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Application of Iot in Smart Cities: A Case Study

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Abstract
Nowadays the idea of smart cities is spreading globally and every city wants to become a smart city. Smart cities are those which include integrated Information and Communication technology in almost all assets of life. These ICTs are used to improve quality of life and provides better performance of technologies at cheaper costs and provide interaction between these sources. The most emerging technology in today's world is IOT which can be implemented for a smart city. IOT is applied nowadays in almost every aspect of life like health, roads, waste management, lights, transportation, buildings and many more implementation of IoT will totally change the verge of development in smart cities and every part of the smart cities will glow behind the opportunity of IoT implementation within the city.

Keywords: ICT, IoT, Smart Santander, SSL

Introduction
The smart cities are those which include application of wide range of electronic and digital technologies, use of ICT, embedded ICTs in governmental systems and the territorialisation of practices that brings ICTs and people together to communicate and share them and interact socially and for the well-being of the society. One of the easy ways to achieve the state of IOTs in to implement the concept of IOT in all possible aspect of life. In this paper we tried to implement various IOT concepts in smart cities development includes roads, healthcare, waste management, resources development and security and many other concepts of IOT through which smart cities can be built across the globe. We collected data and techniques from various researches mentioned below and provided with a combined test result to achieve the above discussed goal.

Luis Sanchez and other authors in their research discussed about IOT facilities for smart cities which are implemented within the Smart Santander project, they tried to check how far these smart conditions are suitable for real-life conditions. The problem they tried to show and tackle is that whether IOT is an essential part of FI or not. The objective of the paper was to test the supporting conditions on proposed protocols and services and configurations in a real world. The paper showed the test bed architecture and the main issue in deploying and integration on large scale. They tried to show design considerations, reliability, mobility, and design considerations. The solution they provided provides significant contribution to these challenges in implementation of IOT in the smart cities.

Byung Mun Lee in his paper about Personal health devices proposed an intelligent system for health care collaborating with IOT devices which gives feedback to an individual and they proposed an algorithm which can be operated in these health devices. They presented various collaboration methods for these IOT and health devices which can improve ubiquitous health. In their paper they tried to reduce the risk of blood pressure, obesity, diabetes using their personal health devices. The merits of this technique is that it provided with a more effective model applied for patients to manage their metabolic syndromes

Related Works
Authors Reinhard Mullner and Andreas Riener have proposed an efficient way to control street lighting system. In many areas, conventional street lighting systems are mostly online

at the night even when the frequency of passersby is very low. This results in wastage of power in large amount. With the introduction of smart street lightings (SSL) i.e. flexible lightings under the act of internet of things (IoT), power loss can be reduced to very large extent. As after implementation of IoT, almost 95% of public will possess smart phones, so street lightings will be controlled by the signalling and position of smart devices of pedestrians. Methodology used here will be based on new location sensors in smart devices and SSL based sever with multi-hoping. This will be a huge plus point in power saving field of science. Hence, SSL system will be highly useful in areas with low frequency of pedestrians. The only demerit possible here is a normal case i.e. areas where frequency of pedestrians is always high, this system may not be more useful in these areas.

Samir A. Elsagheer Mohamed in his paper has talked about the future of IoT based street lighting system. He claimed that the huge amount of electrical power is consumed in many countries in lighting the streets. In some specific periods of time, vehicles pass in very low rate and many parts of streets are totally empty i.e. unoccupied. So in his paper, Samir proposed a system that automatically switches off the street lights of areas where there is no vehicles at that instant of time and turns on the street lights few seconds before some vehicles are going to come. The methodology used here will be based on Vehicular Ad-hoc Networks (VANET). VANET makes it possible to know the presence of vehicles, their speed, and their locations in real time aspect. So this system will save a large amount of electrical power. In addition, it will result in increment in lifetime of lamps and will futher reduce the pollution.

K.H.S.D. Abhishek and K. Srikanth in their paper have focused on technological aspects which will be introduced along with the IoT. They have discussed about the useless electrical power consumption due to overtime online of street lights in non-required areas. They proposed a new model to save power with optimized management and efficiency. It uses LEDs and multiple sensors using ZigBee protocols. This will help in designing an efficient method for controlling street lighting in remote areas. System uses highly economical LEDs to ensure perfect illumination and power saving. Also they concluded that this system will save upto 70-75% of electrical energy and will further increase the lifetime of street lights.

Soledad Escolar, Jesus Carretero, Maria-Cristina Marinescu and Stefano Chessa came up with an idea of adaptive control system for estimating the amount of energy saving in smart street lighting which will be adapted as a new technology with the introduction of IoT. They evaluate their approach by using a special simulator which combines wireless sensor networks and belief-desire-intention (BDI) agents. This will enable a precise simulation of the city infrastructure plus the adaptive behaviour which the city implements. This will result in energy savings up to 35% more than usual street lighting systems. Hence with the introduction of IoT in smart cities, street lighting systems can be improved further with new upcoming technologies among which one is proposed by Soledad Escolar and his team. Furthermore this technology can be added with Google traffic to know the adaptive behaviour of vehicular and other sensing devices.

