IJBPAS, November, Special Issue, 2021, 10(11): 375-390
ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)
'A Bridge Between Laboratory and Reader'

www.ijbpas.com

BIO-INSPIRED FRAMEWORK FOR THE DEPLOYMENT OF THE SMART CITY ENVIRONMENT USING INTEGRATED TECHNOLOGY

PRAKASH A[1*], CHRISTU PAUL. R[2], S. STEWART KIRUBAKARAN[3], MOHAMMAD HAIDER SYED[4], KANNADASAN B[5] AND JYOTHI N.M[6]

1: Associate Professor in Computer Science and Engineering at Veltech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Avadi, Chennai, India

2: Professor in Automobile Engineering at Hindustan Institute of Technology and Science, Chennai, India

3: Assistant Professor, Department of Computer Science and Engineering, Karunya Institute of Technology and Sciences, Karunya Nagar, Coimbatore- 641114

4: Assistant Professor in Computer Science at College of Computing and Informatics, Saudi Electronic University, KSA

5: Assistant Professor in Civil Engineering at B.S.Abdur Rahman Crescent Institute of Science and Technology, GST Road, Vandalur Chennai, India

6: Computer Science and Engineering at Koneru Lakshmaiah Education Foundation, Vaddeswaram, Guntur, District, Andhra Pradesh, India

***Corresponding Author: Prakash A; E Mail: prakashcse@veltech.edu.in**

Received 20th July 2021; Revised 22nd Aug. 2021; Accepted 30th Sept. 2021; Available online 1st Nov. 2021

https://doi.org/10.31032/IJBPAS/2021/10.11.1034

ABSTRACT

This study's goal is to provide a communications and relational foundation for the preservation of social goods, as well as to assess the present state of understanding of the innovative environment. The first paragraph in an essay began with an introduction or explanation of the term "metropolitan environment." This viewpoint includes, amongst others things, city activities, intelligent architecture or facilities, the use of knowledge and technologies, connectivity, surveillance, and the use of electronic processes. The sections that

follow look at particular challenges in city design, growth, and governance. Technological techniques allow for the efficient use of diverse information about cities or the implementation of high-quality municipal infrastructures. The introduction of city design technology and methods is provided in the following section of the book. Linked online goods or applications should be built, maintained, or authorized to fulfil the challenges of modern cities. A brief section examines some of the difficulties surrounding technological assistance companies.

Keywords: Bio inspired Framework; Artificial Intelligence (AI); Networks; Intelligent Cities; Environment

INTRODUCTION:-

A city could be thought of as a service company with its inhabitants as consumers, offering services to them. There is a desire for stronger, better productive, economic, or sustainable cities, that is moving this same collective wisdom of towns forward, improving the ability to foresee as well as regulate metro flows, or integrating an architectural, electronic, and administrative components of a metropolitan conglomeration. A focus of city growth and profitability might have shifted to electronics. Extracted information or wireless communications would be used in smart urban **[1]**. Network connection, clever administration, wise service and created good, brilliant educational standards, and intelligent security devices are all examples of remedies as in European urban. An idea of a smart city encompasses an agglomeration's architectural, administrative, or electronic components **[2]**. This method integrates concepts like interconnectedness, comments, self-organization, and acquisition to gain a clearer comprehension of how towns develop, operate, or evolve in a rather organic manner.

Cities were evolving from analog to smart urban, with electronic or clever cities serving as more technologically oriented counterparts to smart urban notions. When a metropolis was configured, integrated, flexible, autonomous, adaptive, self-repairing, or durable, it becomes "clever." Parts of its buildings and equipment were inextricably connected or streamlined, allowing citizens and other participants to receive assistance. Inside the larger hacking, electronic, clever, or cognitive cities texts **[3]** a concept of smart urban centers interpreted from preferences of technology or materials has some precise qualities. Intelligence municipalities, or clever spaces, refer to a variety of modern electronic activities about

electronic interiors of urban areas, such as smart metering, smart thermostats, or other infrastructure for power, fresh water, and waste disposal. Clever cities, innovation of new wisdom of cities that reflect monolithically as well as dispersed intellect **[4]**, or digitally urban areas, obtained from the digital image of urban centers, mean a virtual analogy of towns.

