International Journal on Future Revolution in Computer Science & Communication Engineering
Volume: 4 Issue: 12
ISSN: 2454-4248
72 – 76

Integrating Smart Objects into a Integrated Internet of Things Architecture for Smart Cities

T. Venkat Narayana Rao [1], Mattapally Sahithi [2], Yadavalli Varshini[3]

Professor[1], Student[2], Student[3] , Department of Computer Science and Engineering,
Sreenidhi Institute of Science and Technology,
Yamnampet, Hyderabad, TS, India.

Abstract: Increasing population in urban centers day by day demands for more services and infrastructure in order to meet all the needs of residents and visitors of the city. Due to the increased developments in advanced metering and digital technologies smart cities have been equipped with different electronic devices on the basis of Internet of Things (IOT), The utilization of all the technologies to achieve this objective presents an opportunity for the development of smart cities. This paper focus specifically to an urban IOT system and also to provide a comprehensive review on the concepts of smart cities, technologies of IOT and its applications.

Keywords: *Smart cities, Analog to digital Converter(ADC),Information and communication technologies(ICT), IOT, Urban.*

*****

1. Introduction

Internet of Things (IOT) is a communication standard that predicts a future, in which the objects of everyday life will be equipped with transceivers for digital communication, microcontrollers. This system possess suitable protocol stacks through which we can communicate with one and other users/devices and has integrated with basic part of the Internet [1].The objects which we use in daily life are used for the equipment with electronic devices and protocol suites to make them interconnected and connected to the Internet and is used in developing the cities.

IOT is a dynamic global network infrastructure which has capabilities of self-configuring based on standard and interoperable communication protocols. The characteristics of IOT are dynamic, unique identity, integrated into information network and self configuring. The concept of IOT is to make the internet much more pervasive and effective. Furthermore, by establishing quick access and contact with a variety of devices such as, home appliances, surveillance cameras, monitoring sensors, actuators, displays, vehicles.IOT helps in the improvement of wide variety of applications usage which will make use of large amount of data that is generated by objects which provide new companies, services and public administrations opportunities.

For such a mixed field of application identifying solutions and making these solutions capable of satisfying all the requirements of the application is a formidable challenge. Due to this difficulty incompatible proposals for the practical realization of IOT systems have been led. Therefore, in the perspective of a system, the realization of an IOT network, along with the required backend network services and devices, still lacks an established best practice because of its novelty and complexity. In addition to the technical difficulties, the adoption of the IoT paradigm is also hindered by the lack of a clear and widely business model that can attract investments to promote the deployment of these technologies [2]. Here, IOT paradigm with respect to application for a urban context is prime interest, as it responds to a strong push for many governments to adopt ICT solutions in the managing public affairs, thus realizing the so-called Smart City concept [3].

2. Smart City Perception and Services

Smartness of a city is determined and technological implementation by Internet of Things (IOT). IOT is a new model that is gaining fast growth in the purview of modern wireless telecommunications. The primary thought of this concept is the global existence around us ensuing variety of things or objects. The key idea of the IOT is the outspread existence of objects which can be measured and inferred.

The complete verdict , execution and management of the smart city will be controlled by a single, devoted department in the city[4]. By doing so, we can avoid disputes between different stakeholders, for attribution of decision making power.

On technical side, the significant issue lies in the ability of exchanging the information between varied technologies which are being use currently in city te and urban developments. In this esteem, the vision of IOT will assist us to grasp a combined urban-scale ICT platform, thus unchaining the potential of Smart City vision[5][6].

 ISSN: 2454-4248
72 – 76

In view to the financial status and conditions, a good business model is yet to be complete. This made a situation, wherein the investments in public services are determined by a general drop-off. This situation is depressed by adverse global economic circumstances, which stopped the growth of huge smart city market from becoming a reality. So, some initiative should be taken to resolve this situation.

Fig 2.1.1.Iot in smart cities

The above fig. 2.1.1, provides the idea about how the IOT has extended the services that associate social service with fair investment. Some of applications of IOT in cities are smart parking, smart buildings and rest will be discussed in other sections [7].

2.1 Structural Health of Buildings

Some of the old buildings of a city should be maintained properly, this can be attained by continuous monitoring the conditions of buildings and by identifying the areas that are responsible for impact of external agents. This system contains a set of sensors, which are organized in the form of a network[8]. These sensors monitors the vibrations occurred in structures such as buildings and bridges. The health of structures is accessed by analyzing the data collected from sensors. This data aids in detecting in cracks and locating the damages and calculating the remaining life of a structure. This system also offers advance warnings, if there is any forthcoming failure of structures. These systems use large number of sensor nodes which are wireless and which are motorized by the traditional batteries, researchers are exploring energy harvesting technologies for harvesting ambient energy , such as , sunlight, mechanical vibrant and wind energy.

