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SMART CITY DESIGN WITH IOT

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ABSTRACT

Smart implementation of the Internet of Things is observed in smart city projects. Nowadays this process is implemented world-wide. Various electronic equipment and internet protocols are used to maintain implementation of IoT in smart city projects. The emission of CO2 is reduced due to this smart city project, as well as autonomous driving process is increased by this process. To maintain smart parking RFID is used by this process. This paper can evaluate the interconnection between these protocols. Safety and security related issues are improvised by the Internet of Things and increase the smartness of the city. High-quality architecture is important to maintain implementation of IoT. However, implementation of IoT consists of various challenges such as DoS and other security issues.

Keywords: IoT, DoS, CO2, RFID, autonomous driving

INTRODUCTION

Nowadays smart and innovative solutions are required to grow and expand cities, as well as productivity of cities, is improvised with the implementation of IoT technology. Implementation of the Internet of Things can reduce management costs and increase operational efficiencies. IoT devices are implemented in homes in internet boxes and Television. A smart city is conducted with smart door locks, real estate sector, smart thermostats, smart alarm, and other systems and applications. Various processes are used to increase the smartness of a city by using the Internet of Things. Implementation IoT for smart cities consists of various weaknesses which are included in this paper. It is important to learn about the proper deployment and adoption of IoT.

INTERNET OF THINGS AND SMART CITY

Potential applications are implemented to increase the effectiveness of smart cities, in this case, Internet of Things are implemented successfully. According to Kim et al. (2017), the Internet of Things is treated as an emerging technology, this technology is used and implemented widely. This technology is able to create smart cities without the intervention of any human. Number of internet-connected devices has increased more than the human population. In figure 1, the growth of smart technology is depicted which is composed of Gartner.

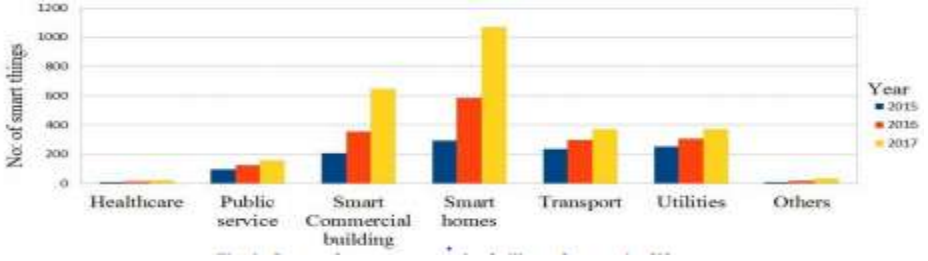

Figure 1: Gartner forecast on growth of pillar of smart city
(Source: Park et al. 2018, p. 256)

A high number of commercial buildings and smart homes are depicted in figure 1. To increase the smartness of power it is important to maintain water management and smart power. High performing sensors are implemented to collect important information from the environment, addressing sensors are implemented with the observation of the Internet of Things. IoT technology is involved in collection and analysis of data. Decision-making and transmission of information are maintained by the Internet of Things, which directly has an impact on smart cities(Park et al. 2018).

Proper communication standard is important for deployment of the Internet of Things. Standardizing communication is involved in several worldwide organizations. The International Telecommunication Unit, Institute of Electrical and Electronics Engineers, Global Standard I, and the Internet Engineering task Force are implemented to enhance smart cities with the help of the Internet of Things. The Internet of Things is composed of software and hardware technology to increase the smartness of a city. Interconnecting networks, various software components, and other data storage platforms can maintain a smart city. Advancement in technology and advancement, integrated and intelligent environments are maintained by the Internet of Things. A smart city is connected with physical infrastructure. To increase the effectiveness and intelligence of a city it is important to implement business infrastructure, ICT infrastructure, and social infrastructure. A large deployment of IoT can increase smartness of cities. Machine to machine and human to machine communication processes are implemented properly. Intervene of Things is implemented with Wireless sensor networks. According to Hammi et al. (2017), to enhance the Common Operating Picture (COP) of the city's diverse platform, and application is used, this process is implemented to generate information.

IOT AS AN ENABLING TECHNOLOGY FOR SMART CITY

To enable smart city deployment in all over the world, IoT concept leverage is implemented successfully. The capability to manage and monitor devices is maintained remotely by the Internet of Things technology. Various real-time traffic data streams can provide information on the analysis of various technologies. Development of infrastructure can change the quality of IoT products. This process can maintain transportation services and cost-efficient municipal services. Smart city architects and smart city features are maintained by potentiality of the Internet of Things. The efficiency of the Internet of Things system is implemented to secure the Internet of Things and the delivery process.

