An Approach Towards Smart City: A Review

Greeshma R, Meghana S, Sahana R G, Sanjay Kumar S, Naveen Kumar H N, Mahadevaswamy
Department of Electronics and Communication Engineering
Vidyavardhaka College of Engineering
Mysuru, India

***Abstract*— Digital cities are contemporary metropolitan ideas that are necessary for the community to live a good existence. The main objective of the smart city is to pilot the growth of the economy and enhance the quality of life of people through enabling the developments in the local area and exploiting technology, particularly the technology that results in Smart outcomes. It is a way of analytical regarding integrating diverse machinery to attain intelligent and supportable practices. A Connected Town makes use of "Information and Communication Technology" to improve functioning competence, distribute features along with the citizens, and enhance the civil facility and national well-being. Amsterdam is the first Sensible City developed in 1994. Cisco and IBM launched different agendas in the mid-2000s, and activities started to raise. "Internet of Things, Analysis of Data, Artificial Intelligence, Blockchain, and Geospatial Technology" are all crucial to smart city development around the world. A smart city model will be built with features such as home automation, in which household appliances can be controlled via voice command, smart energy meters that send electricity bill messages to users' mobile phones at precise intervals, LED streetlights that control the intensity of streetlight depending on the situation, and a smart traffic control system that reduces the time spent waiting.**

Keywords*— *Smart city; Automation; Artificial Intelligence; Internet of Things; Smart Energy; Electric Vehicles

I. INTRODUCTION

Cities are the driving force for the economic growth of every nation. Approximately 31% of India's population lives in metropolitan cities and provides nearly 63% of GDP (Census 2011). With a shoot-up in urbanization, cities are expected to domicile 40% of the total population and provide approximately 75% of India's GDP by 2030, which demands holistic growth in social, economic, institutional, and physical infrastructure. The word "smart city" is characterized as "Urban Intelligence" either "Intelligence in Urban Life," which allows for cozy with safe characteristics in people's lives. Here description or explanation of a smart city may vary from one location to another, from one individual to another, and from one governance to another, depending on its resources and strategies [1]. Smart cities are comprised of a variety of zones particularly requiring uniform growth in the matter of proficiency, satisfaction, and ingenuity. A city that focuses on the nature, profitable, and public aspects of city life in a suitable, and clever manner to achieve a higher quality of life via the integration of intelligent and practical solutions.

By combining the Internet of Things, Machine Learning, and Automation we can adopt Connected City technologies. Digital City features will include smart parking, which will find the parking space for cars and supports virtual payments, as well as smart traffic management, which will keep an eye on traffic patterns as well as optimize stoplight to alleviate blocking. Conservation of Power and habitat productiveness, for instance, when roadways are empty the lamps are made to dim are the illustration of Intelligent City features. Power supplies require some operations for maintenance and planning, where smart grid technology can help. Digital city projects, on the other hand, can be utilized to battle global heating, dust contamination, waste disposal unit, and hygiene, by utilizing networked waste pickup, bins, and rapid administration.

The smart city model can be built on the following aspects. Home automation is known as domestic or smart house automation in which lighting, ventilation, heating, security, and air conditioning, in addition to home appliances, are all controlled and automated. The usage of Wi-Fi for remote monitoring and control is common [3]. When home equipment is remotely controlled and monitored via the Internet, they are considered part of the Internet of Things Smart Home can be operated both manually and in voice switching [4]. Electrical energy is a need in our day-to-day lives. The need for electrical energy is steadily increasing. The high energy distribution is required to improve people's quality of life.

Customers are dissatisfied with statistical mistakes in periodically kilowatts invoices [5]. The AT command of a microcontroller in a Smart energy meter based on the GSM invoice approach encourages a paperless environment in which meter updates are directly delivered to the customer by SMS [6]. The proposed meter is a tweak to the existing smart meters. Providing a streetlight to a city is one of the most important burdens too. There are a variety of benchmark strategies and techniques for managing the Street light approach to guarantee that it uses passive and is also cost-effective [7]. A Light Dependent Resistor (LDR) is used to build an automatic street light controller, and an LDR sensor is used to monitor the Intensity of light [8]. The amount of traffic is more on working days, and holidays [9]. Furthermore, a critical issue is the motion of emergency vehicles such as ambulances, and fire engines in such traffic. The smart traffic control system uses a PIC microcontroller to control operations by different methods, monitor the volume of the traffic and bulk flow using IR (Infrared Sensors), and adjust traffic signals based on the volume of the traffic [10].

