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Internet Of Things Based "Nashik Smart City"

Ajinkya Kishor Deshmukh
BE Computer Dept. of Computer
BVCOERI, Nashik, India
Ajinkya.deshmukh48@gmail.com

Roshan Dinkar Gaikwad
BE Computer Dept. of Computer
BVCOERI, Nashik, India
gaikwadroshan90@gmail.com

Shital Ashok Gaikwad
BE Computer Dept. of Computer
BVCOERI, Nashik, India
sanvi24495@gmail.com

Megha Nandram Avhad
BE Computer Dept. of Computer
BVCOERI, Nashik, India
meghaavhad123@gmail.com

Mr. H. D. Sonawane
M.Tech Software Dept. of Computer
BVCOERI, Nashik, India
hod.bvcoecomputer@gmail.com

***Abstract*—**IoT (Internet of Things) is an advanced automation and analytics system which exploits networking, sensing, big data, and artificial intelligence technology to deliver complete systems for a product or service. These systems allow greater transparency, control, and performance when applied to any industry or system. IoT systems have applications across industries through their unique flexibility and ability to be suitable in any environment. They enhance data collection, automation, operations, and much more through smart devices and powerful enabling technology. IoT is a technical base behind developing smart city and it acts as a building blocks of the same. IoT helps in improving the quality of life of citizens and transforming cities with the help technological solutions.

Keywords*-Smart city, Internet of Things (IoT), Massage Queue Telemetry Transport (MQTT), Extensible Messaging Presence Protocol (XMPP), Data Distribution service (DDS), Advanced Message Queuing Protocol (AMQP), ZigBee.*

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I. INTRODUCTION

IoT systems allow users to achieve deeper automation, analysis, and integration within a system. They improve the reach of these areas and their accuracy. IoT utilizes existing and emerging technology for sensing, networking, and robotics. IoT exploits recent advances in software, falling hardware prices, and modern attitudes towards technology. Its new and advanced elements bring major changes in the delivery of products, goods, and services; and the social, economic, and political impact of those changes. The most important features of IoT include artificial intelligence, connectivity, sensors, active engagement, and small device use. The hardware utilized in IoT systems includes devices for a remote dashboard, devices for control, servers, a routing or bridge device, and sensors. These devices manage key tasks and functions such as system activation, action specifications, security, communication, and detection to support-specific goals and actions. The most important hardware in IoT might be its sensors. These devices consist of energy modules, power management modules, RF modules, and sensing modules. RF modules manage communications through their signal processing, WiFi, ZigBee, Bluetooth, radio transceiver, duplexer, and BAW. The sensing module manages sensing through assorted active and passive measurement devices. IoT software addresses its key areas of networking and action through platforms, embedded systems, partner systems, and middleware. These individual and master applications are responsible for data collection, device integration, real-time analytics, and application and process extension within the IoT network. They exploit integration with critical business systems (e.g., ordering systems, robotics, scheduling, and more) in the execution of related tasks.

Having recognized that cities are the engines of growth and are drawing a million people every minute from rural areas, the Government has introduced the 'Smart City Challenge', handing over the onus of planned urbanization to the states. In the approach to the Smart Cities Mission, the objective is to promote cities that provide core infrastructure and offer quality of life to citizens, a clean and sustainable environment and application of 'smart' solutions. There are a number of latent issues to consider when reviewing a smart city strategy. The most important is to determine the existing city's weak areas that need utmost consideration, e.g. 100-per-cent distribution of water supply and sanitation. The integration of formerly isolated legacy systems to achieve citywide efficiencies can be a significant challenge. Successful implementation of smart city solutions needs effective horizontal and vertical coordination between various institutions providing various municipal amenities as well as effective coordination between central government (MoUD), state government and local government agencies on various issues related to financing and sharing of best practices and service delivery processes.Another major challenge in the Indian smart city space is that (usually) software infrastructure in cities contains components supplied by different vendors. Hence, the ability to handle complex combinations of smart city solutions developed by multiple technology vendors becomes very significant.

This application will help for transparency between the citizens and the governing bodies that govern the specific locality. This application will help for increase in the technological point of view. It will enhance the awareness among the citizens of respective locality. It is said that the "prevention is better than cure". Smartness means take pre actions on respective regards which will help or developing smart cities. Thus this application is attractive to local and regional administration.

