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Study of Internet of things and challenges in construction of a Smart City

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Abstract :

International policymakers and academics alike have embraced the "Smart City" idea. A slew of technological advancements is harnessed in this proposal to make cities smarter for people. “It is estimated that half of the world's population lives in cities and metropolitan regions. Since the previous several decades, urban population growth has had a negative impact on the quality and quantity of services offered to inhabitants. It is the goal of smart cities to provide the best possible solutions. Many Smart City (SC) projects have resulted in the deployment of Information and Communication Technologies (ICT) to discover sustainable, efficient, and effective solutions to the expanding list of difficulties confronting cities (Caragliu, Del Bo, & Nijkamp, 2011; Su, Jie, & Hongbo, 2011). Some of the problems we face include those related to education, health, traffic, energy, garbage, and the fight against crime (Chourabi et al., 2012). IoT will be able to openly and transparently integrate a wide range of various and heterogeneous end systems while allowing open access to specified subsets of data in order to generate a slew of digital services. The Internet of Things There are so many different devices, connection layer technologies, and services involved in an IoT system that creating a common design is a very difficult undertaking. While urban IoT systems still fall under a wide category, the particular application domain they serve is the subject of this article. A smart city is a city that utilises the most modern communication technologies possible to enable added-value services for both the administration of the city and the residents. Urban IoTs are meant to support this idea. As a result, this paper presents an in-depth analysis of the supporting technologies, protocols, and architecture for an urban IoT”.

Introduction

The world's population is steadily increasing throughout the course of human history. There will be an additional 2.5 billion people on the planet by the year 2050, according to a United Nations assessment published in 2013. If current trends continue, by 30 years, 68 percent of the world's population will reside in cities. As the world's population continues to grow at such an astounding rate, cities will face an array of new problems. Sustainability and smart city development are only two examples of these concerns. Smart cities have benefited greatly from

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advancements in IoT research. Smart cities use IoT applications without human intervention. Numerous IoT devices are linked to one another through

each other and work together to accomplish a variety of goals. As the number of Internet of Things (IoT) devices grows in the next years, so do the risks of data breaches and leaks. Big data generated by billions of IoT devices is sent to the cloud for processing, administration, and storage purposes. Sending all of your data to the cloud runs the risk of jeopardising its security and confidentiality. Fog computing overthrows the cloud computing paradigm.

Pervasive and ubiquitous computing, wireless sensor networks, Internet communication protocols, sensing technology, communication technology, as well as embedded devices all come together in a new paradigm known as the Internet of Things (IoT). In a smart city, the Internet of Things (IoT) is used to connect, interact, control, and offer insights into the different silos of fragmented systems that make up the city infrastructure. Because of the enormous number of networked devices and the enormous quantity of data they create, solving urban problems has never been easier. The actual and digital worlds are constantly interacting in a synergetic way as a result of the integration of these technologies with municipal systems. The linked smart cities are built on top of this sophisticated and ubiquitous ecosystem. With the help of IoT and physical digital integration inside municipal systems, we explore the notion of "smart cities," including its main characteristics and driving technology. IoT-enabled smart city applications and the research difficulties and open topics that need to be addressed in order to realise the IoT in smart cities are presented.

Methodology

Identifying Smart City Use Cases. As time passes, so does the global population. Resources utilisation and other devices play a huge part in the smart city's IoT analysis and management. The Internet of Things (IoT) is used in a smart city without the need for human intervention.

The emergence of Smart City concept

The term “Smart City was coined in the early 1990s. New Information and Communication Technologies (ICTs) were being studied at the time for their influence on city infrastructures. How can a city prepare for the use of new technology and transform itself into a smart

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community? That was the emphasis of the California Institute for Smart Communities (Alawadhi et al., 2012). After a few years, the University of Ottawa's Center for Governance began to criticise the concept of smart cities as being too technological. About a decade ago, academics began asking actual smart cities to demonstrate the many features concealed by the phrase smart city (Hollands, 2008).

The words intelligent city and digital city, which are synonyms for smart city, are sometimes used interchangeably (Albino, Berardi, & Dangelico, 2015). These variations may be divided into three broad categories: technology, people, and community (Harrison et al., 2010; Nam & Pardo, 2011). (a) smart city is a living solution that integrates different life facilities such as transportation, power, and buildings in an efficient manner to improve the services for its citizens; (b) smart city exemplifies the importance of sustainability of resources and applications for future generations.

