial ecosystem. An example of how smart buildings are managed in the industrial sphere is the use of robots in factories and warehouses. The use of robots in the smart industry is called the Internet of Robotic Things (IoRT).

***Smart building benefits***

Smart buildings allow individuals and businesses to save energy costs, for example by monitoring energy usage. By saving energy and using green technologies, smart buildings leave a smaller carbon footprint and are more environmentally friendly. By utilizing smart technologies, the resale value of smart properties and buildings can be increased.

Smoke, fire, and gas sensors in smart buildings help to create a safer living and working environment.

Smart building monitoring automates maintenance schedules and can identify malfunctions in home appliances and factory machinery.

Wireless technologies can reduce personnel costs in commercial buildings, for example sensors can activate lighting and sprinklers instead of needing to be turned on or off by a building manager. In smart buildings, safety equipment such as fire extinguishers and CCTV cameras can be monitored remotely**.**

***Smart building challenges***

Tracking and monitoring employees in workplaces involves privacy and data issues that many organizations have not faced before and may need legal assistance to address. Smart buildings may need a substantial capital investment in technology, for example a building management system (BMS) or building automation system (BAS) that acts as a digital hub to manage the devices and applications that control the building. For some people, smart technologies may be intimidating, particularly when things go wrong, for example a failed sensor or unintelligible error message from a connected device. Smart buildings are reliant on persistent internet connections.

***Smart building solutions***

Smart building solutions can be focused on the following areas:

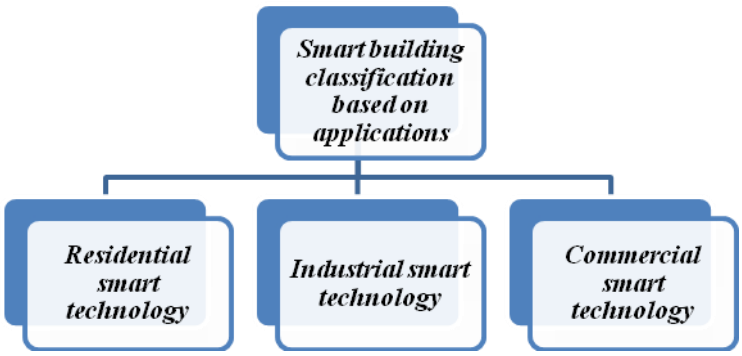
1. **Infrastructure management**. Managing infrastructure is subdivided into elevator & escalator, parking, smart water management, and more.
2. **Security management**. This includes the development of access control software and hardware, safety management solutions, video surveillance systems, etc.
3. **Resource management**. The implementation of energy management solutions grows rapidly because of environmental reasons. The aspect includes lighting, heating, water supply, and all components included in HVAC systems.

***Smart building monitoring***

Building state monitoring generates insights into the health of a building and how it is used, which can be used to optimize building operations, improve the living environment for residents, and increase profits for the building's owner.

Building state monitoring tracks building assets, records resource consumption, identifies unexpected damages and equipment failures, maintains optimized maintenance schedules, and alerts relevant authorities about problems in and around a building.

Smart building applications and low-level sensors automate building monitoring. Monitoring systems are able to translate, in real time, sensor data into actionable insights, and physically respond to water or gas leaks, fires, break-ins, or environmental changes without the need for human intervention.




**Applications**

***Offices***

Inefficient use of resources in the office by dozens of employees has a significant impact on the vendor's budget. It also blocks the company's prospects for sustainable growth. This is why offices are the most common use case of smart building solutions. The intelligent building systems are connected with IoT sensors and software. Altogether, they enable companies to cut operation costs, reduce waste, and manage spaces effectively. Smart building companies ensure the following functions:

- Smart corporate-level management.
- Parking space management.
- Employee authorization management.
- Optimization of lighting, heating, and water supply in crowded/empty areas.
- Adjusting air conditions to the season and employee preferences.
- Notification of leakage and security breach attempts, fire alarms.
- Video surveillance in public spaces, and more.