2.2 Waste Management

In the present scenario, waste management is one of the major issue in many cities. People cannot find a better place for storage of waste material and even cost of service has increased drastically. Waste management can be done by using proper waste containers, which will have the capability of sensing the level of load and permits the collection trucks to collect the waste in an effective way, and also improves the quality of recycling. The cost of waste collection will also be decreased and, this also causes some ecological advantages. [17].

Fig 2.2.1. Waste Management

The complete process of waste management system using IOT is shown in fig. 2.2.1, the IOT will connect the devices in the end i.e., intelligent waste containers is integrated to a control center where the processing of data is done by an optimization software and also determines the optimal management of the collector truck fleet.

2.3 Air Quality

Air quality is a global challenge for regulators, governments, citizens and city administrators. Many governments are investing multi-billion dollar in policies and solutions to improve air quality and they are empowering cities to tackle air pollution locally. We use mobile enabled sensors which can measure and report air quality in real time. This mobile enabled sensors are smaller, low cost and portable , which uses advanced sensors and both IOT platforms and communication Technologies. Even “BigData” and machine learning are applied in this scenario for detecting weather forecasting issues. This will also help to understand the fluctuations in air and causes for air pollution.

2.4 Noise Monitoring

Noise levels has been increased day by day in some cities and there is a need for noise monitoring. IOT based noise

 ISSN: 2454-4248
72 – 76

pollution monitoring systems use a number of noise monitoring stations that are deployed at various places. The data on noise levels from the stations is collected on servers or in the cloud. This data is then aggregated to generate noise maps and corrective measures can be initiated.

2.5 Traffic Congestion

One of the serious issue today is road transport and traffic congestion and monitoring. The Intelligent Transportation System (ITS), sends the information of traffic to control room which improves the traffic efficiency.

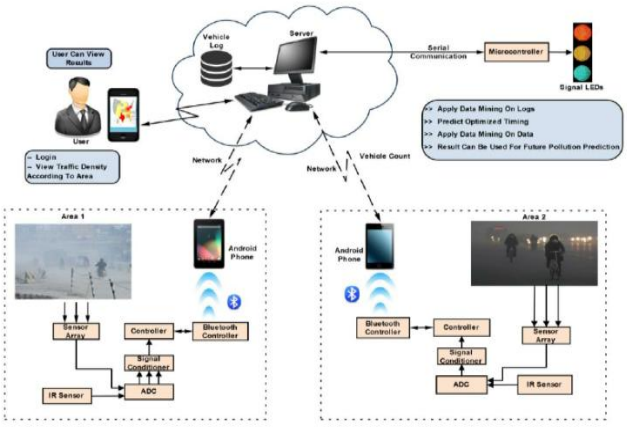

Fig 2.5.1: Architecture of Traffic Congestion & Monitoring System

The fig. 2.5.1 includes two major modules i.e. the architecture of traffic congestion and monitoring system in IOT is divided as hardware and software modules. The hardware module contains microcontroller, Bluetooth controller, sensors and ADC etc, whereas software module contains server, data mining techniques, Android Applications etc. The system utilize new technologies for real-time collection, organization and transmission of information to provide an efficient and accurate estimation of traffic density and weather condition, which can be exploited by traffic-aware applications.

2.6 Smart Parking

In today's world finding an available parking place is becoming an issue for drivers and it also becomes harder as number of private car users are increasing on daily basis. By taking this condition as a chance for smart cities, certain actions are to be initiated for improving efficiency of parking resources which can decrease the searching time, road accidents and traffic congestion. Giving information in advance to drivers regarding access to parking areas around them can reduce the traffic and parking issues. The fig. 2.6.1 depicts steps for finding parking place.

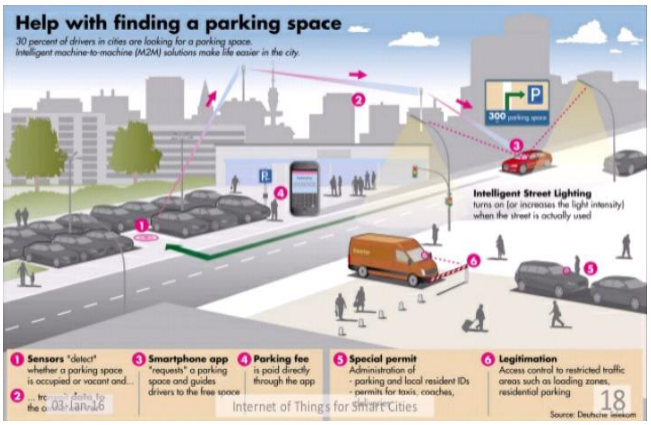

Fig 2.6.1: smart parking using IOT

3. IOT Technologies for Smart Cities

The IOT is a network which uses communication protocols on internet super highway [10][11]. It is a type of broadband network which uses standard protocols. The main theme of IOT is to make objects universally present, which can be measured and understood. These objects have the capability to change the environment. On this base, IOT is allowed in the developments of various objects including communication technologies. IOT consist of set of smart devices which includes mobile phones and objects like landmark ,foodstuff, work of art and many other[12][13]. These can work together to provide a common target. Internet of Things has a strong impact on the life of users[14]. Some of the IOT-related technologies are discussed in the following sections.

