Implementation of Smart Cities under IoT & Big data Analytics

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Summary
In this modern era; technological aspects are enhancing with the mitigation of rusty flaws and traditional methods and encapsulating the same in a wide range of latest methodologies. However, in this brutal research we focus on the man-power or human effort in daily based tasks being done in the city environments and provide an enthusiastic solution to incorporate the maximum level of ease. The research involves automation of such tasks and actions in order to save time and to ensure the productivity with a great extent also endorse the use of modern technologies. To do so, we will be incorporating the idea of automation in a city / smart processes and tasks for a city with the controlling mechanism through an automated system such as sensors, gadgets etc. The control mechanism would be under the surveillance of the device and can be operated under the umbrella of any operating system. On the other hand, there would be a bulk of data in form of user database, product descriptions, device operational attributes and user responses; it would be termed as the IoT (Internet of Things) environment. The overall, control would be sensor based and data can be received and transferred by means of WiFi.

Key words:
Big Data, Internet of Things, Sensors, Surveillance.

1. Introduction

Today, there are many requirements and needs that are needed to be fulfilled in terms of ease of access. However, if we look at the basic peculations we may found the need of Information technology in almost each and every area. In many of the community services whether it is in the information systems, local departments, law enforcement, public libraries, learning institutions, hospitals, water supply services, transportation systems, and waste management; we will always be in sake of the ease of access in these sections. On the other hand, the IoT plays its role in encapsulating the mitigated access of all the devices and gadgets at one platform. Similarly, in these days, devices are meant to be automated in order to pace up the accessibility and productivity and improve the outputs at greater levels. In the educational platforms, the devices can be formulated and automatized and can be accessed using a single device such as wrist watch or cellphone etc. also we can use up the sensors to automate the operations of daily life to save man power and effort and reduce the time collaboration with the basic needs. Similarly, the large data analysis adds new advantages to the table which include a higher level of efficiency and speed [1] [2].

While in few decades ago, companies were required to gather information, analyze and to update it so that it can be easily retrieved in future for decision making process, but today companies can easily find ideas to foster instance decisions. The companies now have a competitive advantage that never existed before by having the capacity for faste process. Before one can arrive at the ultimate conclusion of the research, it is important to first realize that the main goal of leverage Big Data is to reach to both quick and accurate decisions. This can be referred to as situational awareness. In whatever the environment or industry situational awareness leads to clustering, a better understanding of the information at your disposal, what can be controlled, and performing instant analyzes to pinpoint the deviations from the normal behaviors or patterns that can influence the outcomes of the business process. Savors thesis-having things, arriving at the most appropriate decision dance within the required duration in each gets to be simpler. In the whole smart cities is speculated for the economic growth in the urban development and can be feasible for the rectification of many technology dependent issues [1] [2].

However, this paper is organized in a very handy shape, firstly we introduced the basic idea and need of smart cities, after that we will present the basic processes of incorporation of smart technology which will follow along with the approach towards the same and finally we will provide the intro to the tools being used and we will conclude the paper with a summarized section.

2. Process Involved in Smart Citiees.

2.1 City Monitoring and Operating System

The aim of the city system architecture is to form the combination of local systems with the environmental inputs of the daily tasks in order to provide solicited solution for the mobility of operations and monitor the performance for the optimization of the processes. Different interfaces can be added up such as lighting

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systems, mobility systems etc. over the ad hoc networks and any other transportation mechanism which can control and monitor the bunch of devices using a single platform where all of the needed information will be located in a real time dataset in this case Internet of all things (IoT)[2].

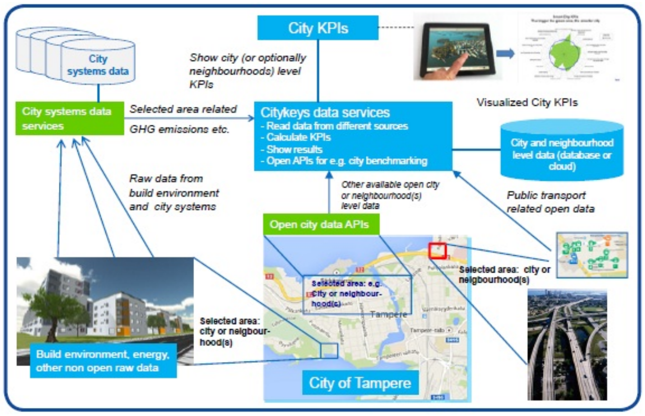

Fig. 1 City System Architecture.

2.2 Enabling Interoperability Environment.

There arises a very serious concern when independent organizations are sharing the health information between themselves and where each one of them is using a different electronic personal health care information system (HIS) or a personal health record (EMR) management system. This is because an integrated interface or interoperable environment that is easily understood by all the end users in the field of healthcare is required [8].