II. LITERATURE SURVEY

Cities are engines of growth for the economy of every nation, including India. Nearly 31% of India's current population lives in urban areas and contributes 63% of India's GDP (Census 2011). With increasing urbanization, urban areas are expected to house 40% of India's population and contribute 75% of India's GDP by 2030. This requires comprehensive development of physical, institutional, social and economic infrastructure. All are important in improving the quality of life and attracting people and

investments to the City, setting in motion a virtuous cycle of growth and development. Development of Smart Cities is a step in that direction. A Smart City would have a different connotation in India than, say, Europe. Even in India, there is no one way of defining a Smart City.

Some definitional boundaries are required to guide cities in the Mission. In the imagination of any city dweller in India, the picture of a Smart City contains a wish list of infrastructure and services that describes his or her level of aspiration. To provide for the aspirations and needs of the citizens, urban planners ideally aim at developing the entire urban eco-system, which is represented by the four pillars of comprehensive development — institutional, physical, social and economic infrastructure. This can be a long term goal and cities can work towards developing such comprehensive infrastructure incrementally, adding on layers of 'smartness'.

In the approach to the Smart Cities Mission, the objective is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' Solutions. The focus is on sustainable and inclusive development and the idea is to look at compact areas, create a replicable model which willact like a light house to other aspiring cities. The Smart Cities Mission of the Government is a bold, new initiative. It is meant to set examples that can be replicated both within and outside the Smart City, catalyzing the creation of similar Smart Cities in various regions and parts of the country.

Accordingly, the purpose of the Smart Cities Mission is to drive economic growth and improve the quality of life of people by enabling local area development and harnessing technology, especially technology that leads to Smart outcomes. Area-based development will transform existing areas (retrofit and redevelop), including slums, into better planned ones, thereby improving livability of the whole City. New areas (Greenfield) will be developed around cities in order to accommodate the expanding population in urban areas. Application of Smart Solutions will enable cities to use technology, information and data to improve infrastructure and services. Comprehensive development in this way will improve quality of life, create employment and enhance incomes for all, especially the poor and the disadvantaged, leading to inclusive Cities.

Some typical features of comprehensive development in Smart Cities are described below.
i. Promoting mixed land use in area-based developments — planning for 'unplanned areas' containing a range of compatible activities and land uses close to one another in order to make land use more efficient. The States will enable some flexibility in land use and building bye-laws to adapt to change;
ii. Housing and inclusiveness — expand housing opportunities for all;
iii. Creating walkable localities — reduce congestion, air pollution and resource depletion, boost local economy, promote interactions and ensure security. The road network is created or refurbished not only for vehicles and public transport, but also for pedestrians and cyclists, and necessary administrative services are offered within walking or cycling distance;
iv. Preserving and developing open spaces — parks, playgrounds, and recreational spaces in order to enhance the quality of life of citizens, reduce the urban heat effects in Areas and generally promote eco-balance;
v. Promoting a variety of transport options — Transit Oriented Development (TOD), public transport and last mile para-transport connectivity;
vi. Making governance citizen-friendly and cost effective — increasingly rely on online services to bring about accountability and transparency, especially using mobiles to reduce cost of services and providing services without having to go to municipal offices; form e-groups to listen to people and obtain feedback and use online monitoring of programs and activities with the aid of cyber tour of worksites;
vii. Giving an identity to the city — based on its main economic activity, such as local cuisine, health, education, arts and craft, culture, sports goods, furniture, hosiery, textile, dairy, etc.
viii. Applying Smart Solutions to infrastructure and services in area-based development in order to make them better. For example, making Areas less vulnerable to disasters, using fewer resources, and providing cheaper services.