3.1 IoT for Smart Cities: requirements and real examples

Requirements of the Internet of Things are maintained by the incorporation of IoT platforms and smart city solutions. Various systems, connected devices, and people are managed by implementing the Internet of Things. Cost related risk is reduced by the IoT platform. Various heterogeneous systems in the city are connected by the Internet of Things. Implementation time of IoT techniques is decreased in this case, which is an important part of a smart city initiative. New opportunities for the city are maintained by IoT technology and increased security factors. The Internet of Things can maintain connection between devices and data. Various capabilities such as light, humidity, temperature, and pressure are maintained by the Internet of Things process. Various sectors are controlled by the Internet of Things such as manufacturing, transportation, health, and others.

In 2015, a smart city initiative was launched by the White House. Technological collaboration between cities, universities, and federal agencies, other private sectors are controlled properly by deploying Internet of Things. In 2016, the Ministry of France is trying to implement the Internet of Things in the transport system, which is

considered as an important part of a smart city. This process is called Scoop@F, which can improvise smart vehicles. 20 million euros are budget for the Scoop@F project. On the other hand, in 2020, Sweden will try to make Malmo a carbon-neutral city. According to this project, this city is conducted with renewable energy as well as it is also observed that 10000 people can make houses in this city and approximately 20000 people are able to stay here for work or study.

Interconnection between people, information about accidents, and traffic are provided with the help of smart route and interconnection via 4G and 5G technologies and wifi. Driving condition is improvised properly by a connected car. This process is conducted by collecting and disseminating traffic conditions and real-time traffic information. High-performing telecommunication technologies are used in smart cities, which are able to maintain various connections inside and outside of city and provide various facilities towards the citizens of the city(Simmhan et al. 2018).

Mainly an advanced urban infrastructure is provided by the Internet of Things. To reduce CO2 emission, this process can allow interaction with the environment through a smart application. Environment and quality of life are improvised in smart cities by reducing pollution levels. Bresciani et al. (2018) stated that, improved health, faster, safer, and cheaper commutes are involved in the quality of life of citizens.

3.2 IoT application for Smart Cities

To consider the IoT paradigm it is important to maintain various allocations of the Internet of Things. Now, various studying and planning processes are conducted to collect information and knowledge about the adoption of Information Communication technology. To realize a smart city project, it is important to understand the mechanism of Information Communication Technology.

3.2.1 Health of Building

Continuous monitoring and information about the condition of building are important criteria for maintaining the historical building. Various external agents are involved in the building process, due to this factor it is important to justify all affected areas, which can increase potentiality of buildings. Multiple structured buildings are present in the city, which have different ages and sizes. The structure of dams, buildings, and bridges are very old. WSNs are embedded within a concrete structure and this structure can assess the condition of a building(Park et al. 2018). To collect information about the structure's state a radio signal of suitable amplitude is provided.

3.2.2 Waste management

Waste management is treated as a rising problem in urban. Socioeconomic and environmental factors are related to waste management. Along with this environment, sustainability is maintained by the waste management process. Data collection ability is increased with the implementation of IoT infrastructure, which is treated as a major benefit of the Internet of Things. Along with these various issues related to smart cities are maintained properly by IoT technology. IoT technology can help garbage trucks to pick up all garbage. LPWAN technology is used by connecting with various computing servers. The garbage collection process is conducted with garbage trucks.

3.2.3 Smart parking

Wireless sensors are implemented in parking spots to maintain a smart parking process. Sensor bus parking system is implemented, which can provide notification about leaving a parked vehicle. Three key components are used in Madrid and Spain to maintain this smart parking system. Network-enabled urban bus systems with wifi service are treated as an important part of smart cities. Bus riders are trying to use UBN navigation to collect all facilities of smart parking. To operate buses differently, it is important to implement a crowd information server. This entire process is conducted with implementation of the Internet of Things technology.

Parking bay occupancy is maintained by IoT technology. Parking vacancy information is maintained by high-performing servers. Various visualization platforms, such as smartphones, are used to provide various kinds of information. To maintain the vehicle identity process it is important to implement Radio Frequency Identity Technology, which is maintained by the Internet of Things technology. Along with this human-machine interaction and advisory board are implemented to maintain a smart parking system. Parking lot check out and parking lot check-in is maintained by implementation of various high-performing technology such as RFID, barriers, and readers.

3.2.4 Smart grid

Various new technologies are implemented in smart grids such as autonomous and intelligent controllers. Two-way communication between power utilities and consumer and data management processes are used in the smart grid as a new and innovative technology, these technologies are involved in composing distributed an automatic advance energy delivery network. To maintain transmitting information of smart grid sensing infrastructure is deployed successfully. Information on Technology is implemented to maintain power net networks. The cost-effective power generation process is maintained by IoT technology. According to Batesand Friday (2017), along with this IoT is maintained transmission, consumption, and distribution process.