For the smart city's solution, interoperability environment is one of the key items to be taken care of ICT systems that enable the development of better diffusion of new and older services across the cities.

2.3 Smart Transport System.

Tomorrows' Elastic Adaptive Mobility (TEAM) presented a new notion of a very elastic and collaborative mobility with an aim of developing systems for both travelers and drivers. All the participants will now be able to make better travelling choices by having the ability to take into considerations all of their needs and constraints and those of others and the network at large.

The latest technologies will be beneficial to all travelers by availing instant traffic recommendations that are in line with all aspects of the environment and global mobility. By connecting the travelers, conductors and collaborative network infrastructure operators it turns to be static in the elastic mobility when the transport network is fully utilized [6].

3. Smart Cities Technologies

3.1 Internet of Things (IoT).

Internet of Things (IoT) falls outside of an explicit definition, encompassing an integration of technologies and myriad of applications plus a lot of business opportunities, and instead a definable communication protocols or architectures. There are many views that define IOT differently. But, generally the IOT is taken to be a set of enhancing technologies which are virtually useful to all activities in the society in order to boost the productivity. Technologies that are basic and dynamic detect process, power, refines and manage data but supporting technologies on the other hand are low-power embedded and energy harvesting systems. The precept of the enabling technologies is that they are independent of application and domain, which is actually the IoT's main strength over applications, domains and property specific measures that are so dominant in the contemporary world [3].

3.2 Smart Data.

The colossal amount of data that the smart city's collect needs to be quickly analyzed in order to make it more useful. Some cities are using online open portals as an avenue to publish data in order to allow easy access to it by the individuals who want to use it in order to predict the future models.

4. Big Data with Smart Cities

Traffic will be measured and regulated using RFID tags embedded on vehicles. In order to indentify the congested roads, the tags will be sending the location information of every car to a central control unit. The citizens will now be able to access the exert information about the state of public transport through their mobile devices or Smartphone's [4].

The data will even be generated from the garbage collection. In order to dispose the garbage, residents will be required to have smart cards that will be used in the containers. There is a work in progress that is undertaken by Cisco, architects and other planers to eliminate the operations of the garbage collector. This means garbage trucks will shortly stop their services and each and every home will be required to have disposal unit that will suck the garbage up to a center where it will be discarded by a process that is environmental friendly. The garbage will also be useful in generating electricity for the city [4].

The data will increase the safety of the citizens. Children in the park, for example, will be required to wear bracelets that have sensors so that in the event that one may go missing he or she will be easily detected.

Street lights can be controlled using the smart energy networks. For example the smart grids can detect the number of people in a particular area in a particular time and turn off the lights in areas in which there is few or zero number of people and they will greatly help in reducing wastage of energy [4].

5. Challenges in Smart City

Smart cities projects require expertise that covers many areas including finance, planning, transportation, energy security, telecommunications and more. They also require public-private partnerships (PPPs) that embrace all these different dimensions.

IoT smart city concept is a holistic, layered framework that addresses the needs of multiple aspects of smart city projects and allows cities to use urban data to stimulate economic competitiveness and build more efficient and effective solutions Effective for many of the city's challenges.

By working with an ecosystem of partners, we offer products, tools and services for public service providers, urban network operators, application providers and enterprises.

We use our technologies and expertise to create an efficient common network infrastructure, secure IoT architecture, and control and management layers that meet the needs of CIOs, city agencies and municipal councils.

Fig. 2 Technologies involved in Smart City.

Our market tests and use cases cover smart metering, parking, energy, public spaces (such as bus shelters), private smart city networks, crowd control and more. Our solutions help you put the IOT into the life of your city.

6. Smart City Building Blocks

• The Smart City infrastructure includes a broad range of mobile network technologies that support standard cellular protocols, Wi-Fi ® (coverage for both indoor and outdoor sites), LoRa, MuLTEfire and LTE major public safety and the first speakers [9].

• Optical and microwave products and a unified and user-friendly network manager.

• Cloud-based network solutions allow cities to take advantage of open cloud architecture of Nokia Nudge Networks SDN and Data Center Interconnect, which supports low-latency and highly secure connections between data centers

• The IMPACT Platform (Intelligent Management Platform for All Things) IoT Platform provides the layers for managing connectivity, activating applications and managing peripherals that are secure on every point. 'End and allows you to use data and analyzes to create value for your city [1].

• The Connect Program IoT Community Ecosystem brings together innovative companies to collaborate with end-to-end concepts, end-of-life prototypes, business models and marketplace trials [8].The Net Guard security portfolio uses security analyzes and threats to protect the intelligent city and prevent infections.

Nokia's corporate communications and collaboration solution provides an open, agile and incremental framework that allows city administrators to take control of their communications services.