Limitations in urban renewal, construction, or management were inspiring fresh concepts in a range of contexts. Specialists in fields of design, infrastructure planning, construction, architecture, information technology, devices of atmospheric engineering, real estate investment, banking, or municipalities better understand participants or learn how to integrate them more effectively **[5]**. For smart urban improvements, related manner adept of seeing deeply into how cities work, how residents use the municipality, how they feel about it, where the city has obstacles, and what sorts of modification could be accomplished could be adopted.

Residents, employees, students, academics, creditors, and innovators use the same equipment 24 hours a day, seven days a week. A municipality could be regarded as a process of stakeholders with conflicting interests, including broader groups or voluntary organizations, a finance industry as well as innovators, residents or inhabitants, local council or local governance, community associations, scientific researchers, and academic facilities. Smart urban initiatives should address individual communities in a limited context or with interested parties **[6]**. Metropolitan administration, IT and telecommunications businesses, utilities, municipality professional support, or power system service providers are all key stakeholders as in the smart city. Families, neighborhoods, cities, corporations, or institutions, both public and private, could all be regarded as having common good. Prioritizing these perspectives would aid in determining consumer impact and influence regarding a particular project, as well as bringing numerous stakeholders into clever municipality processes or optimizing demands **[7]**. To distribute international research investments such as arising ICT tools, methodologies, and know-how, experimental technology portals, and application providers for exploratory one-service implementations or emerging network innovations, partnerships and strong collaboration strategy and techniques among various stakeholders were required.

As information technologies became more common in urban settings, they had provided opportunities to obtain data that was previously inaccessible. This review is required for a thorough knowledge of existing customers. There are enormous quantities of data obtainable that represent what transpires in the city and might be leveraged to construct or update innovative approaches in connected fields of e-services implementation. Public data on mobility, energy consumption, moisture condition, data submitted at source by shippers, and a variety of other statistics were amongst the information and data received from municipal management and stakeholders. Assessing the city-systems would be aided by realizing what information systems the municipality possesses **[8]**. Therefore, "neither one has comprehensive overall precession their city's research and data systems," to the truth. Statistics, publications, analytical techniques, video footage, portraits, maps, visualization techniques, or 3D models were a few of the kinds of data available about municipalities. With the advancement of both processor speed as well as complex algorithms, this data could then be examined in located close, providing a foundation including all software components.

Literature survey:-

Municipalities were committed to effective regional resource strategy to provide inhabitants with effective services in hopes of increasing their standard of living. This necessitates innovative thinking about how to meet the provision of quality and other amenities, as well as how to improve service delivery through the expansion of urban infrastructure. This argument is simple: get rid of material and substitute it with electronic information or conversations via an e-office. ICT solutions were progressively being sought by legislators or public managers to deliver efficient and meaningful public services in areas of utilities, infrastructure, education, medicine, or security. Numerous municipal governments or metropolitan bureaucracies were beginning to see the value of system implementation and more integrated thinking **[9]**. Businesses benefit from more truthful as well as productive interactions with the town, such as more expedited and accessible procurement strategies, licensing or taxes operations, or availability of online facilities.

It should be about acquiring or delivering better e-services to participants, as well as the interaction between a governmental agency and affected individuals, through the creation of automatic