Characteristics and components of a Smart City

It is essential that the subsystems of a dense environment function together as a single system, with intelligence incorporated into each unit. According to the researchers that advocate for this holistic viewpoint, a city's different subsystems (transportation, energy, education and healthcare) must be organically linked into a single system in order for it to be considered a smart city (Gurdgiev & Keeling, 2010; Kanter & Litow, 2009). A smart city, according to (Giffinger et al., 2007; Perera Zaslavsky Christen & Georgakopoulos, 2014), has six possible characteristics: a smart economy, smart people, intelligent governance, intelligent mobility, intelligent environment, and intelligent living (perera zaslavsky christen & georgakopoulos, 2014).

Smart city ecosystem and internet of things

Sensor deployments have grown in recent years as processing and storage capabilities, as well as sensor manufacturing costs, have all improved. The Internet of Things (IoT) was born out of technological advancements rather than user or application demands, unlike smart cities. People and things may be linked to everything and everyone at any time, anywhere, and via any channel or network, according to a commonly accepted definition of the Internet of Things (IoT). As shown in Figure 5, despite their differences, the IoT and SC are advancing toward one another in order to reach a shared objective. Because of the wide range of sensor platforms, observation methods, sensor processes, location data, and technological requirements,

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developing models to describe sensor information in terms of position characteristics, observed objects, time, and status is a time-consuming procedure".

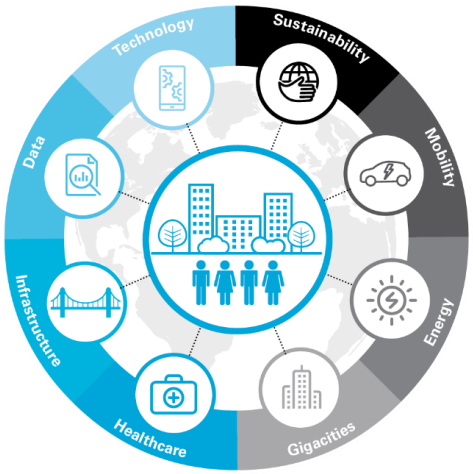

Image Source : https://www.whitecase.com/publications/alert/smart-cities

A. Traffic Congestion:

The Internet of Things (IoT) can keep tabs on urban traffic congestion. A superior source of information than camera-based traffic monitoring systems is low-power ubiquitous transmission. Modern automobiles are equipped with GPS monitoring systems as standard equipment. While city residents plan their shopping trips and business commutes in advance, municipal authorities must keep traffic under control and dispatch cops where they are needed.

B. Air Quality Management:

Cities are contaminated because of their high population density, parks, etc. In metropolitan areas, IoT will make it possible to monitor the air quality. Connected to the ICT infrastructure, runners' gadgets will be able to run health apps. Citizens will be able to access their favourite personal training application over the internet. When it comes to outdoor activities, they know which routes are the healthiest. Sensors for air quality and pollution should be placed around the city, and the data collected from these sensors should be made accessible to the public.

C. Smart Health:

Monitor the patient's heart rate, temperature, pulse, and breathing, among other vital signs. Alerts and warnings for life-threatening instances in hospitals and at distant

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patient sites, such as an ambulance and an elderly care facility. Digital sensors in the IoT ecosystem may be used to help patients with mental health issues, including newborns and young children.

D. Smart Energy:

An IoT-hosted service can aid in the monitoring of the city's energy consumption, giving city officials and residents a clear picture of how much energy is used for various city services, "such as heating and cooling public buildings, traffic lights, public lighting, surveillance cameras, and public transportation. This will assist in identifying and prioritising the major sources of energy use. Power drawing monitoring devices must be connected to the local power grid. Active functions to control local power generation structures [e.g. solar panels] may also be added to these services.

E. Smart Infrastructure:

Proper structural maintenance necessitates external agents assessing the actual state of buildings on a regular basis and identifying the areas that have the greatest impact. Structural measurements collected by sensors in a building may be used to establish a distributed database for the Internet of Things". Sensors that monitor pollution levels, temperature and humidity, vibration and deformation, and structural stress are just some of the examples of sensors that may be used to monitor the health of the structure. Adding seismic measurements and vibration might help researchers better understand how small earthquakes affect city structures. In order to develop the necessary infrastructure, sensors must be installed in buildings and surrounding regions and connected to a control system.

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