

Available online at <http://www.mecs-press.net/ijeme>

# In What Ways Smart Cities Will Get Assistance from Internet of Things (IOT)

Humera Faisal<sup>1</sup>, Sobia Usman<sup>1</sup>, Syed Murtaza Zahid<sup>1</sup>

<sup>1</sup> COMSATS, Lahore

Received: 26 October 2017; Accepted: 19 December 2017; Published: 08 March 2018

---

## Abstract

The concept of smart cities has become very popular in recent times and with much more clear understanding. The evaluation of Internet of things and recent progress in the technology has given smart city project a real lift. IOT models can easily be integrated in different fields and sections of a city to attain a working smart city. Modern Smart city should not only be technologically advanced but must also provide better quality of life and more opportunities improved lifestyle and development for its citizen. This Paper provides us a survey of how Internet of things can help us in the development of a smart city and also identifies the main components and elements characterizing a smart city.

Furthermore we will also discuss the benefits a society will get from the working smart city project.

**Index Terms:** IOT, Smart City, Components, ICT.

© 2018 Published by MECS Publisher. Selection and/or peer review under responsibility of the Research Association of Modern Education and Computer Science.

---

## 1. Introduction

Internet of things is a concept based on the network of objects in combination of electronic equipment, software technologies and connectivity for the interchange of data and information. This can be extended to the concept of the smart city in which objects sense, control and transfer information without human intervention for the improvement of the quality of standard and simplifying the complex system associated with the current cities. [1]It can be defined as the connection between the entities of this world via different electronic and software empowerment to achieve the goal of a world with intelligence and the next step is to use this connection to create a city working smartly and efficiently. [2]

It is a reality in which everything around us behaves as an object connected to a large network to have an effective and smart living to improve the environment around us. [3]The idea behind Internet of things was to

\* Corresponding author.

E-mail address: humerafaisal@ciitlahore.edu.pk, sobia@ciitlahore.edu.pk, s.murtaza.zahid@gmail.com

revolutionize everything around us that have power of decision making using latest technologies. This points to the fact that proper and organized use of the given information and computing and electronic technologies will improve the urban city productivity. This concept of IOT opens the door for the development of a Smart City. [4]Internet of things is a very large network of objects of our daily use which are provisioned with pervasive smartness to improve the quality of life in a city which is the goal behind the implementation of a smart city. [5]

IOT can be implemented to make different department of our cities work efficiently by the use of objects which are assigned IP address, including sensors, machines, and other electronic devices, that are all part of a massive network which communicates to each other transferring information, taking real time decisions to enable efficient working of objects. This IOT is the basis of the concept of a smart city in which ideally all the objects communicate with each other to transfer information just like us the humans to assist in the improvement of the quality of life in variety of ways. IOT is definitely is the major factor for the smart cities. [6]

Smart city is just an application of the concept of IOT in which different technologies are integrated with the current communication system to support the automated working of devices of our everyday use for better city administration and provide more benefits for their citizens. [7]The prominence of the internet of things has enabled the concept of smart cities which has been very important for the urban development. Smart city solutions will allow the real time data collection and analysis which will enhance the decision making capabilities immensely. [8]Internet of things provides every time connectivity to anything surrounded by us with the help of advanced technology to make cities a smarter place to live and to provide solution of different urban city problems. [9]

The remainder of this paper is structured as follows: section 2 provides an overview of the research approach, followed by describing the components of a smart city and concluding with a brief discussion on how the components of a smart city will get benefit from IOT followed by conclusion and further directions.

## **2. Literature Review**

With the advancement in technology and internet the concept of internet of things has materialized very quickly. It is a concept to convert every physical object that we use in our everyday life to become intelligent object that can take decision without human intervention obviously keeping track of data through sensors and supports a communication link to the internet. The internet of things links two different worlds, the world of internet and our physical world. The resulting system will bring smart technology in our lives. It is expected to expand after the recent plan of Google to launch the 'loon for all' project. According to Google two-thirds of the world population does not have the facility of internet. Internet connectivity with the required technology is the requirement to have smartly working objects. The major goal is to create smart cities extending to smart universe for the maximum optimization of the available resources.