6. Configuration Methodologies

6.1 Hardware.

The Wasp mote Smart Cities board has a purpose of extending the Smart Metering Board's monitoring capabilities to the outdoor locations from indoors environment. In addition the brightness, temperature and humidity sensors, Libelium panels and other three more sensors with specific applications were added: three cracks monitoring sensors to monitor in structures and building, a single-strand strain gauge for crack detection, a displacement sensor] for the width of the crack (SLS095) [10], and for the propagation of the crack a multi-strand strain gauge was also installed. In order to detect the amount of suspended particulate/dust in the environment a PM-10 (GP2Y1010AU0F) was added to the applications that controls the air quality [10] . A WM-61A microphone that is suitable for measuring environmental noise in the A decibels scale was added.

Dimensions: 73.5 x 51 x 1.3 mm
Temperature Range: [-20oC, 65oC]
Weight: 20gr

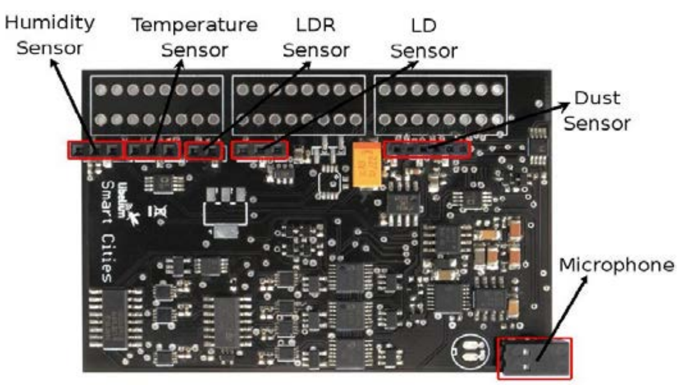

Fig. 3 Hardware Infrastructure for Sensor Installation.

Maximum admitted current (peak): 400mA
Sensor Power Voltages: 3.3V, 5V, 10V and 24V
Maximum admitted current (continuous): 200mA
Board Power Voltages: 3.3V and 5V

6.1 Sensor.

Particle Sensor (PM-10) – Dust Sensor (GP2Y1010AU0F):

Fig. 4 Partial Sensor [10].

Sensitivity: Typical: 0.5V/(0.1mg/m3), Minimum: 0.35V/(0.1mg/m3), Maximum: 0.65V/(0.1mg/m3)
Supply voltage: -0.3V ~ 7V
Output voltage range: 3.4V
Output voltage at no dust: Typical: 0.9V, Minimum: 0V, Maximum: 1.5V
Current consumption: Typical: 11mA, Maximum: 20mA
Operation temperature: -10oC ~ +65oC
LED Operating supply voltage: 0.5V
LED Pulse width: 0.02ms
LED Pulse Cycle: 1ms

6.1.1 Measurement Process.

An infrared light that is produced by an ILED diode and then being reflected by dust in the air is detected and captured through the means of a phototransistor by a GPY21010AU0F sensor which is an optical device. A pulse signal of 0.32MS by width and 10ms duration which is automatically generated by the hardware in the card when the sensor is on and being a signal of pulses of the same duration and amplitude that is proportional to the density of the dust in the environment is supplied to the diode (see the graph in Figure 4) [10]. A demodulation circuit that extracts envelope of pulse train at the output where an analog voltage of 0V -3V interval can be played at one of the analog inputs of the knob (ANALOG1) is added in order to read the signal. A semiconductor switch that is enabled with DIGITAL 2 signal is used to control the voltage’s supply

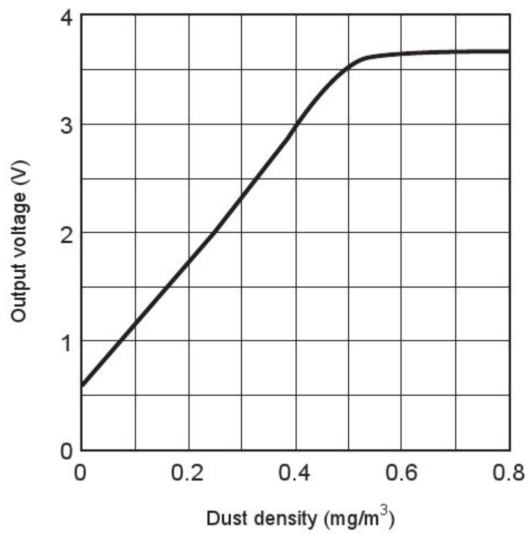

Fig. 5 Measurement of Dust Sensity [10].

Fig. 6 Implementation of Noise Sensor [10].