failover between cities and collaborators. E-participation, for example, could be acquired by direct correspondence via media platforms or simple technologies. Instead of agencies with paper applications or long hoards of people queuing for services, the municipality could communicate with its citizens via incredibly quick, interactive screens. All metropolitan government services or electronic administration are now benefiting from technology advancements. As a result, public management or authority provides a set of ICT-based infrastructural facilities. Collaboration, exchange of information, and actual information are all critical requirements for smart grid software and systems to be implemented. Exchange of information refers to the interchange of material among diverse companies, individuals, or technology, with emerging ICTs playing a critical role. Transmission of data, interoperability, or technology frameworks is all involved as in collecting, interpretation, and communication of knowledge. On behalf of a particular supplier, there are enterprise-based techniques to designing these strategies. Municipalities were adopting a myriad of features to boost or improve cross-departmental cooperation or customer contact. Digital administration (e-governance) could provide a new tool for establishing an urban environment, assisting municipalities in improving the quality of local authorities, producing better judgments to become more attractive, or integrating residents in decision-making operations. A government of a metropolis or a small population now provides services that were previously available digitally (through its web interface) **[10]**. Dynamic web design, content marketing, or security enables cities as well as other providers to develop their websites for goods they provide to their target audiences.

Customer's Services:-

The availability of actual information on urban surroundings is critical for the execution of a range of useful software and services. **Figure 1** summarises a clear snapshot of numerous smart urban application domains. The range of application fields is extremely broad. Actual travel statistics, for example, is critical for applications that allow consumers to book travel using public transit **[11]**. A client might get genuine updates on when that bus or train will arrive. Another example is an app to accumulates and transmits actual information about available parking facilities so that cars could find them quickly. The programmer could design software if they

have access to adequate data. Participants are expected to acquire a variety of online activities, including websites for general details, consumer services, commerce, and tourism, all of which would be built on a greater persistence. Smart buildings were implementing digital services in several domains.

Municipalities were provider frameworks, and these activities are the means through which people participate with one another inside infrastructure systems. They frequently use or capital is employed and they almost always claim compensation or interchange. Multilateral and bilateral providers both offer the design and administration of municipal apps and services. Many systems integrators and service providers are going outside planning, engineering, implementing, or launching smart urban products by merging various programs or providing to complete or administer them on the authority of local authorities or other participants. Modern city services should be simple to use, economical, reactive, accessible, or environmentally friendly **[12]**. Consumers as well as other participants want high-level government services that improve and alter their everyday lives. Municipalities are under pressure to increase urban transport administration or provide better, better efficient infrastructure and services, generally at a lower cost. The overall goal is to provide higher-quality services more efficiently, save staff time and minimize product delivery charges, and provide secure, accessible, or quality services.

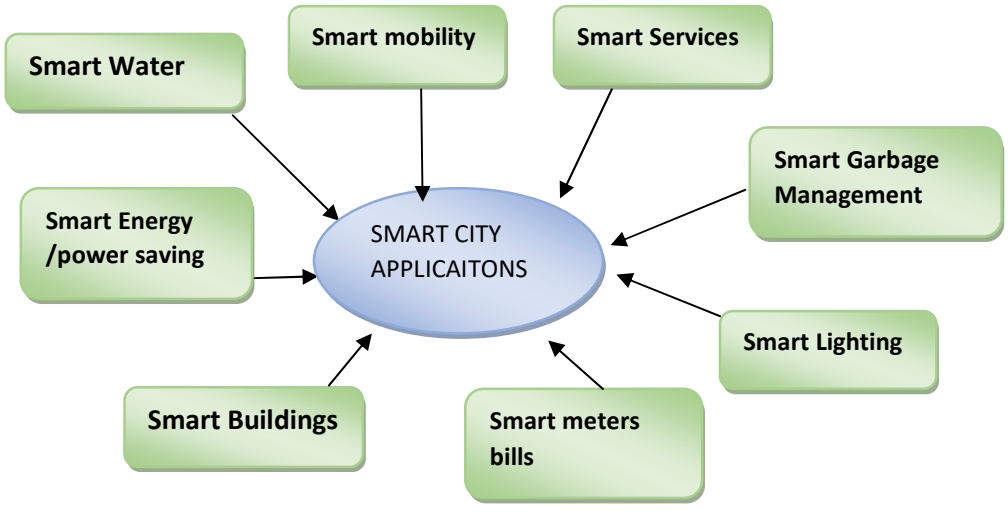

Figure 1: Smart city applications

There are numerous services and devices available **[13]**. Consumers' daily lives, crisis response, building automation, transport, and intelligent procurement are all impacted by growing apps and services. This portfolio's capabilities include power cities, smart appliances, safety, smart buildings, distant health, and wellbeing surveillance, reallocation frequently apply, digital money, and other machine-to-machine (M2M) implementations for the linked metropolis.