***Hospitals***

Smart technology penetrates the healthcare industry. Modern hospitals implement AI-powered diagnostics, healthcare big data, and tech-based patient care practices. Building a smart hospital system can unify all these aspects and bring digital and physical ecosystems together. Smart technology helps with the following:

- Smart terminals. Smart technology can be an all-in-one solution for bedside communication in hospitals. The piece of software with an intuitive user interface is attached to the patient's bed. Patients use it in many ways. They can manage their stay in a hospital, get in touch with staff, send alerts, use entertainment and educational resources, etc.
- Operation management. Sensors automate checking the conditions before surgery or other procedures. They also enable condition optimization.
- Chamber management for patients. They can use an app to manage facility conditions like air temperature, humidity, etc.
- Laboratory management. Sensors and devices control the air quality and other metrics to make sure that samples are stored appropriately. Also, there can be smart access management, which will contribute to robust security.
- Recovery enhancement. Smart devices and IoT sensors can be used to adjust the conditions according to the recovery goals. For instance, a patient had surgery and they are recommended to have a 5-minute walk daily. If sensors don't detect movement throughout the day, the technology can remind patients of the therapeutic goals set.

***Data Centers***

Data centers equipped with the latest technology can transform data management. Smart building data centers enable intelligent data monitoring and visualization. You may integrate the following functions:

1. Uninterrupted power supply, which does not depend on the general power grid and eliminates the risks of data damage or loss.
2. Activation of protective measures includes smoke detector sensors and automated processes like risk management, ID verification, biometric authorization, etc.

***Life Science Facilities***

Advanced inventions and discoveries require advanced research. Smart building technology can facilitate this process. It creates the best conditions for opening new things. This includes:

1. Airflow management and control.
2. Laboratory conditions management.
3. Intellectual property protection.
4. Fire detection.
5. Security risk detection.

**SMART PARKING**

SPS is an essential element of the transportation system in the smart city concept. Blind search for available parking space is accountable for most traffic congestion, accident, and pollution in cities, which severely impact people's life. The realization of a "smart parking" system relies on four main requirements. First, the allocation center has to know the status of all parking spots and the location of all vehicles issuing requests. The second requirement involves effective wireless communication between vehicles and an allocation center. Third, the center must be able to implement a reservation that guarantees a specific parking spot to a driver. Finally, an effective parking resource allocation method needs to be implemented to ensure optimal allocations and reservations.

The concept of IOT (Internet of Things) is used in this Smart Parking System which helps to monitor and control the hardware kits from a remote location just by connecting to internet. The IOT can be illustrated as the networking of physical components which include various sensors and have the capability to connect with other physical devices and can share data in real time over the internet IoT comprises of a large number of information sources (things), which produce huge amounts of non-structured or semi-structured data. As a result IoT requires collecting, accessing, processing, visualizing and sharing large amounts of data. Cloud provides unlimited, low-cost, and on-demand storage capacity, thus making it the best and most cost effective solution to deal with data generated by IoT.The data stored on the Cloud can be accessed and visualized from anywhere through standard APIs.

**SMART LIGHTING**

SL is a crucial component in guaranteeing city safety and establishing a sense of security in residents' minds.A Smart Lighting System (SLS) is an automatic and intelligent lighting control system that is managed in a centralized or distributed way by different IoT communication protocols, devices, and their sensors. An IoT-enabled SLS can be utilized as a solution to reduce the wastage of electricity in a smart city environment. The architecture of IoT-enabled SLS has three basic layers: perception or sensor layer, communication layer,and management layer. Sensors integrated into the light nodes provide automatic control based on the light intensity(using the light sensor) or human presence (using the motion sensors). With IoT communication protocols, these light nodes can forward sensor data and communicate with each other.A management system is needed for analyzing provided data and taking autonomous decisions to ensure efficient power management. The term *smart* in a lighting system in a smart city environment refers to its being autonomous and efficient which is achieved by the features of the IoT technology.

The proposed model saves energy by combining IoT, cloud computing, and 5G technologies. IoT sensors will be installed in all smart city electric appliances (SL, billboards, smart parking, and smart household appliances) to detect motion or respond to commands. The 5G technology will be used to transmit data quickly between communication channels and the cloud. The cloud will be utilized to store and retrieve data efficiently

**CONCLUSION**

This paper focuses on the concept of smart city and related factors which have enormous impact on our daily life. We have also presented some of the most trending and advanced technologies in the field of IoT that are ultimately shaping smart city. This paper covers five distinct areas in the development of smart city includes smart home, smart transportation, smart building, smart lighting system and smart parking. The future scope of this paper will be focusing on implementing various emerging technologies based on the applications in the field of smart city for global excellence.

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