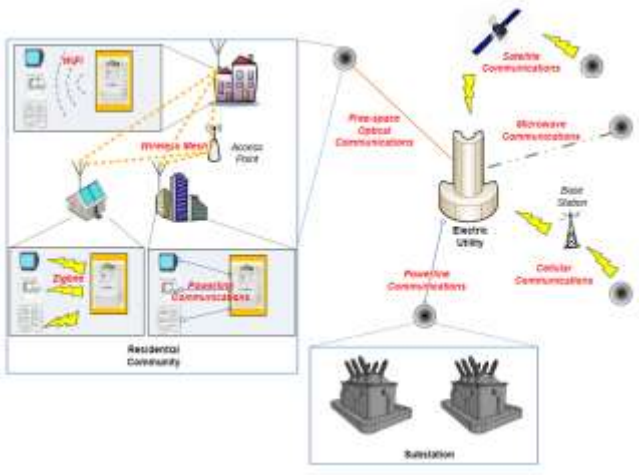

Figure 2: Smart grid architecture

(Source: Bates and Friday, p. 456)

3.2.5 Smart Health

To maintain smart health a Wireless Body Area Network is implemented successfully, this factor is conducted with low-cost wireless sensor network technology. This technology can improve the patient monitoring system in hospitals, work environments, and residents, which is treated as beneficial for patients. Mehmood et al. (2017) stated that, sometimes miniature sensors are embedded in the body. Various medical devices can communicate with this sensor by using different technologies of WPAN such as 6LowPAN, ZigBee, XCoAP, etc. various physiological parameters information such as respiratory rate, blood rate, blood pH, blood pressure and temperature are enhanced by high performing sensors. This physiological parameter related information is collected and analyzed with the help of remote servers, which is depicted in figure 3. The physical limitation of various designs is maintained and solved by this sensor. This sensor needs to be energy-efficient, as the sensor is conducted with small batteries.

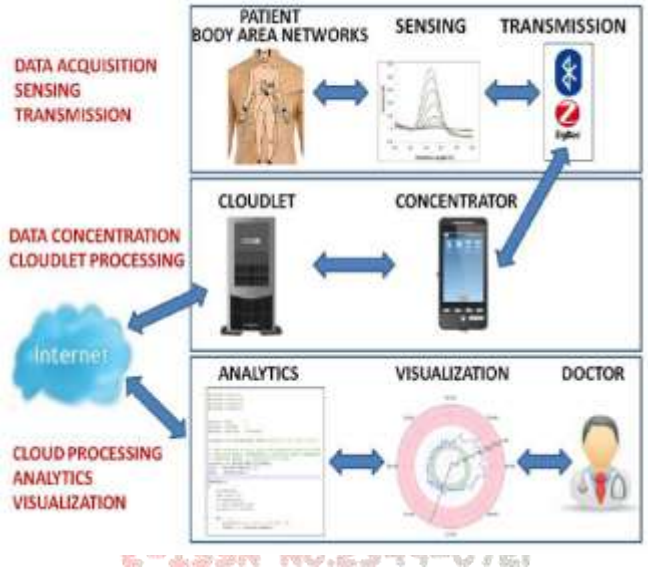

Figure 3: Smart health system

(Source: Mehmood et al. 2017, p. 456)

3.2.6 Autonomous driving

Autonomous driving technology is treated as a valuable aspect of smart cities, this technology can save time for users. The flow of traffic in smart cities is evaluated with the help of this autonomous driving technology. 60 % of parking space is saved by this technology by parking the cars closer to each other. In 2020, autonomous vehicles can increase the market rate, which is stated by Nissan-Renault.This autonomous car is able to circulate 30 to 50 km/h autonomously. In 2017, a test of autonomous cars was conducted by Volvo. An autonomous car is able to detect all anomalies around the trigger and alert automatically about this. This process is conducted with implementation of radar, ultrasonic sensor, and camera. To calculate the best route in real-time, a high-performing and intelligent transportation system are important. IoT based transportation systems can reduce the emission of carbon and save time. This is treated as a major component of IoT based smart cities (Sun and Ansari 2017).

IOT CHALLENGES FOR ACHIEVING SMART CITIES

Multiple technologies are involved in the Internet of Things, due to this factor security-related issues are increased widely. New issues are increasing due to the deployment of the Internet of Things. Major challenges of smart cities are emerging with networking, transport, scalability, privacy, authentication, and heterogeneity. Various challenges of IoT implementation in smart cities are provided below.

4.1. Networking and transport issues

Various and large amounts of objects are involved by the Internet of Things, which are reachable. Santos et al. (2017)stated that, any authorized user can retrieve produced content. In the case IPv4 is implemented to achieve desired goals and address all effective policies, this technology is treated as a most predominant protocol. Along with this IPv6 is considered as a best alternative of IPv4. RFID is implemented as an identifier that is tagged with the IPv6 protocol, which can investigate multiple approaches.

