

# IoT Based Smart Cities

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**Abstract**— Since the development of advanced metering and digital technology, Smart City has been equipped based on things (IOT) in different electronic devices, and therefore smarter than before. The purpose of this paper is to carry out the concept of smart cities and their motivation and application of a comprehensive review. In addition, the survey describes the intelligent networking technology and smart cities and major components of urban functions. This also explains the major challenges and experiences around the world.

**Key words:** Internet of Things (IoT), Smart Cities, Smart Grid, Smart Buildings, IoT Technologies, Smart Internet Governance

## I. INTRODUCTION

### A. Concept

As urban population density, infrastructure and rapidly growing service needs to provide the necessities of life of urban residents. On this basis, digital equipment has grown significantly. For example, sensors, actuators and smart phones can bring enormous commercial potential of things, because all devices can connect and communicate with each other over the Internet .

Things prototype is subject to intelligence and self-configuring objects have been through a global network infrastructure connected to each other. Things are supposed to be widely distributed, low-low storage capacity and processing power of a real object. Our goal is to improve the reliability, security and smart cities and their infrastructure . With this knowledge, this article was based on an assessment networked intelligent city.

### B. Motivation

Smart City has become since the recent development of digital technology and smarter than ever before. Smart cities are equipped with various electronic components for various applications, such as a street camera viewing system, used for the transport system of sensors, and so on. Furthermore, this can extend the use of individual mobile devices. Therefore, by taking into account different environments, different terms should be studied, such as characteristics of the object, contributors, motivation and safety rules . Reference describes some of the main aspects of the 2020 Intelligent City.

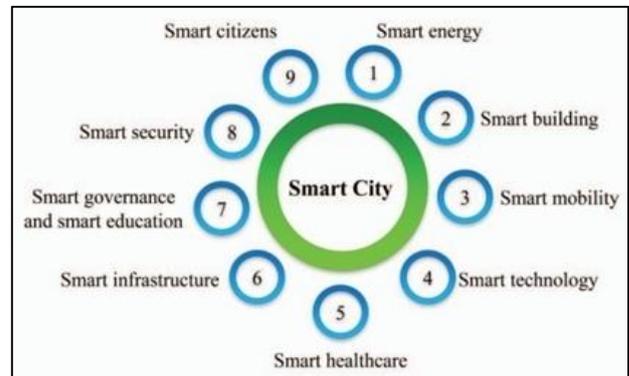


Fig. 1: The main aspects of smart cities

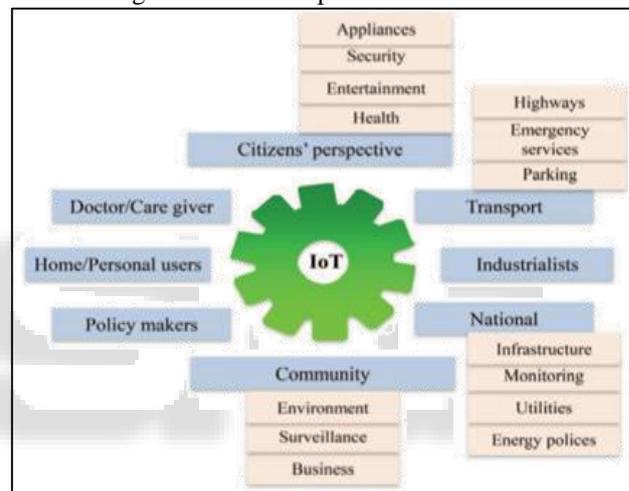


Fig. 2: IoT- based interconnection

In an IOT environment, the evaluation device may be integrated analysis system based on geographic location and use. Specific data collection service may be used with a sensor monitoring cyclists, vehicles, public parking several projects. There are indications that the use of the Internet of Things infrastructure to facilitate the operation of air and noise pollution, vehicle monitoring systems for mobile applications in many service areas.

Internet provides an infrastructure revolution, many of whom are connected to each other. Under a revolution on the Internet will be possible to provide appropriate interconnection between objects.

Interconnection between the IOT of various objects based on the Internet. Therefore, on the one hand, things will affect every aspect of people's lives smart cities, such as health, safety and transportation. On the other hand, it can play an important role in policy decisions (such as saving energy, reducing pollution, etc.), remote monitoring and the necessary infrastructure at the national level. On this basis, things will contribute to energy conservation policy, terms of economic considerations, reliability and other aspects of a more efficient, economical and safe system operation.

