IOT and AI as Key Enabler of Growth of Smart Cities

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Abstract. World population is rising at a rapid pace and is expected to touch 10 billion by the year 2035. Rising population makes the job of the municipal departments and the government difficult with limited resources available. Urban areas are the worst hit. Smart city concept offers a promising solution. It aims to improve the infrastructure, communication and general services provided to the citizens. IOT and AI are the technologies that will work on top of our dependable networks to give uninterrupted communication throughout the city area. The union of IOT and AI will deliver smart insights to help cities minimize the load on the existing infrastructure, counter crime etc.

Smart city describes an area that uses technology and intelligent feedbacks from sensors to make life easier and efficient. It is the combination of IOT and AI that act as key enablers of the smart city.

Keywords: Smart Cities, IoT, AI, M L, Information and Communication Technology (ICT), Big Data

1 Introduction

These days, taking benefit from IoT solutions for smart cities helps citizens encourage development of the economy, enhance the infrastructure of the city, improve the environment condition, optimize the transportation system and decrease the cost of managing the public assets.

To manage the rapidly increasing world population [1], globalization, hyper-urbanization, and to assure economic and environmental stability, cities are now working and spending resources on becoming smart cities. Smart City is utilization of technologies and different types of connected data sensors and actuators to enhance the city infrastructures and the day-to-day operations. Smart cities consist of smart transportation systems, smart citizens, smart and efficient power plants, smart water supplies etc.

Internet is the backbone of IoT infrastructure. Without internet the IoT paradigm will fall over its face. It helps devices to talk to each other and understand the situations and scenarios and

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collect the data and provide intelligent feedbacks in the future using the cloud services. Earlier it was connecting people to people. But now, it is connecting people to devices and devices to devices as well. According to an estimate by IBM, 90 percent of data being generated by smartphones, tablets and other such devices is never analyzed. Further, 60 percent of the data starts to lose its value within milliseconds of being generated [2]. As per another estimate carried out by IDC, there will be more than 30 billion devices and sensors connected to the internet by 2030 [3]. Even after so many devices being connected to the internet, more than 99 percent of the physical world objects will remain separated from the internet [4]. The rapid growth of the communication system and the wireless data transmission technology has enabled more and more devices to connect to the internet and be more relevant and reliable. It is helping in designing exciting and new business opportunities for everyone. In another forecast, it is said that, products and services linked to IoT will generate revenue beyond $300 billion by 2025 [5].

We are living in an increasing technical world, challenging us as human beings.

2 Smart City

At present, there is no standardized, commonly accepted set of definitions which would help to aptly describe a "Smart City" [6].
The concept and the extent of implementation of smart cities vary vastly depending on the level of development in the city. Smart city, at the heart, uses Information and Communication Technologies (ICT) to help make life easier for its people. The governments use ICT to carry out operations effectively and efficiently at the same time, sharing information on the public domain in the mean time improving the quality of services provided to the citizens [7].

With the rapid development in communication field, internet connectivity is spreading and growing at an unprecedented rate. Prices have dropped and businesses are providing customers with high speeds and minimum downtimes. Further, more and more devices are being produced with inbuilt Wi-Fi connectivity solutions and different types of sensors and actuators on them. Smart devices are smarter then ever with low power requirements and smaller sizes. All these factors are helping IoT spread throughout the world like wild fire.

As per the study conducted by IoT Special Interest Group (Technology Strategy Board), IoT is an on-going revolution which allows a huge number of devices with the capability to connect to the internet to capture data and communicate with other devices on the network [8]. The “Things” in IoT are the objects, vehicles, wearable devices, smartphones, clothes, environments etc. They will sense the information from their surroundings and communicate the new information gained to other devices or hubs for further processing.

One of the most advanced examples of a smart city would be the smart parking application of the smartphone of the users [9]. The app would help the users to find and locate the vacant spots without the hassle of going around and looking for empty spaces to park the vehicles. This will help save time and energy of the rider and would help in saving fuel as well. The app would further help in making payments digital with will also help in saving time and there would be no problems of waiting in queues for making the payment and coming out.