A. Radio-Frequency Identification (RFID)

The readers and tags are the part of the system, plays a role in the text of the IOT applications. When an object is applied by these technologies, one can assign a unique digital identity to each object and can carry out their automatic identification. This can be related to the digital information and service [15].

B. Wireless sensor network (WSN)

These WSNs are the group of devices or sensors which are used to monitor different ecological conditions. These also provide dissimilar suitable data which can be used in several cases such as healthcare government services and seismic sensing [13].

 ISSN: 2454-4248
72 – 76

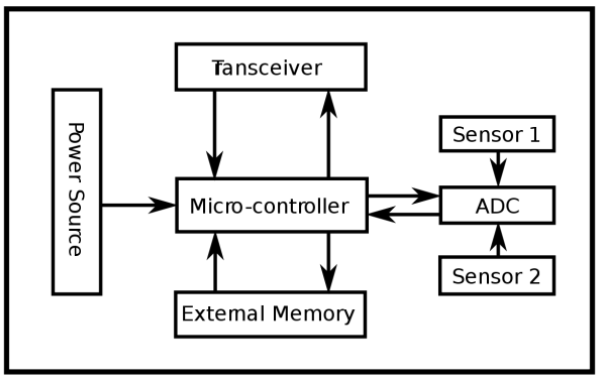

Fig 3.1.1. Architecture of wireless sensor node.

A Wireless sensor network consists of a power supply, radio interface, ADC(analog to digital convertor), micro controller, memory and multiple sensors. The architecture is shown in Figure 3.1.1. The wireless sensor node contains a wide variety of sensors which receives and measures data in analog format. It also contains an ADC which converts analog format to digital format. According to data requirements memory and micro-controllers process some procedures on data. Finally, data will be transmitted by a radio interface.

C. Addressing

Addressing the internet can make a incredible interconnection of people. To set up smart environments, IOT provides an interconnection between objects and things[16]. The addressing of large combination of objects is vital for controlling them through the internet. Due to this, the power of ability of uniquely identifying the objects is crucial for desired outcomes of the IOT. In addition to uniqueness mentioned above, we require some other parameters to develop addressing scheme such as scalability, persistence and reliability etc.[16].

4. Benefits and application of IOT Based Smart Cites

4.1 Improved Infrastructure

Bridges and buildings often require huge investments to maintain and repair over their service lives. Smart technologies will provide cities to identify places that are needed to be fixed, if there is any failure with respect to infrastructure. Workers will be notified by receiving the messages from the smart sensors regarding the damages and conditions of the buildings. Smart sensors will transmit data about the structural changes, and also identify and the tilts and cracks in the buildings. Workers after receiving the notifications will perform the necessary inspections for proper maintenance. These capabilities present a massive opportunity for cities to save tax and lives on preventable infrastructure failures[9].

4.2 Increased Awareness to Traffic/ Infrastructure Issues

In smart cities one of the greater advantages is the capability to monitor common congestion points and certain traffic patterns with the help of sensors which are placed inside of cars. The data composed can be used by drivers where drivers can brake while driving and huge volumes of traffic.

Along with improvement traffic patterns, smart technology can also be used. This technology helps to monitoring traffic lights and pedestrian signals, also in detects how environmental conditions are being affected by traffic. One of such implementation is from Las Vegas, Nevada with a bank of sensors installed around their intersections. Carbon dioxide content in the air and traffic patterns are taken by the sensors and checks whether it is useful to make the light cycle shorter so that the cars are not idling and generating exhaust unnecessarily or over and above permissible limits.

4.3 Health care

The Internet of Things (IOT) has authorized remote sensing and communication with various devices. In healthcare, IOT has many benefits in alerting and monitoring patients. IOT healthcare is applicable in many medical instruments such as glucose level sensing, ECG monitors and oxygen concentration detection. Advanced technological platform has facilitated its achievement, though it has its own challenges.

4.4 Security

Security of data and privacy of things are some of the major challenges which are to be resolved. This is also one of the challenges being faced by IOT. IOT establishes a tiny relationship between devices and sensors for maintenance of security of data and privacy. These are also the one of the factor for success of IOT.