Smart city emphasizes on the need of a system which is spread through a city in which every object is working intelligently gathering information from different sources and processing real time information and taking decisions based on that to simplify the complex operation of a certain city. The whole idea is to capture all the information available from the objects to improve every aspect of daily life. Efficient working is the way forward and smart city is a concept to achieve the goal utilizing all the available technology for the people's benefit.

It is a very attractive and popular idea because it is associated with the wellbeing of people. Cities plays a major role in the socio economic aspects worldwide, currently cities require different ways to management of problems and solution of those problem in an efficient way. The concept of smart city provides the intelligent solutions of problems associated in the cities by the application of technologies to cities. This will require the integration of technology and organization that improves the efficiency of the environment.

We have some relevant cases of smart cities implementation IOT infrastructure. New York Digital City and Barcelona Smart City are the two examples we can consider. The model is in its early stages but it has already achieved goals described in the working model and has made life easier for their citizens in many fields of their

life.

### **3. Components Of Smart Cities**

Smart city evolves from the interaction of different industrial and organizational sectors such as smart connections. Smart cities have currently not been limited to information and communication technologies (ICT), but are concentrated on enhancing urban life regarding their components.

#### *3.1. Smart Governance*

It ensures the basic planning and development required to run the affairs of the city smoothly and effectively. It is a very good idea to keep the decision making aspect and the implementation of those decisions to the specialized people of their relative fields to maximize the effectiveness of the smart city project. The government holds a very important responsibility in administrating everything efficiently which in turns provide a basic infrastructure to work on. [1]

The government needs to work on policies which increase competition in the field of research and revolutionize and enhance the skills required for the development of smart economy. It should also device a plan to increase the living standard of people and create a stable job market which leads them towards smart living. Another important component of the smart city is the devising good development policies for the betterment of the environment we live in to attain the smart environment. Another basic ingredient is the requirement of the advanced technology which means connectivity between things all the time and mutual sharing of information which needs huge amount of data flow and storage that is another component of a smart city which can be referred to as smart connections. [11]

#### *3.2. Smart Connections*

Smart Connections is all about being connected all the times. A concept of smart city has evolved from the concept of smart objects and IOT which basically means every object needs a connection to communicate and behave intelligently. A smart city will ensure that its citizens are getting the required connections. This connection actually creates a link between the people and the objects which is what we require in a smart city project. The big giant of the communication and network world has supported the idea of smart city development through internet of things and are providing the infrastructure for the interconnection of devices and people. Core network requirement includes the any type of connectivity wired or wireless for the communication and sensors which can work as the actuators and huge amount of data flow to be countered, as well as the security [11].Internet of things has revolutionized the current communication infrastructure and integrated a highly advanced communication system [13] in which you have fast communications ways, large data management and manipulation and intelligence is required to convert the given data into information that can be used to the benefit of the people in a user friendly way paving the way for the smart city model.[12]

#### *3.3. Smart Economy*

In its literal meaning smart economy refers to the economy which can be a competitive economy that can be beneficial for the people and providing efficient ways of developing business and trade to boost the economy. A working smart city model enabled by internet of things can save your resources beyond imagination which in turn would help your economy grow. Smart economy is basically shows how good the area is for business and partnerships to grow revenue. One approach towards the smart economy is to indulge common people towards the big decisions, they can monitor, analyze and take fruitful decision regarding the budget that will not only empower them but also offers the path to real time economy decisions [14].Smart Economy is a very important factor of the smart city and it needs to be a knowledge based economy which can provide the new employment

opportunities and is not rigid. it also provides the best use of the natural resources available and the preservation for the future use. Smart economy is actually the ability to take quick decisions according to the global market situations and adapting to the ever changing scenarios for the development and progress of the city [15].Economy is a basic parameter to analyze the performance of a city.

### *3.4. Smart People*

Smart cities need smart people for the development. You need people to be aware of the concept and play their part because technology and the institutions cannot do the job alone. Citizens are very important factor of the smart city because a smart city is a network of people and Internet of things connected to provide better lifestyle to the citizens of the smart cities. Smart People are basically the building block of a smart city which is driven by forward thinking and motivated to achieve new ways of doing certain things [16].Smart cities development affects the lifestyles and the living standards of the people and they are the ones which gets the maximum benefit from the smart cities. The society plays a big role in defining or labeling anything as success or as a failure so as a fundamental component of the smart city environment the people also needs to be aware of their responsibilities and a collective effort is needed from their side to make a smart city project as a success. [17]