An overall focus is to enhance productivity in exceeding servqual model goals, streamline operations, to satisfy the expanding need for company intends to provide sophisticated e-enabled municipal services. The next goal is for e-services to generate a possible stream of revenue for service suppliers. Other goals include generating and providing great e-services than opponents, having better for improved decision-making, and assisting clients in optimizing a range of important systems and practices. Generated programs could provide actual information, improve the ability to predict or control metropolitan flows, or perform other municipal duties. They could also disclose how a city's transportation, sewage, and energy need peak, as well as how to react appropriately. It is critical for city authorities should work together to flatten out these oscillations and create durability. Another technique to increase the amount of knowledge available is through social application-based cooperation and spontaneous intellectual capacity. With web collaboration, outsourcing portals, media apps, and other interactive problem-solving methodologies, social media is provided as an infrastructure layer for organizing intellectual capacity. The main application field is strategic planning, intelligence collecting, and prediction via data to create prognostic models that allow risk modeling and the joint use of public funds. Users were able to immediately take necessary measures if they are alerted promptly, comprehensively, and accurately and if they have access to actual intelligence at the level of single consumer actions and decisions. A city would operate better in general of these dispersed problem-solving judgments. It's all about aspects of unified data that allow them to anticipate instead of reactive to difficulties as they arise. As a result, numerous methods emerge, allowing towns and cities to improve their problem-solving abilities.

Technology Advancement:-

New technology advances were used to enhance municipal apps and services. There should be communications, investigative, and control capabilities that

could be used to change how work should be done while also influencing improved policy and city management. It is revolutionizing the way services are delivered by merging ICTs with municipal infrastructure and altering city management systems **[14]**. These techniques allow for the delivery of services via digital communication, such as web applications or automation of solution providers. **Figure 2** depicts civic operations as well as their innovative solutions. An internet foundation is used to store and forward content for usage by telecom operators and software packages. A merging of bandwidth private correspondence with device-to-device interactions and M2M, according to the paper, would be a big problem.

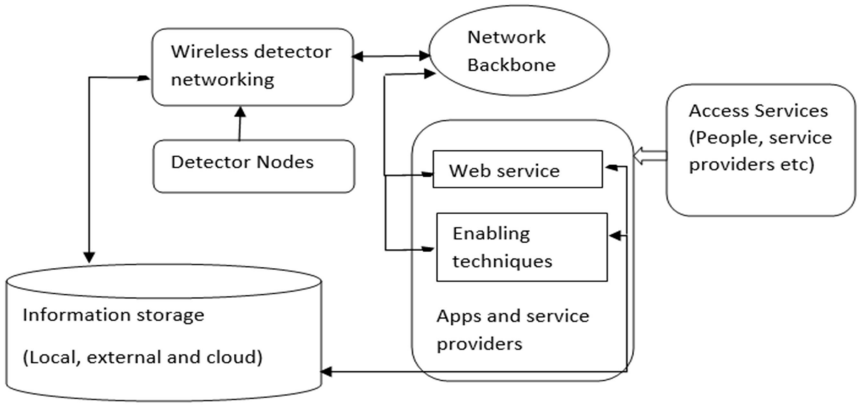

Figure 2: Technological solution to city services

From a smart urban perspective, clever municipal services and apps were concentrating on how to create future Internet-based apps and services. To be able to face the difficulties of modern cities, innovative internet-based products and apps should be launched, implemented, or approved. People that work with data and understanding are particularly affected by this shift or possibility. A generation of relevant information is not limited to a single area, as well as the resultant goods are usually distributed via the internet. A services-oriented business framework, which includes internet services, the extensible markup language (XML), and migrated applications, ultimately enables municipal services to be accessed via smartphones.