Priyanshu kumar has talked about the introduction of smart roads at the most vehicular and pedestrian populated parts of the cities. Smart roads will be embedded with the piezoelectric material which is a special class of smart material. Hence piezoelectric roads will produce the electricity from the pressure or stress caused by the movement of automobiles. The main principle behind this is piezoelectric effect. This will be a huge advantage in field of alternative power resources. Further with the introduction of IoT, many new technologies will be added with piezo plates to enhance this technology. In addition the economy of the country will improve with the introduction of these technologies. Also there may be some demerits such as cost and others, but these are nil as compared to the advantage of the technology proposed.

JayavardhanaGubbi in their paper about vision, architectural elements and future direction. The problem discussed in this paper is about the cloud computing centred vision in IOT. There are many devices on cloud which they tried to connect by using Wireless Sensor Network (WSN). An interaction of a public and a private cloud using aneka. They presented the challenges and realization in Cloud centric IOT. They proposed interaction of clouds to provide more flexibility and scalability in the capacity of cloud computing. The demerits of their proposed paper are that appropriate interpretation and visualization of lots of data presents in these clouds.

Andrea Zanella and Lorenzo Vangelista in their paper focused the use of Urban IOT in smart city vision. Their paper uses the most advanced technologies and value-added services for smart cities. They surveyed IOT in Padova Smart City in Italy. The problem they discussed is IOT being such a wide topic the implementation of IOT over a city is a difficult task; they focused on general framework in IOT for developing a smart city. The merits of these technologies can be how far these technologies are being standardized and are already active in application. The demerit is that the data they applied is for a single city (padova) and cannot be standardized on every smart city.

Hans Schaffers and other authors in their paper about cooperation of smart cities and future internet-enabled devices. They considered IOT as an open and user driven innovation. They discussed about how these innovation can sustain partnership among environment and strategies. They considered contribution of various researchers, ICT companies and national and EU actors. They focused on user driven innovation using their Living Labs. Their paper provides effective way of advancement in technologies which will provide economic benefits in business and society. The demerit in their approach is that their experimentation technique is not concrete and provides less opportunity.

Christos Samaras in their paper discuss about how to improve social networking in a smart city using sensor technology. They propose technique to improve people-centric services. They entitled a method as SEN2SOC for connecting social networking and and sensor technology. They try to collect data from an ongoing process and collect results about the existing capabilities of these sensors just like the Smart Santander project. The main concerned over their work is the privacy as social networking over these sensors is not so safe and required proper protection and also the database management is a challenge for the author. The system will provide users a better knowledge about the smart cities they live and the technological adoptions over time.

Pieter BALLON in his paper discusses about the need of clouds for European cities, they uses the EPIC system to transform cities into smart cities. They propose techniques to use these clouds for basis of pan-European services though which cities can be made smarter. The problems for their implementation are the barriers like language interoperability. The discuss techniques to implement the EPIC project throughout the world. The pan-European cities can implement and using this technique they can extrapolate this technique over other places as well. But the challenges in their paper have not been addressed and are yet to be met.

E.Sasireka in their paper includes Quality of Service (QOS) requirement for a safety of a smart city. The paper is addresses the communications and networking issues of an IoT by first identifying and constructing network architecture for potential smart city application and then defining and satisfying their performance metrics. IT focuses on different quality of services requirement techniques for a smart city.The technique they focused on includes Models for ip-based connectivity and Human as a sensor.The demerits of their approach is that there approach is vague.

M.N.Noori in his paper about applications of support vector machines for reliability and health monitoring discusses the two applications of SVM for reliability and health monitoring. He finds a probabilistic distribution of safe and failure regions the data is collected using Monte Carlo technique. The data for large number can be simulated using total number of points. They try to divide regions into safe and unsafe for better protection of life.

DimosthenisKyriazis in his paper about sustainable smart city IOT applications uses two techniques for attaining a sustainable way of reaching IOT to their full potential. Their technique involves management of heat and energy in commercial and residential areas and other technique involves cruise control for public transportation for driver efficiency.Their paper aims at achieving these smart cities in a more efficient and cheaper way as well as conservation of energies for a eco-friendly environment. The main demerits are the IOT challenges in their papers which are the potential requirements for the proposed applications.

Conclusion

In this paper we collected various technologies in IOT for the development of Smart cities. IOT applications in smart cities include smart roads, smart lighting, smart homes, security and health monitoring. To implement these technologies in the development of smart cities we provided the efficient technique. The solution we provided includes significant contribution to these challenges in implementation of IOT in the smart cities.

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