## II. THINGS TECHNOLOGY IN SMART CITIES

Things using standard communication protocols a broadband network, and its convergence point is the Internet. The main concept of things that can be measured, inferred, understanding and changing the universality of environmental objects. On this basis, things are achieved through the development of various objects and communication technologies. Things to participate in things including smart devices, including cell phones and other objects, such as food, household appliances, landmarks, monuments and works of art , it can work together for a common goal. Things influence of Internet users live in can be seen as a key function [4]. Some things related to technology will be discussed below.

### A. Radio Frequency Identification (RFID)

The key role of these systems in the reader and tag things in the environment. By applying object according to any of these technologies, they can be automatically identified and assigned a unique number identifying each object to be merged into the network, and the digital information and services associated with .

### B. Wireless Sensor Network (WSN)

Wireless sensor networks can provide a different and appropriate data, and, in many cases, such as healthcare, government and environmental services, and seismic sensors [10]. Further, the wireless sensor networks may be integrated with an RFID system to achieve the target, for example, obtain information about the position, motion, temperature, and additional information.

### C. Addressing

In addition to achieving significant interconnection capabilities on the Internet, the trend in the conventional things, and can also provide an interconnection between the object and the object to create a smart [5] environment. For this reason, the ability to uniquely identify the object of a favorable outcome is critical of things. This is because the combination of large objects only solution is the key to control them on the Internet. In addition to the concept of unique mentioned, reliability, scalability, and durability required for showing the development of unique addressing scheme [5] key.

### D. Middleware

As it relates to the promotion of things, some of the problems of heterogeneity of limited storage and processes capability, as well as for the huge difference in the application, subject to network middleware plays a vital role in the application layer. The main objective of the middleware is indeed a concise integration and communication functions of all relevant equipment.

## III. SMART CITY OF THE PRACTICAL APPLICATION OF THINGS

Things to use the Internet to integrate heterogeneous devices. In this regard, all available equipment to be connected to the Internet easily accessible. To achieve this, sensors can be developed to collect and analyze data at different locations to increase the use of [2]. Figure 3 shows the main applications of things in the smart cities of the Internet. The main objective of this knowledge is explained as follows.

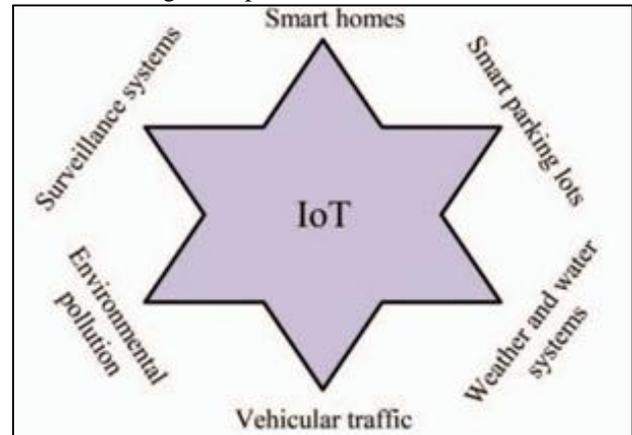


Fig. 3: the main applications of the IOT

### A. Smart Home

Data generated by the sensors can be used to monitor the intelligent home . For example, an innovative demand response (DR) or the function may be implemented by monitoring pollution, contamination and if it exceeds a critical limit, the client can be warned.

### B. Intelligent Parking

By enabling smart parking, you can track located in the departure city and the arrival of a variety of different parking vehicles. Therefore, the number in each field of smart car parking should be designed. In addition, new parking lot for more vehicles should be established. Accordingly, smart parking data can bring benefits to everyday life and business owners in the intelligent city.

### C. Weather and water supply systems

Weather and water system may be used to provide a suitable number of sensors of information, such as the rate of temperature, rain, wind and pressure, and help improve Smart City efficiency.

### D. Vehicular traffic

Vehicle traffic data is one of the most important sources of data a typical smart cities, citizens and the government will appropriate analysis to benefit from use of these data and use. Citizens can also use traffic data of the vehicle to determine the time of arrival to the target vehicle traffic data is useful.