Smart buildings were implementing digital services in different domains. An internet platform, often known as Platform as a Service (SaaS), is a service offered by a computer application running on the Internet or makes its features available to users via an interaction. An interface could be HTML, accessible through a normal client such as an internet browser or a web-API, or through any other method [15]. This could constitute

a great service running on the server - for example, ping scalability, free disc space, the amount of signed-in clients, and so on. Users could eventually receive assistance via home-based or smartphone access, urban digital interactive screens, or kiosks. A way software packages were designed that run as changed dramatically thanks to cloud technology. PaaS (Platform as a Service) is a method of renting network services, data, network bandwidth, and hardware well over the Web. It's a type of cloud computing system that includes both a solution stack and a computing platform. Features of digital services do not need to own or license the technology to utilize it.Customers who should pay do so for the usage of the platform rather than for the ownership or licensing of the service itself. These breakthroughs have enabled the provision of more services to a greater audience, as well as improved access to healthcare and accompanying enhancements and improvements. These modifications to products have reduced administrative costs and better profitability. A person can access a variety of municipal internet services. According to their user profile and accompanying access management, providers could deliver services to distinct user categories, each of which is defined by certain responsibilities and is authorized to engage in a variety of behaviors. Prospective internet providers in smart buildings would rely heavily on development mechanisms involving residents, corporations, and government agencies. Urban planning services, infrastructures, techniques, and ICT systems were deployed and tested before use by end customers. Verifying municipalities' performance levels and enhance their resilience requires them to become progressively able to meet both anticipated and unanticipated problems.

A goal is to put in place surveillance equipment and create a distributed system of advanced sensor units that could monitor a variety of characteristics for better city administration. A variety of fundamental technological advancements, particularly improvements in micro-electro-mechanical device sensing devices and novel approaches to regulate power consumption, have influenced significant advancements in wireless networks. These circuits, which are responsible for detecting as well as initial processing steps, could provide adaptable, low-cost surveillance of a wide range of factors and occurrences at very small spatial scales.

Smart urban systems based on Wireless Communication for action

recognition would see significant growth in this area [16]. A wireless sensor network (WSN) was made up of a large number of distributed and geographically scattered independent sensors positioned either inside or close to occurrence. These sensor nodes could receive and analyze information, and each can sense, interpret, and transfer data about its surrounding context to other adjacent nodes and processors on its own. Wearable devices have distinctive features or restrictions, according to Zheng and colleagues, including humid node density, battery-powered edge devices, extreme electricity, calculation, and memory restrictions, self-configuration, application-specific design specifications, undependable sensor nodes, frequent topology change, many-to-many traffic trend, inconsistent data, and lack of a worldwide protocol stack.A goal of these circuits is to detect and document physical or environmental conditions like warmth, sound, pressure, and other variables, as well as to cooperate send associated data via a network to a central point. Wearable devices would give large grids of real-time, distant contact with the physical environment, similar to how the Web permits access to digital from everywhere. Wireless networks enable the collection of data suitable for enabling the building of pervasive computing, and decentralized knowledge from the detector to the internet would become as important as the Net. Each network device includes processing capabilities provided by one or more configurable embedded systems for regulating router behavior and analyzing information, ranging from a few to several hundred or thousands. Comparatively tiny, battery-powered, sensor-enabled processors that could execute the overall operation of the sensor network could now be produced at a low-cost thanks to sophisticated technology. These sensor networks, which operate as a method of detecting, data analysis, and communication, might be built from these tiny integrated devices, leveraging the idea of sensing devices built through a collective effort of large networks. Various types of storage, a radio (RF) transmitter for interaction with an electrical connection or attachment to an omnidirectional antenna, an electrical conductor for think are relevant, and an on-board battery capacity for electricity was included in these subsystems.

Extensive research has already gone into sensor networks, and a full set of requirements for protocol stack, data link, and entire network was already established. The same could be said for routing protocols that were already needed to initiate a route or

channels from the sensor network to the destination node. Navigation would be a key problem, and because sensor networks have limited funds, network protocols should be lightweight. Many network functions were created in recent times, as shown in Figure 3, but many novel traveling techniques were considered.