Another example of smart city use case would be an application to track and manage fleets of cargo vehicles. Similarly, IoT can help in insurance sector by keeping an eye on the insured vehicles and check for any unauthorized driving patterns. It can also be used in smoke detection and fire alarms. It can extensively be used in healthcare, in managing patients data and giving out proper and on time treatments [7].

3 AI Use Cases for Smart Cities

How can we say a city is "smart"? Simplest answer is that a smart city uses smart and intelligent devices to collect and transmit data to the cloud, without any need of human intervention. Then this data is used intelligently to draw out patterns and predict events and make life easier and smoother for the citizens.

Smart technology is the foundation for smart city development. It helps in improving the infrastructure and services of the city. Artificial Intelligence (AI) is speeding up the smart city concept to greater speeds. Below we mention how AI is fueling the smart city realization.

3.1 Water and Power

With greater control over the machines, pipelines, demand, supply and other utilities, AI will help the government minimize the costs of the services. AI will help in getting out the demand and usage patterns of the city and the officials can work on the findings and provide better and fast services at peak times and reduce the load when the demand decrease. Whilst, water and power conservation will be possible which will help in sustainability [8].

3.2 Smart Parking

Vehicle parking is one of the worst nightmares in India. You go to a market and struggle to park your vehicle. AI and IOT will help in eliminating this problem by collecting real-time data from the sensors and making the data of available parking spots visible on any public domain or app. Once AI has enough data gathered, it can help by providing real-time parking maps [11].

3.3 Waste Management

AI and IoT will help in remote monitoring of waste levels at different parts of the cities. AI can detect the waste generation patterns and help the pickup trucks with the most efficient and fastest route to collect the waste and dump them to the recycling centers [12].

3.4 Public Safety

AI and IoT will help in have an eye on the streets and roads 24X7 curbing the crimes to a large extent. Cities will be monitored all the time. AI algorithms will assist IoT devices by solutions like facial recognition and vehicle over speed detection to keep the public and the city safe. It will help in reducing the crimes in the city [13].

3.5 Road Traffic

Road traffic is one of the biggest challenge cities face today. As the population is increasing, people travelling from one place to another for work and other matter also increases. A smart

city should allow the citizens to move throughout the city with safety and on time. IoT and AI can help the smart cities to map the complete city and its traffic and find the shortest and quickest path from one point to another [14].

4 Trends in Smart City Development

In Smart City development, we will discover four key pillars defining the future strategy for developing and driving a smart city. They are summarized in the following section. This section discusses briefly the four key pillars defining the future strategy for developing the smart cities.

4.1 Trilateral legislative relationship between the Government, the citizen and the Private Sector

The relational management between Government, the private sector and Citizen is based on the following concept:
The intelligent cities will enable citizens to register with their notifications (transport, health care, security, utilities, etc.) or the functions of the city / government officials through a system of complaint management.

4.2 Smart City Integrated Management

City planners and managers should realize that solely ICT will not be able to make a city smart. Constructing a smart city requires a complete understanding of the technology, a procedural approach to implement and control the smart city use cases and the prime focus on making economic gains and making life of the citizens safe and easy. The smart city management includes the following:

4.2.1 Management of the Protection of Governmental and Non-Governmental Critical Infrastructures (Crisis)
4.2.2 Smart Grid Management
4.2.3 Transport Management
4.2.4 Environment and Water Management
4.2.5 Social Assistance Management
4.2.6 Social Education Management
4.2.7 Urban Management (Smart Buildings)
4.2.8 Communication Management
4.2.9 Relationship management with civil society (requests – claims - complaints - proposals)
4.2.10 Financial Management (investment and budgeting)
4.2.11 Urban Security Management
4.2.12 Total Quality Management (Corrective Audit)

4.3 Machine-to-Machine platform

In a technological context, Smart City is actually a machine-to-machine platform M2M that allows different systems (people, devices, machines, buildings, etc.) to be firstly connected, managed, and then controlled in a standard way. The M2M platform is a city-based method and provides information for action and real-time reaction, allowing a better approach to efficient services and continuously improving the budget requirements.