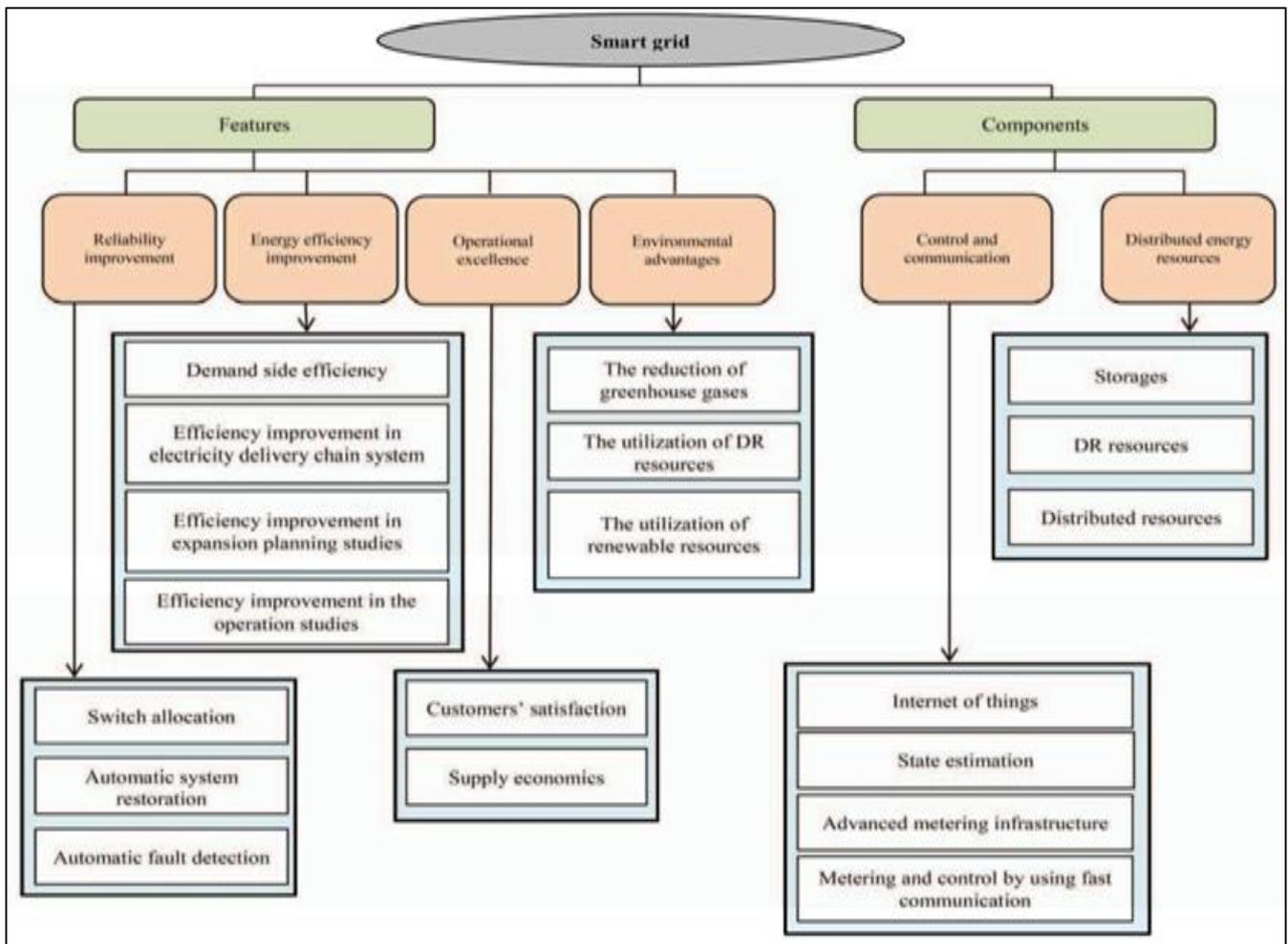


Fig. 4: Smart Grid

**E. Environmental Pollution**

If the citizens of a city is unhealthy, the city can not be regarded as an intelligent city. To this end, Smart City should monitor environmental pollution and citizens, especially those that provide information about medical conditions. Reference [1] also reported a separate module to achieve noise and environmental data.

**F. Surveillance System**

In the smart city, from the public's point of view, safety is the most important factor. To this end, the smart city should be constantly monitored. However, analysis of data, looking for crime is very challenging. References [1] proposed a new program to improve the security of smart cities.

**IV. IOT POTENTIAL APPLICATION FOR SMART CITY**

Figure 4 shows the future IoT applications of smart city is discussed in this section.

**A. Smart Cities and Communities**

Implementation of things, could lead to interact with the environment and services. Therefore, it can bring context and geographical awareness opportunities. In addition, the collective wisdom to improve the decision-making process, and empowering citizens [6]. In addition, through the use of the Internet of Things [7], may provide future smart cities a common middleware services. It should be mentioned that the

sensor can be used to narrow the virtualization gap between technologies.