5. Conclusion

In this paper, the emphasis is focused on the solutions which are available for the implementation of urban IOT implementation. The term smart city covers a large range of situations and alternatives. In many cases the term smart refers to the intensive use of ICT tools and methods to link city services.

 ISSN: 2454-4248
72 – 76

The discussed technologies are close to being standardized and industry players are already active in production of such devices that make use of these technologies to enable the applications of interest. In fact, while the range of design options for IOT systems is rather wide, the set of open and standardized protocols is significantly smaller. The enabling technologies, furthermore, have reached a level of maturity that allows for the practical realization of IOT services and solutions. This starts from field trials that will hopefully help clear the uncertainty that still prevents a massive adoption of the IOT paradigm. A concrete proof-of-concept implementation, deployed in partnership with the city of Padova, Italy, has also been described as a relevant example of application of the IOT paradigm to smart cities.

References

[1] L. Atzori, A. Iera, and G. Morabito, "The internet of things: A survey," Comput. Netw., vol. 54, no. 15, pp. 2787–2805, 2010.

[2] A. Laya, V. I. Bratu, and J. Markendahl, "Who is investing in machine-tomachine communications?" in Proc. 24th Eur. Reg. ITS Conf., Florence, Italy, Oct. 2013, pp. 20–23.

[3] H. Schaffers, N. Komninos, M. Pallot, B. Trousse, M. Nilsson, and A. Oliveira, "Smart cities and the future internet: Towards cooperation frameworks for open innovation," The Future Internet, Lect. Notes Comput. Sci., vol. 6656, pp. 431–446, 2011.

[4] I. Vilajosana, J. Llosa, B. Martinez, M. Domingo-Prieto, A. Angles, and X. Vilajosana, "Bootstrapping smart cities through a self-sustainable model based on big data flows," IEEE Commun. Mag., vol. 51, no. 6, pp. 128–134, Jun. 2013.

[5] J. M. Hernández-Muñoz, J. B. Vercher, L. Muñoz, J. A. Galache, M. Presser, L. A. Hernández Gómez, and J. Pettersson, "Smart Cities at the forefront of the future Internet," The Future Internet, Lect. Notes Comput. Sci., vol. 6656, pp. 447–462, 2011.

[6] C. E. A. Mulligan and M. Olsson, "Architectural implications of smart city business models: An evolutionary perspective," IEEE Commun. Mag., vol. 51, no. 6, pp. 80–85, Jun. 2013.

[7] N. Walravens and P. Ballon, "Platform business models for smart cities: From control and value to governance and public value," IEEE Commun. Mag., vol. 51, no. 6, pp. 72–79, Jun. 2013

[8] M. Dohler, I. Vilajosana, X. Vilajosana, and J. Llosa, "Smart Cities: An action plan," in Proc. Barcelona Smart Cities Congress, Barcelona, Spain, Dec. 2011, pp. 1–6.

[9] J. P. Lynch and J. L. Kenneth, "A summary review of wireless sensors and sensor networks for structural health monitoring," Shock and Vibration Digest, vol. 38, no. 2, pp. 91–130, 2006.

[10] L. Atzori, A. Iera, and G. Morabito, "The internet of things: a survey," Comput. Netw, vol. 54, pp. 2787–2805, 2010.

[11] A. Bassi, and G. Horn, "Internet of Things in 2020: A Roadmap for the Future," European Commission: Information Society and Media, 2008.

[12] "Six Technologies with Potential Impacts on US Interests Out to 2025," Disruptive civil technologies, 2008.

[13] A. Alamri, W.S. Ansari, M.M. Hassan, M.S. Hossain, A. Alelaiwi, and M.A. Hossain, "A survey on sensor-Cloud: architecture, applications, and approaches," Int. J. Distrib. Sens. Netw., vol. 2013, pp. 1-18, 2013

[14] "Strategic opportunity analysis of the global smart city market", http://www.egr.msu.edu/~aesc310web/resources/SmartCities/Smart%20City%20Market%20Report%202. pdf.

[15] A.K. Evangelos, D.T. Nikolaos, and C.B. Anthony, "Integrating RFIDs and smart objects into a Unified Internet of Things architecture," Advances in Internet of Things, vol. 1, pp. 5-12, 2011.

[16] J. Gubbi, R. Buyya, S. Marusic, and M. Palaniswami, "Internet of Things (IoT): A vision, architectural elements, and future directions," Future Gener. Comput. Syst., vol. 29, pp. 1645–1660, 2013

[17] T. Nuortio, J. Kytöjoki, H. Niska, and O. Bräysy, "Improved route planning and scheduling of waste collection and transport," Expert Syst. Appl., vol. 30, no. 2, pp. 223–232, Feb. 2006.