Wi-Fi, Ultra Wide Band, and Connectivity Hart were examples of sensor node satellite technology. Wireless networks are a significant technique that enables to meet metropolitan situations monitoring demands, even though they have not been deployed substantially on a large scale lately. By analyzing actual information, this technology enables rapid and reliable detection of different spatial situations, such as issues associated with an area of high pollution intensity. Dense WSNs of nodes to surveillance capability could help with air pollution or maintenance of metropolitan areas. These powerful complex systems were ubiquitous and widely disseminated, and they're used as interactions alongside sensors and devices throughout a wide geographical area.

Sensing of the city and cloud computing :-

The wisdom of sensor nodes would be primarily demonstrated in the delivery of genuine datasets to connect real-time sensor information with ecological prediction. Implementing infrastructural facilities for integrating both WSN and video intelligence information, leading to more efficient detections, would be a central premise essential for actual information redistribution and use in public infrastructure. **Figure 4** summarises several characteristics of this actual data gathering. Sensors and devices could now be interconnected to dispersed processing facilities because of increased penetration of fixed and mobile connections. To merge cyberspace area and internet objects, municipality attaches sensors for detecting city structures and procedures the sensed data via cloud technology and other methods.

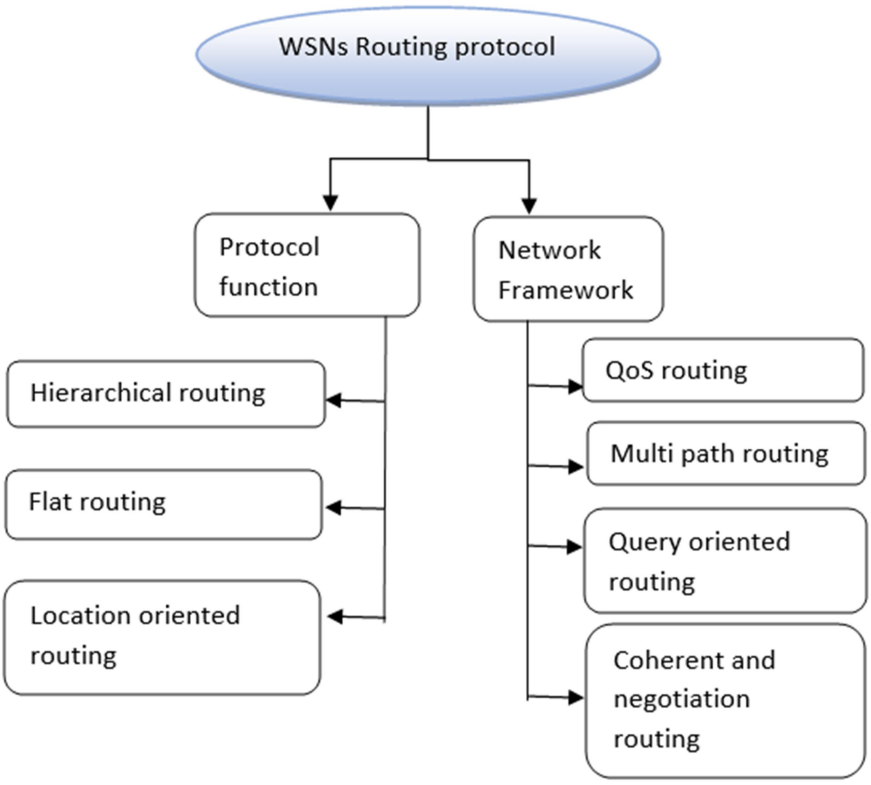

Figure 3: WSNs Protocol

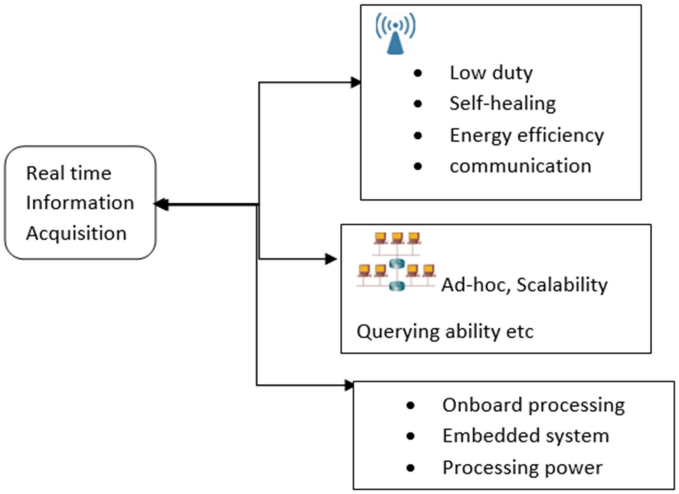

Figure 4: Real-time Information acquisition

Modern wireless sensor nodes were primarily viewed as a new source of data that could be integrated with other geospatial and open data information security. Sensors integrating structures, equipment, transportation, communications, and electricity, for example, provide an available location for testing and validating Internet of Things (IoT) capabilities. A data is given in

actual time to telecom operators, subscribers, and other participants via the web.

Monitoring and interconnectivity of smart sensing devices, which gather and analyze real-world data, enable the creation of a dynamic environment with many groups of users involved in various municipal activities. As an example, consider sensible travel. Actual information about urban context could provide clients with actual trip planning, such as present bus or train schedules. Surveillance of modes of transportation, climate, and traffic patterns could all help in vehicle tracking. Traffic sensors and devices, property monitoring systems as in clever dwelling option, electronic energy meters in the smart utility sector, and other electronic sensors and control mechanisms were widely used for operation and control of city development. In interconnection of physical and digital worlds with a large range of wireless nodes deployed in residences, automobiles, roadways, workplaces, and other public places provides several chances for additional services. It could include elements for vehicle-mounted interfaces, remote measurement devices, lighthouses (clever lighting), mobility (clever driving), domestic appliances (clever electricity), and commercial sensors (smart house). Pervasive spatial intelligence for sustainable urban has the order to enhance such connections by allowing them to acquire, analyze, query, and even employ spatial information within the network itself.