	Issues	Confidentiality	Integrity	Authentication	Authorization	Unlinkability	Anonymity	Traceability	Non-Repudiation
Application Layer	Applications' issues	x	x	x	x	x	x	x	x
	Storage issues	x	x	x	x		x		
	Key management issues	x	x	x			x	x	x
	Trust management issues		x	x	x				x
	Middleware issues	x	x	x	x	x	x	x	x
	Data integrity issues		x	x					
	Data confidentiality issues	x	x						x
	Data authentication issues		x	x					x
Transportation Layer	WIFI issues	x	x	x	x	x	x	x	x
	ZigBee issues	x	x	x	x	x	x	x	x
	3G issues	x	x	x	x	x	x	x	x
	GPRS issues	x	x	x	x	x	x	x	x
	Network access issues		x	x	x	x	x	x	
	Routing protocols issues		x	x			x		
	Encoding issues		x						
	Heterogeneity issues		x	x			x	x	x
Perception Layer	RFID issues	x	x	x	x	x	x	x	x
	WSN issues	x	x	x	x	x	x	x	x
	RSN issues	x	x	x	x	x	x	x	x
	GPS issues	x	x	x	x	x	x	x	x
	Platform issues	x	x	x	x	x	x	x	x

Figure 4: an overview of the main IoT issue

(Source: Gyrard et al. 2018, p. 325)

Figure 4 is depicted that all areas of IoT are not matured and there are no standards, which directly has an impact on the integration process. In the case where the object is an RFID tag then Object Name Server-related

problems are increased rapidly. To mitigate these problems a valuable tag identifier (IP address) is introduced by Uniform reference Locator. According tyoGyrard et al. (2018), along with this Transmission Control Protocol is not implemented in the Internet of Things. However, all kinds of targets and goals are achieved with the implementation of TCP.

4.2 Security issue

This security issue is treated as a major problem of IoT, which directly has an impact on sustainability, the competitiveness of company, and administration. Plan development of IoT technology is conducted with various security issues, which is stated by the Federal Trade Commission. However, IoTios conducted with various security aspects such as enough memory, conventional security solution procedure, processing power, and other existing security protocols. Man-in-the-middle attack and weak wireless communication are considered as the main challenge of IoT, adoption of IoT is affected by these challenges (Anagnostopoulos et al. 2017).

4.3 Denial of service

Real attack vectors for malicious people are provided due to implementation of a huge number of internet devices in cities. Thousands of ten thousand devices are simultaneously used in big cities. To perform different tasks and maintain devices IoT botnet is implemented successfully. DNS service is maintained by IoT technology. In this case, some connected devices play a significant role in the attack, IoT unable to detect them before the attack. Number of malicious attacks increased in the Internet of Things technology. Figure five can provide information about the cross-thematic data management process of IoT to maintain a smart city, and the cloud computing environment is maintained by this process.

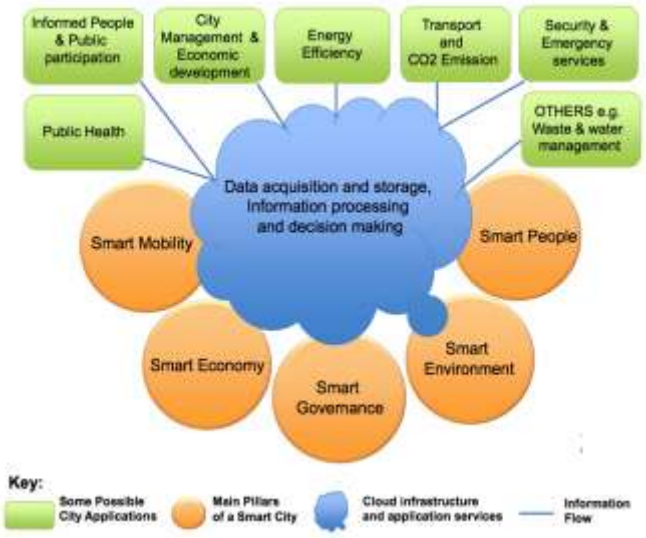

Figure 5: a cross-thematic model of data management for smart city

(Source: Anagnostopoulos et al. 2017, p. 263)

CONCLUSION

The involvement of the Internet of Things can increase smartness of cities. Various governments as the US, Chinese and UAE are able to implement smart city program. Based on this paper it is concluded that IoT is able to provide the best way to make a smart city, which is smart parking, smart health, high-quality waste management, the health of a building, and autonomous driving. These are treated as a major component of a

smart city. Implementation IoT contains various challenges, such as security issues, denial of service, and networking and parking-related issues.

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