Smart IT & Communication:-IT & communication technology will be key component of the investments allocated by the governments to build smart cities. Smart cities will use IT to improve the quality of life of its citizens by providing citizen services over communication networks.
Waste Management:-With the total volume of waste generated globally expected to increase by nearly 50% over the next decade, the adoption of innovative technologies will result in more waste management solutions that move beyond the traditional loose labor, diesel trucks & conventional landfills.
Renewable Energy:-Renewable energy is generally defined as energy that is collected from the resources which are replenished on human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat. Renewable energy often provides energy in four important areas: electricity generation, air and water heating/cooling, transportation and rural energy services.
Emergency Response:-Emergency response is the organizing, coordinating, and directing of available resources in order to responds to the event and bring the emergency under control. The goal of this coordinated response is to protect public health by minimizing the impact of the event on the community and the environment.
Smart Health & Hospitals:-Smart Health IT is an open, standards based technology platform that enables innovators to create apps that seamlessly & securely run across the healthcare system. Using an electronic record (EHR) system or data warehouse that supports the smart standard, patients, doctors, & healthcare practitioners can draw on this library of apps to improve clinical care, research, & public health.
Smart Governance:-Smart Governance is about the future of the public services, it is about greater efficiency, community leadership, mobile working & continuous improvement through innovation. Smart governance is about using technology to support better planning & decision making. It is about improving democratic process & transforming the way that public services are delivered. It includes E-government, the efficiency agenda & mobile working.
Smart Parking Control:-Smart parking system typically obtains information about available parking spaces in a particular geographic area and process is real-time to place vehicles at available positions. It involves using low-cost sensors, real-time data collection, and mobile-phone-enabled automated payment systems that allow people to reserve parking to reserve parking in advance or very accurately predict where they likely find a spot.
Climate Change Monitoring:-A climate change monitoring System integrates satellite observation, ground based data & forecast models to monitor & forecast changes in weather & climate. As Nasik city is agricultural based city this type of application will give fruitful results for farmers who reside in the city and do farming. It will help the farmers to get early notifications regarding the forecast which will help them to take pre-actions to avoid the hazardous results of the climate change on

their respective crops. Thus this will be advantageous to avoid losses and increase the per capita income of farmers as well as the city and help to grow the economy of city as well as the country.

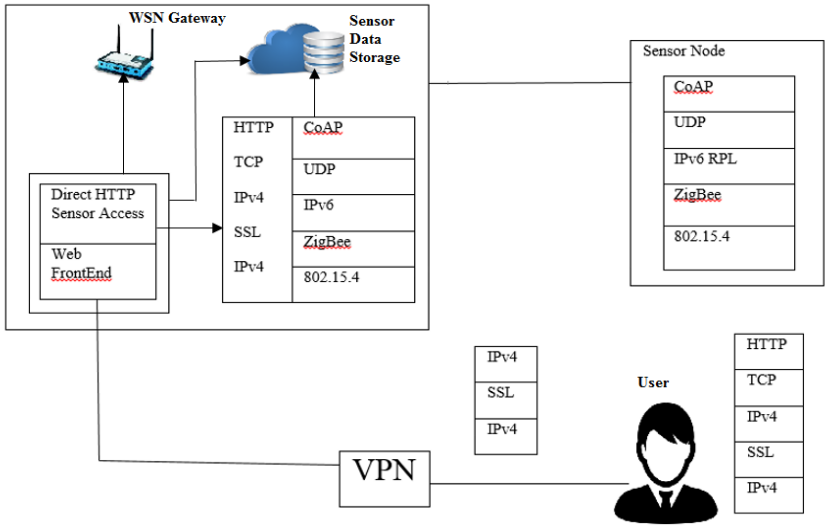

Fig. 1: System Architecture Diagram

III. SYSTEM OVERVIEW

From the literature survey it is clear that smart city services are based on a centralized architecture. That is the data is gathered from different sources. The data is gathered in the form of images, sounds, videos, different climate changes info with the help of transducers. In the present state the data communication not smart as it should be. Thus IoT is the base of all of this, which will gather all the different types of technologies presents are centralized together. These all work for betterment of city as well as citizen residing in it. In this system overview it is described that how the information is gathered form IoT devices is processed and stored and what sort of actions are performed on it. It will help for easily accessible for authorities and citizens to increase the response of authorities to cities problem and promote the awareness and the participation of citizen in the public matter.

A. Web Service Approach for IoT Service Architecture

For designing IoT service architecture regarding web service approach we are focus on using the IoT protocols and IETF standards. The IETF is a large open international community of network designers, operators, vendors, and researchers concerned with the evolution of the internet architecture and the smooth operation of internet. The main goal of IETF is to make the internet work better by producing high quality relevant technical documents that influence the way people design, use and manage the internet.The device in IoT communicates to each other and collects the data and send it to server infrastructure then server infrastructure has to share device data, possibly providing it back to devices to analysis the program or to people. The IoT architecture supports protocols such as, MQTT, DDS, AMQP.

