# Opportunities and Challenges to Implement Cloud Computing and IOT for Smart Cities in India

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**Abstract**- Smart city is the new development stage of the advanced world in era of information technology and is a big issue we encountered during the process of city development. By implementing this concept, flexibility will be improved in city management. Cloud computing provides technology support for the construction of smart city. Smart City represents one of the most promising, prominent and challenging Internet of Things (IoT) and cloud computing. Cloud Computing represents the new method of delivering hardware and software resources to the users, Internet of Things (IoT). Both concepts can have a major impact on how we build smart or/and smarter cities. Cloud computing represents the delivery of hardware and software resources on-demand over the Internet as a Service. At the same time, the IoT concept envisions a new generation of devices (sensors, both virtual and physical) that are connected to the Internet and provide different services for value-added applications. In this paper we present our view on how to deploy Cloud computing and IoT for smart or/and smarter cities. We demonstrate that data gathered from heterogeneous and distributed IoT devices can be automatically managed, handled and reused with decentralized cloud services.

*Keywords* - IoT, Cloud Computing, Big Data Smart City etc.

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## I.        INTRODUCTION

Smart City is a concept that has gained increased attention in academic, industrial, and governmental circles. While the urban population is growing, the infrastructure and resources required to support citizens are often insufficient, leading to degradation in public services.

Today Smarter cities use the system of systems to their advantage when supporting the needs of each citizen through social programs, healthcare and education." "Today, cities are in competition same as companies. They are looking for ways to create jobs, drive profitable growth and productivity, become more efficient and - most importantly – increase the quality of life for residents.The use of Smart Computing technologies to make the critical infrastructure components and services of a city – which include city administration, education, healthcare, public safety, real estate, transportation, and utilities-more intelligent, interconnected, and efficient" .

Cloud computing and Internet of Things (IoT), that are nowadays two of the most prominent and popular ICT paradigms, together with the emerging topics of Big Data and Energy Efficient IT. The Cloud computing paradigm**1** is an umbrella term for computing services that are accessible over the Internet and developed on a common pool of remotely hosted resources. There are different kinds of cloud computing services depending on the type of resources delivered via them, current state-of-the-art

Cloud services can be such as Infrastructure as a service (IaaS), Platform as a service (PaaS), Software as a service (SaaS), Network as a Service (NaaS), Storage as a service (STaaS), Sensor as a Service (SSaas) and others.

### A.        INTERNET OF THINGS(IOT)

IoT starts to be a hot topic in academic and industry fields. The Internet of Things is a computing concept that describes a future where everyday physical objects will be connected to the Internet and be able to identify themselves to other devices. In other words, more objects are becoming embedded with sensors and make themselves recognizable and gaining the intelligence ability to communicate information about themselves as well as the ability to access information that has been aggregated by other things. With the Internet of Things, the physical world is becoming one big information system. The IoT is promising to create new business models, improve business processes, and reduce costs and risks.IoT and its integration in different application domains. The main reasons behind this interest are the capabilities that the IoT will offer. It promises to create a world where all the objects around us are connected to the Internet and communicate with each other with minimum human intervention [3]. These potentialities make possible the development of a huge number of applications in different domains as shown in Figure 1

**Fig 1:** IOT Application

## B. SMART CITIES

A Smart City as a city which functions in a sustainable and intelligent way, by integrating all its infrastructure and services into a cohesive whole and using intelligent devices for monitoring and control, to ensure sustainability and efficiency. This interpretation makes evident, therefore, that Smart City concept



**Fig 2**: Smart City

## VISION

The smart city vision involves enriching quality of life by gaining data insight from interconnected sensors, devices and people. Perpetual urban issues like security, waste management and traffic can be addressed by using data to gain efficiencies but to do this all of the data needs somewhere to go where it can be easily accessed and used by all stakeholders, both private and governmental.

## Six Dimensions

The characteristics of Smart Cities are varies from city to city. Smart Cities can be identified into six main axes or dimensions. These axes are (1) Smart Economy (2) Smart Mobility (3) Smart Environment (4) Smart People (5) Smart Living (6) Smart Governance.



**Fig 3** Six Dimension of smart city

## CLOUD COMPUTING

Cloud computing is basically an Internet-based network made up of large numbers of servers - mostly based on open standards, modular and inexpensive. Clouds contain vast amounts of information and provide a variety of services to large numbers of people. The benefits of cloud computing are Reduced Data Leakage.



**Fig 4** Cloud Computing Things

## Characteristics of Cloud Computing

- On-demand self-service as needed automatically without requiring human interaction with the cloud provider.
- Broad network access through heterogeneous devices (e.g., mobile phones, tablets, laptops, and workstations).
- Rapid elasticity in the sense of rapidly scaling up or down the IT infrastructure commensurate with demand.
- Measured service, leading to a transparent relationship between the consumer and provider of the cloud service.

## II. RESEARCH METHODOLOGY

With our study we would extend the advances of IoT and cloud computing, by highly innovative and scalable service

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platforms through which to enable smart city services. The paper analyzes the gaps and designs solutions of how cloud computing is applicable to real-time data from embedded applications, thus unifying the IoT and cloud paradigms.

## III.     PROBLEM STATEMENT

Today, India is less than 30 per cent urban and the quality of life in its cities is chronically low. India's cities and rural to urban migration patterns accelerating, the country faces a critical challenge: managing this rapid urbanization in a way that enhances the livability of India's urban spaces.

There are many challenges and opportunities of emerging and future smart grids and smart cities [2] which can be addressed by means of cloud computing.

