Impact of IoT on the automation of processes in Smart Cities:
security issues and world experience

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Abstract. The idea of Smart Cities is inconceivable without automating the basic services and processes such as traffic, communication, and data sharing. It is imperative for smart cities to make use of all the fluid connections that IoT offers in order to achieve its goal of providing quality life to people living in it, through the incorporation of smart technologies. Smart cities seek to connect anything that has an on and off switch to an integrated network that contains all the devices connected to the internet, from toasters to rigs in oil fields. This research explores security issues of IoT and considers the best practices if implementation of IoT in different countries around the world.

1. Introduction
The very idea that the essential services and functions of the city remain interconnected and share real-time information in order to avoid any bottlenecks, requires a system that connects them all. It should be kept in mind that mere connection between these devices and services is not enough for the cause, they need a well-integrated automation system that ensures smooth running of the process.

This is where IoT comes into the equation, it provides that network through which the dream of smart cities can be realized. In a future smart city, all the electronic devices, human wearables, and machines that are connected to the internet will be able to communicate and make decisions based on the streams of data being received from other devices [1].

Thus, IoT becomes an integral part of the concept of smart cities, it should not be seen as an external factor exercising some impact on this concept. Internet of things will make sure that all the features that a smart city promises to deliver are materialized through effective automation and integration. The outstanding features of a smart city include increased pace of activities, fluid communication, automation of basic services, better traffic, better municipal services, secure internet, and environmental betterment, among many others [2].

The impact of IoT on these factors will be discussed in detail in the following discussion along with an evaluation of the positive and negative features that it aspires to bring to smart cities.
2. Security issues of IoT

Security is a major concern for cities across the globe, whether they're smart or not. If security threats are divided into two basic categories, these categories will be physical threats and virtual threats. As the IoT in Smart Cities aspires to connect all the electronic devices in a single network it poses serious security threats. As more devices with less sophisticated security parameters are included in the system, there will be more loopholes and more vulnerabilities. It has also been noted by Morgan, that a person might be at risk of hacker gets in his home network through a seemingly unimportant device such as a toaster, as toaster will be connected to the system [3]. Hence, cybersecurity threats are a feature of IoT when it is included in the automation process of Smart Cities. Physical or man-made threats are easier to be tackled in an IoT integrated network. According to Singh, a sophisticated network of facial recognition devices and biometrics can be used to track the activities of individuals thus, the overall security of the cities will be enhanced. Hence, by connecting those facial recognition, and biometric systems in an integrated network of IoT, the authorities will be able to track down any person in the case of suspicion [4].

3. Implementation of IoT in different countries

Lighting a city up with an efficiently planned lighting arrangement is important for convenience as well as beautification the city. As of now, majority of the streetlights and city lights are controlled and operated manually. There are two main features related to the subject of automation of lighting that the IoT addresses: energy consumption, and examination of failure. It has been mentioned by "IoT and Its Impact on Smart Cities", that traditional lighting systems, the ones being followed by the majority of cities today, depend on manual inspection of failure [5]. This process makes the process long and expensive as individuals have to manually inspect if any light is broken. It takes human capital, consumes fuel to travel, and makes the process slow. With the integration of IoT in the system, the lighting system can be connected to a network and monitored remotely, if any light goes out of order, the system will detect it and inform the relevant authorities about the failure. By doing this, the automation process saves a lot of expenses like human capital, fuels costs, and also saves time. hence, the integration of IoT has a positive impact on the process of automation of lighting systems in smart Cities. The consumption of electricity is also unnecessarily high in streetlights and other decorative lights. most of them are controlled by manual switches which are in turn operated by people. Many times, such lights remain turned on during day hours and thus waste electricity. the impact of few streetlights might not seem to be much, but when few lights are wasting electricity in every city around the world, the amount of wasted energy becomes huge. The integration of IoT will connect these lights to a system that detects daylight and turns the lights off immediately. By doing this, another portion of smart city is automated using IoT.

Another major impact that IoT exercises on the automation of Smart Cities are that of making them future proof. Most of the time cities grow in an uncontrolled manner, suburbs are often merged into the urban centers because of their swelling size. This trend has given most of the present-day cities their shape. It is also the reason why cities have their prime resources in the middle and everything else builds up around it in layers, with the outer most layer often conveying an unpleasant scene such as slums. According to Ellsmoor, the expansion of Smart Cities will not be like this at all, these cities will make use of Big Data to accurately predict the direction and extent of city expansion. The practical implementation of these ideas has been initiated in the United Kingdom (UK), where it has been decided that smart technologies will be used to plan the growth of cities. One prominent feature of these Smart Cities will be the smoothly integrated network system that will keep basic processes and services automated. The implementation of IoT in this process of smart growth becomes imperative for this automation. As IoT is integrated into the system, it will not only decide how people interact with their environment but also how their environment interacts with them. The core objective behind this automation drive will be the aim of utilizing minimum resources for maximum possible outcome, this is exactly what the process of automation promises. And IoT has a relationship of direct proportionality with automation [6].
Weather is a natural process and it cannot be controlled or manipulated completely by human involvement. It is, however, imperative for future cities to make themselves as immune to atrocities brought upon them by weather changes, as possible. To achieve this feat, the Smart Cities will require a system that detects these changes beforehand and alerts the inhabitants to take precautionary measures. According to Singh [4], the integration of IoT in smart cities will ensure help them in improving their emergency readiness and will create a deep environmental awareness. It means that automated systems based on sensors will record the weather situations regularly, this information will then be run through statistical data analysis software. These analyses will be able to predict weather-induced disasters when an anomaly is detected by the automated system. By doing this, the IoT will enable all the services connected to the network to respond immediately and properly to the threat. For example, if heavy rains are predicted in one part of the city, the automated process will start to direct traffic towards alternative routes in order to avoid a potential traffic jam in that area, this feat is only possible if IoT is integrated with this system of automated weather prediction. As more and more systems become integrated with each other, similarly, more and more cities will be integrated with each other and the whole network will act like a super-organism. It becomes critical for all the participant cities in this network of Smart Cities to keep pace with other cities because if information flow from one of these is affected by weather or climate-induced events, whole network of cities will be affected by it. Hence, the cities of the future need to be weather-proof in order to keep pace with time. This process of weatherproofing is only possible when such events can be predicted before-hand and proper arrangements are made before the event. This ability is achieved by implementing IoT.