A wide range of indicators could be monitored for enhanced city administration thanks to a decentralized system of integrated sensor nodes, and information was supplied electronically and in actual time to people or supervisory authorities. In the case of an accident or other issue, participants could make fast assessments and remedy the problem by taking appropriate action using networks and sensors to identify and monitor operations, as well as the cloud for exchanging data. To make existing data useful as a conjunction of multiple sources to generate new services, a mashup is necessary. This could range from identity and access to implementation, web, and platform servers that power participant facilities and internet sites to guarantee a citizen-centric view and actual data updates across city systems. E-government platforms make it possible to connect with citizens more effectively. Data is accessed, for example, via web-based maps that residents could access. An actual monitor for evaluating municipal assets could assist city officials in managing smart urban policies and ensuring

that essential controls and systems are in place for greater accountability. The use of information and communication technology to enhance surveillance and warning measures is directly linked to consciousness. Dynamic modules that inform people of occurrences or notices and permit them to activate subsequent actions could be included at the application level. Rescue personnel have a common understanding of an issue or make judgments based on what other authorities are doing.

CONCLUSIONS:-

This research contributes to our understanding of urban planning services and applications. This article's first plan was to give an overview of smart cities, and its secondary purpose was to provide a technological solution and collaboration platform for the expansion of the municipal sector in addition to the quality of urban networks and applications. A city or urban region could be thought of as a collection of assets and resources supported by information flow, people, and objects, as well as feedbacks. A city environment encompasses a basic management system for amenities, transportation, data structures, products, medical, financial, and educational protection, as well as people, industry, transportation, telecommunications, drainage, garbage, and electricity in different districts of cities. As a result, each metro's urban area was divided into three ratios: physical, electronic, and cultural. Surveillance, assessment, and navigation system were critical aspects of a modern city that are required to fully exploit the benefits of information and communications technology. A suggested communication platform for the expansion of municipal services is depicted in Figure 6 as in the preceding part. This platform for collaboration could be utilized to enhance metropolitan geographical systems and procedures. Application of architecture for the execution of a suggested messaging service presented in an article in a request for particular city applications is one of our potential work priorities.