**B. Smart Home**

Things heterogeneous devices by platform, daily activities in home automation. In fact, by converting the object into the device through the Internet using the information connected to each other, it may be performed by a web service interface. A lot of smart home applications using sensor networks. Connection to the Internet to view remote control or the smart devices thereof to achieve the above-described application program . For example, intelligent lighting has been getting a lot of attention in recent years . It spends ten percent of global electricity consumption in lighting, which can lead to 6% of greenhouse gas emissions [5]. In this regard, 45% of the illumination energy may be required [4] are preserved by using intelligent lighting control mechanisms.

**C. Respond to customer**

You can use the AC controller and many other smart devices to manage your smart home [2]. The home gateway is in proposed to let the controller responsible for the family to collect data from many families integration. Bids based on a signal from the AC controller, the polymerization can be predetermined tariff electricity market, and send a signal, accept / reject for these devices.

The possibility of monitoring and control equipment, active customers can improve the system, which

is involved in the operation of a well-known demand response. Due to operational and economic advantages, report of the International Energy Agency (IEA), the activities of the demand side of every energy policy decision-making a critical choice. According to DR,electricity.

Consumers can adjust the power mode, in order to improve the reliability of electricity or prevent price spikes .

Power system to predict the future is highly concentrated in the smart grid, the importance of renewable energy generation, abatement programs, and enhanced DR [3]. Smart Grid focus, a combination of different renewable energy and disaster recovery to provide consumers with different options and improved use of the facility environmental initiatives.

*D. Smart energy and smart grid*

Use was to provide intelligent management of energy distribution and consumption in heterogeneous networking environments. The IoT node has functions such as sensing and networks, which increases the possibility that energy suppliers will optimize the scheduling. This management can be extended to an emergency situation. One of the most important this expansion a result of fault location, isolation and restoration services (FLISR) . Because of things to achieve this property, which provides a method of determining the location of faulty components, separating them, and application switching tasks, in order to restore the largest number of advanced tools affected the healthy portion of the feed energy. Further, at an advanced level, the activation function can be developed and the customer dispersed generator [7] by using a self-healing process. These policies can be implemented to improve reliability, power quality and profitability [3]. Some of the main specifications of the smart grid is shown in Figure 5.

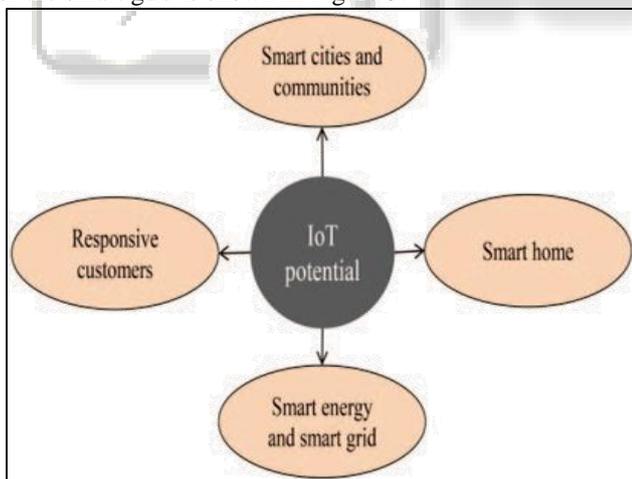


Fig. 5: Things potential of smart cities

V. PRACTICAL EXPERIENCE OVER THE WORLD

Report of practical experience in the world according to the National Intelligence Council, and the result is that internet of Things is one of the most effective tools for US interests in 2025 [9]. As mentioned earlier, the number of devices connected in 2011. With a population of more than 2012 the number reached about 9 one billion connected devices by 2020 and to reach 24 billions This trend has significant growth [5]. Based on the above data, things will undoubtedly

become one of the next major resources big data. The key policies and the results of smart cities are recorded in the intelligence community forum Award 1999-2010 in the following cities: Suwon and Seoul (Korea), Taipei (Taiwan), Mitaka (Japan), Singapore, Waterloo and Calgary (Canada) Glasgow.

City	Experience
Amsterdam [40]	Reduce transportation, energy, improve safety
Barcelona [41-45]	Implementation of sensor technology, the analysis of traffic data streams to use a new bus network design and implementation of intelligent transportation
Stockholm [46]	Provide a common fiber optic network across Stockholm
Santa Cruz [47]	Analysis of crime data to predict the needs of the police, and maximize the presence of the required local police

Table 1. POLICIES and strategic city and smart city

VI. CHALLENGE

This section typically challenge the proposed transaction by the application of Things smart city based.