II. LITERATURE SURVEY

Qunlong Duan et al. [1] proposed an approach that uses computerized rooted energy and framework within the data transaction for the exceptional working and supervision of the

digital city. The digital city framework comprises the Smart grid, STSs (Smart Transportation Systems) which comprises of Electric Vehicles (EVs), microgrids, and Smart EH (Energy Hub). An upgraded Directed Acyclic Graph technique is employed framework for the sake of improving the safety of details transactions inside the digital city. Here the method is, that a blockchain security layer is added, preventing cyber intruders from accessing system data. It provides an Intelligent Priority Selection (IPS) method to support sophisticated math operators to allocate stations MCSs (Municipal Charging Stations) are the best option. The Unscented Transform is also used to deal with the unreliability of the technology framework.

Nallapaneni Pradeep Kumar Mallick et al. [2] have proposed a study titled Intelligent Cities in India: Characteristics, Plans, Present position, and Challenges. To explain the smart city physiognomies, the author employed the (3-C) Competence, Convenience, Concept. The city of Digital Mission in India has adopted the following future features: Buildings and other framework equipment may be expanded for all citizens, and such pliable would serve to enhance the quality of life. Second, service facilities need to be built within the city which decreases the usage of automobiles, hence lowering dust pollution and conserving resources. Such qualities will aid in the town's profitable development. One more significant characteristic is the construction of general utility services in dedicated local housing communities, such as recreational, playgrounds, and parks. Providing intelligence transit systems, importantly high-quality, low-cost general transit. Favourable governance plans will boost activities related to moneymaking such as industry, tourism, education, and sports facilities, among Public-Private Partnership (PPP) is another term for public-private cooperation. Technology should be used to make administrative and government services more transparent and speedier.

T Satyendra K. Vishwakarma et al. [3] have presented a Digital, energy- well-organized Home Automation system that will be accessed and controlled from wherever in the world. Here the method, used is a house system's main supply connected to the Internet connectivity which can be accessed over the Internet. The static IP address is utilized for wireless communication. Automation of Home is built on an inter-modal application that can be controlled through Google Assistant's voice recognition feature or a web-based application. As a result, the main objective of the project is to improve the level of automation in-home system to make it more secure and clever.

Harsh Kumar Singh et al. [4] have created an Automation of Home system based on the Internet of Things that uses a Wi-Fi-based microcontroller. Web servers, databases, web interfaces, solid-state relays, and NodeMCU are all part of the proposed system. The server manages and monitors the state of the appliance as well as user commands, and it may be readily customized to accommodate more hardware interface modules. The web server is powered by NodeJS, which is hosted on AWS (Amazon Web Services). The vision of the automation system is to provide remote access via a web browser from any mobile device or PC with an internet connection. Wi-Fi was opted to improve the safety, movability, and pliability of the system.

Himanshu K. Patel et al. [5] presented a metering system that uses the kilowatt-hour as the standard unit of measurement to measure power usage. When billing needs readings to be read once during the time, this technique eliminates fallacies and dishonest behavior by human intervention. The Arduino microcontroller and GSM are used to implement the model, which allows for bidirectional communication between the user and the meter. It supports a paperless environment by sending meter updates to the consumer directly via SMS. Manufacturing costs are reasonable, given that the country is being constructed with the emergence of smart cities, and the world is moving closer to being digitized.

G.I.Rashed et al. [6] presented the smart energy metering system found on the Global System for Mobile (GSM) that is beneficial for getting meter readings when required. The data point doesn't need to visit an individual customer to obtain energy data used and dispense bill slips. The microcontroller's design could be used to monitor and document readings from the meter. This approach doesn't require any manual disconnection for the customer connection if the customer disclaimer is present. Through the Short Message Service (SMS), the user can disconnect and connected again to the client connection. Customers can also monitor the ranking of power (load) from any location. The readings of the smart meter are sent through this system via GSM to advise the customers on an everyday basis and by employing GSM to keep users informed daily. Furthermore, it is advantageous to avoid full feeder disconnection during load shedding and to remotely allot minimum power during load shedding.

A. Athiramkumar et al. [7] have developed a system to control streetlights effectively. This approach is more adaptable, efficient, and accurate, with fewer human procedures. When sunlight is present, an LDR Sensor is used to regulate led LDRs with the function of turning off the light. Two more LEDs (led 2 & led 3) can be controlled by IoT. All data parameters will be transmitted via IoT to a web server, managed by an app, and shown on an LCD. When the battery is down, the grid is automatically connected.