REFERENCES:-

[1] Silva BN, Khan M, Han K. Towards sustainable smart cities: A review of trends, architectures, components, and open challenges in smart cities. Sustainable Cities and Society. 2018 Apr 1; 38: 697-713.

[2] Talari S, Shafie-Khah M, Siano P, Loia V, Tommasetti A, Catalão JP. A review of smart cities based on the internet of things concept. Energies. 2017 Apr; 10(4): 421.

[3] Sharma M, Joshi S, Kannan D, Govindan K, Singh R, Purohit HC. Internet of Things (IoT) adoption barriers of smart cities' waste management: An Indian context. Journal of Cleaner Production. 2020 Oct 10; 270: 122047.

[4] Latchoumi, T. P., Reddy, M. S., & Balamurugan, K. (2020). Applied Machine Learning Predictive Analytics to SQL Injection Attack Detection and Prevention. *European Journal of Molecular & Clinical Medicine*, *7*(02), 2020.

[5] Al-Turjman F, Lemayian JP. Intelligence, security, and vehicular sensor networks in the internet of things (IoT)-enabled smart-cities: an overview. Computers & Electrical Engineering. 2020 Oct 1; 87: 106776.

[6] Vinayakumar R, Alazab M, Srinivasan S, Pham QV, Padannayil SK, Simran K. A visualized botnet detection system based deep learning for the internet of things networks of smart cities. IEEE Transactions on Industry Applications. 2020 Feb 6; 56(4): 4436-56.

[7] Trindade EP, Hinnig MP, Moreira da Costa E, Marques JS, Bastos RC, Yigitcanlar T. Sustainable development of smart cities: A systematic review of the literature. Journal of Open Innovation: Technology, Market, and Complexity. 2017 Sep; 3(3): 11.

[8] Qureshi KN, Rana SS, Ahmed A, Jeon G. A novel and secure attacks detection framework for smart cities industrial internet of things. Sustainable Cities and Society. 2020 Oct 1; 61: 102343.

[9] Dr.P.Sivakumar, "Exploring The Trajectory Prediction Using Lstm And Extreme Machine Learing", journal of critical reviews, issn- 2394-5125 vol 7, issue 10, 2020. (Scopus)

[10] Dr.P.Sivakumar, "Design and analysis the performance of real time content delivery network using beam scanning" journal of critical reviews, ISSN- 2394-5125 VOL 7, ISSUE 04, 2020.

[11] Ezhilarasi, T. P., Dilip, G., Latchoumi, T. P., & Balamurugan, K. (2020). UIP—A Smart Web Application to Manage Network Environments. In Proceedings *of the Third International Conference on Computational Intelligence and Informatics* (pp. 97-108). Springer, Singapore.

[12] Lai CS, Jia Y, Dong Z, Wang D, Tao Y, Lai QH, Wong RT, Zobaa AF, Wu R, Lai LL. A review of technical standards for smart cities. Clean Technologies. 2020 Sep; 2(3): 290-310.

[13] Latchoumi, T. P., Balamurugan, K., Dinesh, K., & Ezhilarasi, T. P. (2019). Particle swarm optimization approach for waterjet cavitation peening. Measurement, 141, 184-189.

[14] Magaia N, Fonseca R, Muhammad K, Segundo AH, Neto AV, de Albuquerque VH. Industrial Internet-of-Things Security-Enhanced With Deep Learning Approaches for Smart Cities. IEEE Internet of Things Journal. 2020 Dec 3; 8(8): 6393-405.

[15] Arroub A, Zahi B, Sabir E, Sadik M. A literature review on Smart Cities: Paradigms, opportunities, and open problems. In2016 International conference on wireless networks and mobile communications (WINCOM) 2016 Oct 26 (pp. 180-186). IEEE.

[16] Ruhlandt RW. The governance of smart cities: A systematic literature review. Cities. 2018 Nov 1; 81: 1-23.