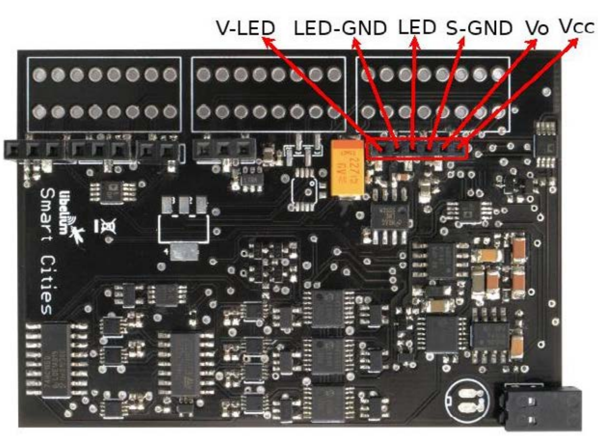

Fig. 7 Socket Hardware [10].

Linear Displacement Sensor - Crack measurement (SLS095) [10]:

Sensor resistance: 400Ω
Electrical stroke: 10mm
Resolution: 10µm (imposed by the analog-to-digital conversion)
Linearity: □10.5%
Supply Voltage: +8.9V
Temperature Operation: -30oC ~ 100aC
Power dissipation (20ºC): 0.2W

6.1.2 Measurement Process.

SLS095 is a linear motion sensor by Penny and Giles and it is a potentiometer that has a wiper that moves with an axis as it is directed by the body of sensors. The two ends of the potentiometer are fixed on the sides of the crack and the width is measured by readings of the wiper. Because of this reason, the sensor is configured as a divider of voltage, with one end as a 3V power supply source and the other end being grounded and the wiper being connected to the Wasp mote analog-to-digital converter input ANALOG7, which leads to a resolution of approximately 11 µm. The voltage supply emanates from a solid state switch that is controlled by DIGITAL1 [10].

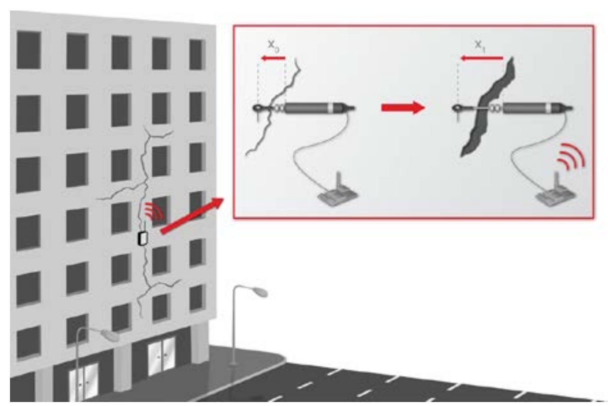

Fig. 8 Crack Detection Sensor [10].

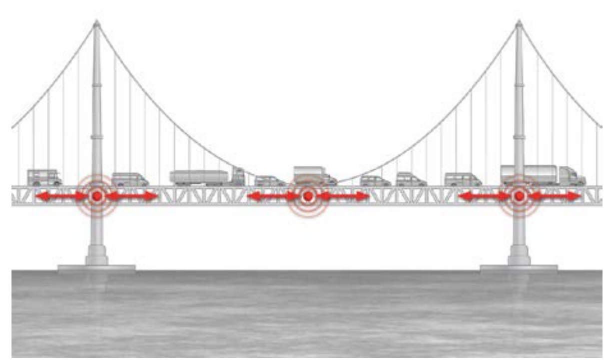

Fig. 9 Result measurement of Bridge [10].

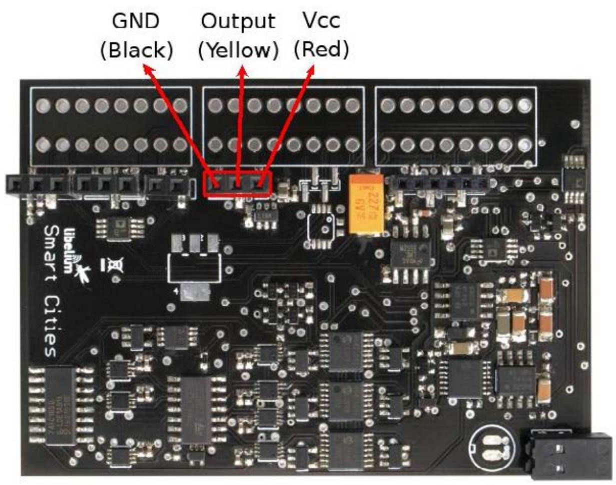

Fig. 10. Socket Infrastructure for Sensor [10].

7. Conclusion

In a nutshell we can conclude that smart cities are the vital requirements for the individuals now a days, it not only fulfills the technological aspects but also enhance the mode of living and preservatives of the city. Majorly the considered areas are communication, education systems, healthcare and traveling in-courses. Therefore, IoT and Big Data forms a great combo for incorporation of smart technological devices comprises of sensors and tags etc. to improve these paradigms and to enclose the living criteria in a concise and well-structured shape of ease.

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