*A. Security and Privacy*

When all the data is collected and analyzed in a common IoT platform, the system may be subject to several attacks (for example, cross-site scripting and side channels). In addition, such a system is exposed to significant vulnerabilities. In addition, the multi-tenant system may also lead to security problems, and lead to data leakage [2].

*B. Heterogeneous*

The IoT systems usually evolve with each system component is woven for outstanding solutions for specific application environments. Therefore, the authorities must analyze the situation of their own goals, determine the computing hardware and software needed, and then integrate these heterogeneous subsystems. The presence of these infrastructure solutions and appropriate collaboration between them provide a system of things is indeed a daunting challenge.

*C. Reliability*

Some reliability problems have emerged in the system based on the Internet of Things in. For example, to communicate with them is not reliable, since the movement of the vehicle. In addition, there is a lot of smart devices, cause some reliability issues in terms of their failure of reliability.

*D. Massive*

Certain specified scene requires a lot of interaction between embedded devices, which can be distributed across a WAN environment. Things system provides a suitable platform for data integration and analysis [2,46-52] from different devices. However, such large-scale information needs at a high rate, which makes it difficult to overcome the typical challenges of proper storage and computing power to collect. on the other has Allocation of device monitoring tasks things, because these devices must be connected to the processing and dynamic delays associated.

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*E. Legal and social aspects*

Things system may be based on information provided by the service user. In this case, the service provider must comply with different local and international laws. In addition, users should have sufficient incentive to participate in determining programs and data collection. This will be the matter of data representing more convenient to the user the opportunity to choose to participate and submitted . Ref. [5] deals with the combination of human resources data, providing interactive system security issues.

*F. Big Data*

Considering about 50 billions of devices, of course, you need to pay attention to transfer, store and recall and analyze large amounts of data, they produce [2]. Obviously, networking infrastructure will be the main resource of some big data.

*G. Sensor Networks*

Sensor networks can be seen as one of the most important technologies for making things [4] of the Internet. This technology can provide measurement, inference and understanding [5] ability to shape the world of environmental indicators. Recent technological developments and improvements in remote sensing applications large-scale.

applications provide efficient and cost-effective equipment. In addition, the smartphone associated with a variety of sensors, so they can achieve a variety of mobile applications in many areas of the Internet of Things. To this end, the main task is to deal with the challenging energy and network constraints and uncertainties [6]. Scale data DR of obstacle sensor.

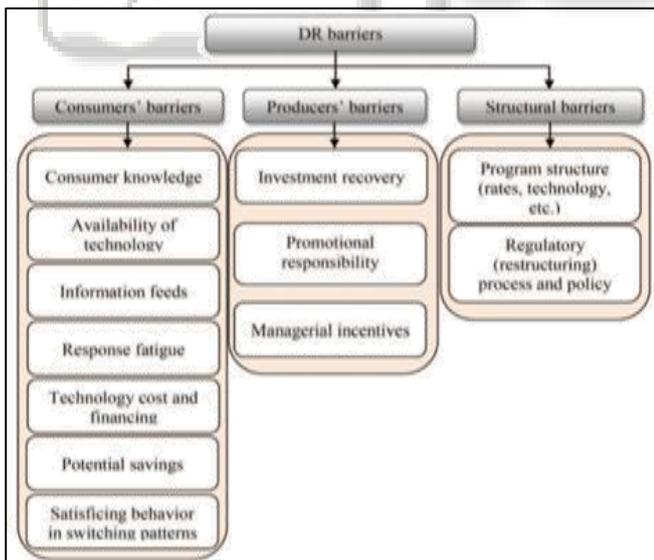


Fig. 6: DR disorders

Although things can contribute to the system load response participation is still possible to limit the DR penetrate obstacles. 6, these barriers can be divided into three categories, namely: the consumer disorders, producer disorders, and disorders in the structure [7] conducted a thorough investigation.

VII. CONCLUSIONS AND FUTURE TRENDS IN THE RECENT LITERATURE WAS REVIEWED TO INVESTIGATE VARIANTS

Features and characteristics thereof networked system and effective incentive to use them. Since the implementation of Things infrastructure can bring many opportunities, the highest motivation study first described, and then outlines some useful applications. Describes how to use them to develop and improve daily activities. Furthermore, the challenge generated when the system is in a IoT embodiment is explained in detail. In this regard, networking platforms and other autonomous and intelligent systems, providing information and a wide range of applications combined with the future is one of the most interesting trends. In addition, to provide a mechanism to overcome some of the fundamental challenges of citizens' privacy is still an area of concern. In fact.

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