## IV.     MOTIVATION

A cloud-based platform will be instrumental in minimizing network complexity and providing cost-effective solutions as well as increasing the utilization of energy. Smart grid and smart city services/applications may be deployed in various ways, such as in a private cloud, community cloud, or hybrid cloud.Smart cities are a concoction of people, governance, technology and environment. Internet of Things or IoT plays a major role in cementing the distinct blocks of smart cities. Monitoring assets and managing resources, collecting data and pushing it to right target audience, analyzing huge volumes of data for enhanced management and essentially connecting people, and things for an enhanced lifestyle are what an IoT platform intends to do.
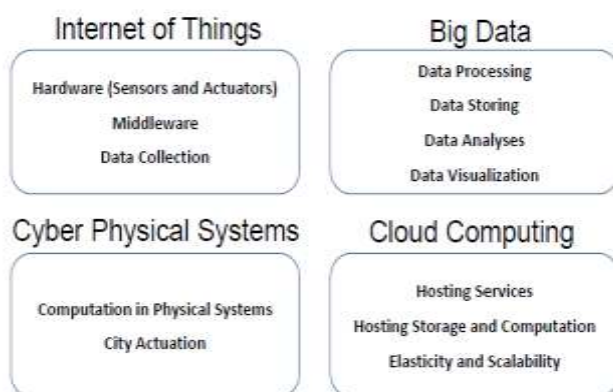
## V.     SOFTWARE PLATFORMS FOR SMART CITIES



**Fig 5:** Platforms for Smart Cities Enabling Technologies

## VI.     TECHNOLOGIES USED FOR SMART CITY

### A.     Artificial Intelligence [AI]

Decision-making mechanisms go, there is no better example than the human brain, so Artificial intelligence must evolve to emulate it. Scientists are now using AI tools that understand and respect human decision-making, and are able to provide readers with input and support regarding the information, explanations, options, and outcomes that are important to them.

### B.     Big Data

Big Data is a term for data sets so complex or huge that conventional data-processing techniques are insufficient. Data sets are analyzed and assessed to uncover unknown correlations and patterns. Mathematical and statistical models and algorithms are used to find trends and make predictions. The application of bigdata is widespread in India, from healthcare to banking to retail to manufacturing to education

### C.     IOT

IoT - **internet of everything** - takes things to the next level by offering advanced interaction between devices (such as hand held computers, sensors), actuation and automation systems and services. IoT allows devices to share and receive information with software and applications using a variety of telecommunication technologies and protocols. The Internet of Things (IoT) is making it possible to make cities greener, safer and more efficient. By connecting devices, vehicles and infrastructure everywhere in a city, governments and their partners can reduce energy and water consumption, keep people moving efficiently, and improve safety and quality of life.

### D.     CLOUD COMPUTING

Cloud computing has become mature and pervasive. The main driving force behind cloud computing is to provide on-demand resources from the pool of virtualized resources to tackle elasticity and scalability for large-scale computational tasks. Some widely used cloud-based applications/services include icloud, youtube, Dropbox, Gmail, etc. Therefore, it is of interest how cloud computing can be implemented in other emerging areas as well, particularly, smart grids and smart cities.

### E.     SMART CITY APPLICATION

Smart City applications such as street light control, smart parking and road traffic management are starting to be widely deployed around the world, bringing benefits to city operations, better quality of life and reduced costs and energy use.

### F.     SMART CITY DESIGN IOT ARCHITECTURE

Smart city architecture representation can serve as a starting point for defining the platform services and components needed to deliver the digital transformation for citizens.

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**Fig 6:** Design Architecture for Smart cities

- IoT sensors capture real-time data from many sources such as water quality, air quality, traffic conditions, energy grid utilization and equipment operations, for instance.
- Functions run by different departments are digitized in the form of unbundled cloud services including governance, transportation, energy and others. The cloud services can be combined with new offerings.
- Mobile applications are the conduits for digital services that deliver innovative affordances with the smart city platform to significantly enhance the quality of life.
- Security is a critical component to keeping citizen data and access safe through the use of profiles and claims.
- An open data foundation supports machine learning algorithms that create compelling real-time insights and affordances for citizens on the go. Big Data analytics over data lakes that store historical smart city information that has been ingested via IoT channels can provide trending analysis and predictive capabilities.
- With the smart city platform, operations can better monitor, automate, optimize and predict a wide spectrum of parameters about activities in the city to deliver great experiences and a much higher quality of life for its citizens.

## VII.    APPLICATION IN IOT

- IoTC and Data Mining
- IoTC in Video Surveillance
- IoTC in Biometric
- IoTC for Security Purpose in Education
- Iotc To Device Intelligent Shopping Applications
- IoTC in Smart Product Management
- Implication of IoT in eHealth

- Smart Agriculture using IoTC
- Evolution of Smart Water using IoT.

## VIII.    BENEFITS OF IOT

- To access, contact and control devices at remote areas.
- To handle patients and provide prescription to them remotely.
- Store enormous data on cloud for future use.
- Saves time and manpower.
- Saves energy and cost.
- Get relief from hurdles of managing such huge amount of data.
- Use of high complexity calculation and availability of sufficient computing space to get precise results.

## IX.    CONCLUSION

A Smart City deployment requires the integration of a distributed open sensor network and a decentralized cloud-based platform. The existing IoT technology and Cloud Computing are very intimately connected to each other. These technologies are seamlessly combined to give way to a new technology. Which provides for a better security and accuracy of results derived by applications.

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