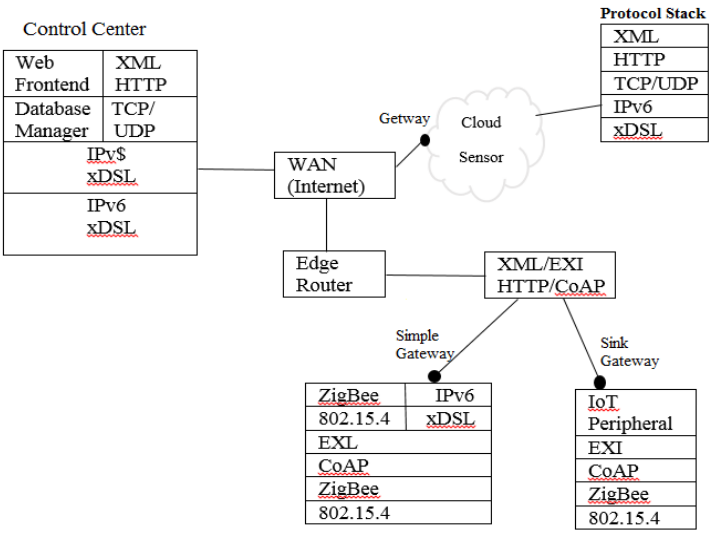

Fig. 2: System Block Diagram

MQTT:- The Massage Queue Telemetry Transport (MQTT) is designed to collect device data, and its main purpose is telemetry or remote monitoring. Its goal is to collect data from many devices and transport that data to the IT infrastructure. The MQTT is work on the top of TCP.
XMPP:- The Extensible Messaging and Presence Protocol (XMPP) and it was originally called 'Jabber'. It was developed for instant messaging (IM) to connect people to other people via. Text messages. The XMPP names shows the targeted use of presence, meaning people are intimately involved. XMPP uses the XML text format as its native type, making person to person communication natural. Like MQTT it runs over TCP or perhaps over HTTP on the top of TCP. Fig. 3 shows a reference protocol architecture for the urban IoTsystem that entails both an unconstrained and a constrainedprotocol stack.

DDS:- It stands for Data Distribution Service and it targets the devices that directly use device data. It distributes data to other devices. It is the data-centric middleware and can efficiently deliver millions of messages per second to many simultaneous receivers.

	Constrained	Unconstrained
Data	EXI	HTML/XML
Application/ Transport	HTTP/TCP	CoAP/UDP
Network	IPv4/IPv6	IPv6/ZigBee

Fig. 3: Protocol Architecture

AMQP:- The Advanced Message Queuing Protocol (AMQP) is all about queues and it sends traditional messages between servers. AMQP is focused on not losing messages. The communication from publishers to exchanges and from queues to subscribers use TCP, which provides strictly reliable point to point connection.

The IETF formed a number of work groups to evaluates sensing and control networks, with rapid depletion of IPv4 and IPv6 addressing along with other existing protocols such as ZigBee seemed to be a natural fit for use in low power sensing and control networks. ZigBee suites the high level communication protocols used to creates personal area networks with small low power digital radios. ZigBee applications includes wireless light switches, electrical meters within home displays, traffic management systems, and other consumer and industrial equipment that requires short range low state wireless data transfer. Its low power consumption limits transmission distances to 10-100 meters line of sight, depending on power output and environmental characteristics. ZigBee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distance once. ZigBee is typically used in low data rate applications that require long battery life and secure networking (ZigBee networks are secured by 128 bit symmetric encryption keys) ZigBee has a defined rate of 250 Kbit/sec, best suited for intermittent data transmissions from a sensor or input device.

IV. CONCLUSION

In this paper we conclude the solution for currently available implementation of the IoT based Nashik smart city. The discussed technologies in this paper are standardized and many industries are developing the devices enabled for this IoT paradigm. The technologies used to implements the architecture of Nashik smart city are furthermore have reached a level of maturity that allows for practical realization of IoT solution and services which are carried out in Nashik smart city paradigm.

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