As important as features like safety from manmade and natural threats is, the importance of cleanliness can never be written off when it comes to Smart Cities of the future. This service, as mentioned before, is related to the municipal agencies and remains critical to the overall wellbeing and health of a city. The automation system of Smart Cities includes thaw plan of automating the system of collecting trash and transferring it to recycling units and/or dumps and landfills. Amsterdam has connected sensors in 2000 of its trash bins, these sensors keep a real-time fill level data of the bins and transfer it to the relevant authority regularly [7]. Because of this process, the individuals who are tasked with emptying trash bins know exactly when to go on and perform their duties. It helps save fuel and time by avoiding unnecessary pre-planned tours to empty half-filled bins. Hence, the integration of IoT is helping authorities to keep cities clean and is also helping them to cut off extra expenses. Apart from this, a well-integrated system of security cameras will make sure that littering of public places and roads becomes traceable and the responsible people are made to pay for their behavior. According to Lea, closed-circuit television (CCTV) cameras can be effectively used against people who throw litter on the roadside. The same strategy can be implemented for the interior of the city and the roads. When all the cameras covering the city are integrated into one network of IoT, no one will be able to throw litter without getting identified and will be fined for it [8].

So, the implementation of the concept of the Internet of things at the level of a whole region was undertaken by the Belgorod region of the Russian Federation. Here, the region receives financial support from the government and successfully implements the IoT technology in the city. Information about the successes and stages of the development of the Internet of things was presented by the mayor of Belgorod, Galdun Y.V., at the first All-Russian youth forum for the development of territories in Stavropol. According to the report of Galdun, at the moment, the city has built Internet of things communications on the area of one quarter of the city. This system controls the serving infrastructure of the city quarter, providing online access to the data of services and to the personal data of applicants. Changes and updates on the improvement of territories are implemented on the basis of statements of local residents through the online notification system. The effectiveness of the introduced technology is not in doubt, as these technologies simplify the personal and social lives of citizens [9].

As we move forward with the concept of Smart Cities, the number of electronic devices is predicted to increase exponentially. Moreover, the consumption of electricity is projected to grow as more people make use of electronic equipment for their ease. In such circumstances, it becomes important for the authorities to implement systems that ensure efficient use of energy and curb wastage to minimum
possible levels. Real estate developers are investing heavily in the field of IoT as it ensures reduced energy consumption and saves both, energy and money. This feat is achieved by IoT by analyzing the data provided by the system, thus, it makes those buildings and living spaces energy-efficient and cost-effective for both, the developers and the inhabitants [10]. IoT has the potential of saving energy by analyzing the day-to-day usage patterns and predicting the most efficient practices to meet the needs of a building or a society. IoT can help in placing different resources in a building in such a way that it boosts productivity and trims energy usage. For example, increased consumption in a specific part of a building can be identified by IoT and its cause can be faulty wiring or air-conditioning system. Moreover, IoT can predict deteriorating health of several systems installed in a building, by doing this, it alerts the authorities to service or replace the aging equipment which saves a lot of energy. These examples only exhibit a small portion of how IoT impacts the automation processes taking place in Smart Cities [11].

The cities of the future promise quality life with facilities like automated municipal services increased security and efficient energy consumption through integration of IoT and data analysis. The process of providing the people with all those facilities requires these cities to automate their process in order to save time and energy. The automation process requires a well-integrated network of devices in which all the resources of a city are connected to each other and operate based on the feed received from other members of the system. This complex web of interconnected devices lays the foundation of a modern Smart City.

4. Conclusion and recommendation
The process of this automation of cities relies heavily on IoT. The implementation of IoT in the automation process of smart cities ensures that security of these cities is enhanced through modern technologies such as facial recognition and biometrics. The visual beauty of the cities i.e. decorative and streetlights, also become efficient as they get connected to an IoT network, it helps cut costs of over hiring and fuel. Cities can be made immune to weather changes by the implementation of IoT, this network will help in predicting such events before-hand and will thus enable cities to adjust without losing efficiency. Finally, it has been discussed that IoT is helping Smart Cities to plan their expansion through data analysis and it is also making those cities energy efficient by predicting consumption patterns. Hence, it is clear that IoT has an overall positive and supportive impact on the process of automation in Smart Cities.

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