4.4 Decision on the bundled network

Thanks to the internet, state-of-the-art communications systems, it is created a global network of networks that delivers data and information instantly from all areas of activity to a "Smart City." The management decision can be taken in cooperation and after counseling with the concerned decision makers, Public-Private Partnerships (PPP) experts, empowered institutions, and live video system with "shared real time digital content" (database - documents, images, video, etc.).

Being in real time, the process of solving the problem or an event takes place through simultaneously flow of the retrieval of information (document, networked sensors, images) - analysis and synthesis (city management in cooperation with the concerned departments) - operational order or decision. The data flows instantly because it supposes the simultaneously participation in live video of the decision maker, and the counselor.

5 Conclusion

It has been a long-desired thought of smart cities with fully interconnected use cases like self-driving cars, vans and buses all connected with one another and further with smart highways, smart traffic lights and smart parking lots. Entire city will work in tandem to help citizens to move throughout the city with efficient resources and safety and on time without being late. It will be a fully connected online system that will not only protect human lives, but also save precious time and fuel. It will be a truth which can only be achieved only when the governments and the tech giants move towards collaborations connecting together to make the cities smart.

India should welcome IoT and AI based technologies to enter and help India to develop in all fields. Cities all over India and throughout the world should plan a course of action to implement and use smart city use cases which will definitely help them develop and touch new heights and make their citizens happy and safe. Once initiated, it will be just a matter of time before the complete smart city concept is realized.

References

[1] Gartner Says a Thirty-Fold Increase in Internet-Connected Physical Devices by 2020 Will Significantly Alter How the Supply Chain Operates, http://www.gartner.com/newsroom/id/2688717

[2] IBM Connects “Internet of Things” to the Enterprise, http://www-03.ibm.com/press/us/en/pressrelease/46453.wss

[3] IDC: 30 Billion Autonomous Devices By 2020, https://securityledger.com/2013/10/idc- 30-billion-autonomous-devices-by-2020/

[4] Seize New Product and Revenue Opportunities with the Internet of Things, http://www.cisco.com/web/solutions/trends/iot/portfolio.html

[5] Forecast: The Internet of Things, Worldwide,2013, https://www.gartner.com/doc/2625419/forecast-internet-things-worldwide-

[6] Aawatif Hayar & Gilles Betis Frugal Social Sustainable Collaborative Smart City Casablanca paving the way towards building new concept for “Future Smart Cities By and for All”, IEEE SENSET 2017 Conference Lebanon
[7] https://riberasolutions.com/smart-city-iot-and-ai/
[8] https://iagre.org/internet-of-things-main
[9] A. Khanna and R. Anand, "IoT based smart parking system", 2016 International Conference on Internet of Things and Applications (IOTA), 2016. Available: 10.1109/iota.2016.7562735.
[10] https://achievion.com/blog/how-artificial-intelligence-ai-is-helping-to-make-the-smart-cities-concept-a-reality.html
[11] T. Kilic and T. Tuncer, "Smart city application: Android based smart parking system", 2017 International Artificial Intelligence and Data Processing Symposium (IDAP), 2017. Available: 10.1109/idap.2017.8090284.
[12] R. Elhassan, M. Ahmed and R. AbdAlhalem, "Smart Waste Management System for Crowded area : Makkah and Holy Sites as a Model", 2019 4th MEC International Conference on Big Data and Smart City (ICBDSC), 2019. Available: 10.1109/icbdsc.2019.8645576.
[13] M. Mendonca et al., "Improving public safety at fingertips: A smart city experience", 2016 IEEE International Smart Cities Conference (ISC2), 2016. Available: 10.1109/isc2.2016.7580772.
[14] Z. Arbi, O. Belkahla Driss and M. Sbai, "A multi-agent system for monitoring and regulating road traffic in a smart city", 2017 International Conference on Smart, Monitored and Controlled Cities (SM2C), 2017. Available: 10.1109/sm2c.2017.8071843.