A. Elakya, P et al. [8] have developed an ideal solution for smart street light functionalities. Green energy harvesting aims to provide power without relying on an electrical or electronic grid. The thermoelectric energy collection is mostly dependent on the Thermo-Electric Generator's activity (TEG). Here, non-biodegradable garbage is burned to generate electrical energy, and piezoelectrical sensors are used to collect energy, hence beneficial to operate the streetlight, waste materials, solar, and foot power are used to generate electricity, which is then stored in a battery. The system is fed with a category of noon and night light times for the following year to ensure that the lights turn on and off on their own at the specified time, allowing the model to function up to scalable and smart.

Shyam Shankaran R et al. [9] have shown an image-based traffic monitoring system that decreases cycle time and has unique allowances for exigency vehicles. The transition from a traditional traffic control system to a flexible traffic control system is much desired to alleviate the issues of traditional traffic control systems. Adaptive Traffic Control System (ATCS) is a traffic administration technology that alters or adapts traffic signal timing based on actual traffic demand and is accomplished via a control system. The sensors are used for present traffic solidity calculation, while the application is built utilizing captured data analysis of the city's current traffic flow. It also includes capabilities for intelligent transportation systems such as violation detection, emergency vehicle prioritization, road monitoring, and better civic management.

Bilal Ghazal et al. [10] have developed Traffic light control systems that are frequently used to monitor and administrate the flow of automobiles at junction circles. The authors want to ensure that autos move easily beside the divider lines on the roads. Nevertheless, considering the various characteristics involved, coordinating different traffic signal systems at adjacent intersections is a challenging challenge. The system uses a PIC microcontroller which uses IR sensors to assess vehicle density and creates dynamic time slots of varying levels. Furthermore, a transportable controller device is being evolved to solve the issue of urgent vehicles becoming stranded on crowded roadways.

Xydis et al. [11] focused on the ideas and views of personnel working in municipalities, regions, and the wider public sector relevant to smart city deployment. The subjects taken into consideration to conduct a survey are respondents from Hungary, Denmark, Italy, Slovakia, and Lithuania on the matter. The study reveals that comprehensive training is very much essential to cope with the challenges in building smart city. In general, it was revealed that there is a need for further training for the public sector to deal with the increasing challenges. Mohamed et al. [12] developed an effective strategy for water energy scheduling. Efficient stochastic optimization model is built upon point estimation method.

Calvillo et al. [13] proposed a model for planning and operation of distributed energy resources via linear programming. The prominent contribution of the work is analysis of synergies in an interconnected scheme. P. Sarda et al. [14] proposed an approach for trustworthy data sharing which ensures privacy preserving. Block chain technology is proposed to achieve real-time work history verification at lower cost. E. Baccarelli et al. [15] proposed a novel technique known as Fog of Everything (FOE) which integrates Fog computing and Internet of Everything.

III. CONCLUSION

Despite the apparent benefits of smart cities, there are many difficulties that stand in urban digital transformation. The invention of innovative technologies has revamped our day-to-day lives to a broad extent, and the infrastructure in most cities has remained static. The use of IoT sensors to acquire information from air pollution to traffic congestion levels demands advanced infrastructure supported by innovative hardware. Most cities in developed countries are already struggling with other infrastructural problems such as broadband internet, electricity, water, steam pipes, etc. Another aspect that many people find disturbing is the amount of personal data collected by IoT smart sensors. Complete transparency as to how the data will be used, and educational initiatives aimed at informing citizens on how smart cities work, should alleviate these concerns, at least in part. Security challenges in smart cities are the reason why many people are skeptical about smart city projects. IoT devices are essentially security loopholes. The growing number of IoT sensors and the increased interconnectivity of mutually interdependent siloes of city infrastructure raise rightful concerns. If the security standards remain unchanged, cybercriminals could one day shut down an entire city. Fortunately, tech companies are creating security solutions based on big data analytics, blockchain, and encryption technologies which are designed to handle increasingly more sophisticated cyber-attacks.

REFERENCES

[1] Duan, Qunlong, Nguyen Vu Quynh, Heba M. Abdullah, Abdulaziz Almalaq, Ton Duc Do, Sobhy M. Abdelkader, and Mohamed A. Mohamed, "Optimal scheduling and management of a smart city within the safe framework," *IEEE Access 8 (2020):* 161847-161861.

[2] Rajendran, Logesh, and R. Shyam Shankaran. "Bigdata Enabled Realtime Crowd Surveillance Using Artificial Intelligence and Deep Learning," *In 2021 IEEE International Conference on Big Data and Smart Computing (BigComp)*, pp. 129-132. IEEE, 2021.

[3] Vishwakarma, Satyendra K., Prashant Upadhyaya, Babita Kumari, and Arun Kumar Mishra. "Smart energy-efficient home automation system using IoT," *In 2019 4th international conference on internet of things: Smart innovation and usages (IoT-SIU)*, pp. 1-4. IEEE, 2019.

[4] Singh, Harsh Kumar, Saurabh Verma, Shashank Pal, and Kavita Pandey, "A step towards Home Automation using IOT," *In 2019 Twelfth International Conference on Contemporary Computing (IC3)*, pp. 1-5. IEEE, 2019.

[5] Patel, Himanshu K., Tanish Mody, and Anshul Goyal. "Arduino based smart energy meter using GSM," *In 2019 4th International Conference on Internet of Things: Smart Innovation and Usages (IoT-SIU)*, pp. 1-6. IEEE, 2019.

[6] Rashed, G. I., Hussain Haider, and M. B. Shafik. "Improving the reliability of energy supply utilizing smart energy meter system based on GSM: a case study in Pakistan," *In 2020 5th Asia Conference on Power and Electrical Engineering (ACPEE)*, pp. 1080-1084. IEEE, 2020.

[7] Athiramkumar, A., D. Palpandi, and K. Satheesh. "SOLAR BASED STREET LIGHT WITH AUTO INTENSITY CONTROL," *Turkish Journal of Physiotherapy and Rehabilitation 32: 3.*

[8] Elakya, A., S. Sellva Sindhoori, S. Selvendran, P. Shanmugapriya, and E. Sneha. "Smart Street Light Using Hybrid System," *In 2021 7th International Conference on Advanced Computing and Communication Systems (ICACCS)*, vol. 1, pp. 1224-1228. IEEE, 2021.

[9] Shyam Shankaran R and Logesh Rajendran, "Real-Time Adaptive Traffic Control System For Smart Cities", *In 2021 International Conference on Computer Communication and Informatics (ICCCI -2021)*, Jan. 27 – 29, 2021, Coimbatore, India.

[10] Ghazal, Bilal, Khaled ElKhatib, Khaled Chahine, and Mohamad Kherfan. "Smart traffic light control system," *In 2016 third international conference on electrical, electronics, computer engineering and their applications (EECEA)*, pp. 140-145. IEEE, 2020.

[11] Xydis, G.; Pagliaricci, L.; Paužaite, Ž.; Grinis, V.; Sallai, G.; Bakonyi, P.; Vician, R. SMARTIES Project: The Survey of Needs

for Municipalities and Trainers for Smart Cities. Challenges 2021, 12, 13. https://doi.org/10.3390/ challe12010013.

[12] Mohamed A. Mohamed, Elham Tajik, Emad Mahrous Awwad, Ahmed M. El-Sherbeeny, Mohammed A. Elmeligy, Ziad M. Ali, A two-stage stochastic framework for effective management of multiple energy carriers, Energy, Volume 197, 2020, 117170, ISSN 0360-5442.

[13] C. F. Calvillo, Á. Sánchez-Miralles and J. Villar, "Synergies of Electric Urban Transport Systems and Distributed Energy Resources in Smart Cities," *in IEEE Transactions on Intelligent Transportation Systems*, vol. 19, no. 8, pp. 2445-2453, Aug. 2018, doi: 10.1109/TITS.2017.2750401.

[14] P. Sarda, M. J. M. Chowdhury, A. Colman, M. A. Kabir and J. Han, "Blockchain for Fraud Prevention: A Work-History Fraud Prevention System," *2018 17th IEEE International Conference On Trust, Security And Privacy In Computing And Communications/ 12th IEEE International Conference On Big Data Science And Engineering (TrustCom/BigDataSE)*, 2018, pp. 1858-1863.

[15] E. Baccarelli, P. G. V. Naranjo, M. Scarpiniti, M. Shojafar and J. H. Abawajy, "Fog of Everything: Energy-Efficient Networked Computing Architectures, Research Challenges, and a Case Study," *in IEEE Access*, vol. 5, pp. 9882-9910, 2017, doi: 10.1109/ACCESS.2017.2702013.