### *3.5. Smart Environment*

Smart environment is a tool to provide planning for the growth, utilization and protection of the natural resources in effective and intelligent way. it is necessary to use the technology to increase the quality of the natural resources to support the long term ecological balance and to manipulate the available resources to the betterment of the society. [17]

## **4. Discussion**

Internet of things extending to the smarter cities and smart living concept is getting popular as the time goes by and recent innovations has also made it the most talked prospect of the IT world. The leaders in the IT industry has also stepped into this revolutionary phase of smart cities development which shows the great signs for the future of the Internet of things concept and pervasive computing. ARM has been involved in developing different internet of things devices for the smart city project. Now the biggest computing technology company has also taken the initiative for the building an IOT devices. Intel will now be involved providing the computing technologies and communication products that will give new direction for the IOT paving the way for the creation of smart cities worldwide.

IOT and the smart city concept heavy flow of data which also needs to be secured .Everything around us will communicate so the flow of data will be immense and the issue of security is also need to be considered. McAfee a leading internet security provider is hoping to secure the devices of IOT and the infrastructure of the smart city without affecting the efficiency. Another giant in the field of networking of internet, Cisco has showed their interest in the smart city development by working on different projects related to IOT integrating their networking infra structures. Microsoft also announced operating system IOT devices it's a cross platform service that will connect through the IP's of the devices. Oracle is also embedding java technology to increase the productivity and efficiency of IOT. Smart city is obviously a next step of Internet of things or we can say the Internet of things are the basic infrastructure of the working smart city. Smart city can easily be implemented by integrating the concepts of IOT which is already in practice in different areas of the world.

Below is the table of the smart city components emphasizing on the area of work and their benefits to the society. Smart Governance will ensure us the efficiency and reduction of the work load of the people. It will also enable the common people of the society to have access to the decision making and policies of the government and he can also give his own input. Connectivity will definitely help us improve our lifestyle and

knowledge about certain things that we usually don't have. Always on connections means lesser time for our work and quick solutions for our problems. Economy is very essential part of any city development and working on smart economy will certainly provide us with lots of benefits one those will be more and more opportunities for business and employment which in turn will have economic growth. By making people aware and intelligent of the latest trends we are bound to get good results because they are the building blocks of the society. Equal opportunities for quality education will help tremendously for the growth of the society. Safe and cleaner atmosphere is what we need in this world, by integrating the technology we can make our environment cleaner and make this world a safer and cleaner place to live. A smart city is one that highlights environments, services and opportunities for everyone .It also provides support for all age groups and it supports variety and multiformity. It is also requirement of a smart city to provide information whenever it is required through its use of the technology. Working on the areas which we have discussed and shown in the below table can help us maximize the benefits of the smart city for the people. This concept will involve the whole community which will ensure the participation of each and every individual by making them part of the system as we have shown in the table.

Table 1. Smart City Components and Their Benefits

Smart City Components	Working Area	Benefits
<b>Smart Governance</b>	<ul style="list-style-type: none"> <li>• Basic Planning &amp; Development</li> <li>• Open Government</li> <li>• Online System &amp; Services</li> </ul>	<ul style="list-style-type: none"> <li>• Quick &amp; Real Time Access to Government Policies and Plans</li> <li>• Reduction of Human Effort</li> <li>• Efficiency Enhanced</li> </ul>
<b>Smart Connections</b>	<ul style="list-style-type: none"> <li>• High End Connectivity 24/7</li> <li>• Objects to People Connectivity and vice versa</li> <li>• Data Management and Information Sharing</li> </ul>	<ul style="list-style-type: none"> <li>• Better Lifestyle and quality</li> <li>• Knowledge Based Living</li> <li>• Problems Minimized</li> <li>• Work Load Reduces</li> </ul>
<b>Smart Economy</b>	<ul style="list-style-type: none"> <li>• Provide Opportunity and Productivity</li> <li>• Competitive Environment</li> <li>• Financial Hub</li> </ul>	<ul style="list-style-type: none"> <li>• Global and National Investment</li> <li>• More Employment Opportunities</li> <li>• Increase in GDP</li> </ul>
<b>Smart People</b>	<ul style="list-style-type: none"> <li>• Quality Of Life</li> <li>• Education Facilities</li> <li>• Health &amp; Safety</li> </ul>	<ul style="list-style-type: none"> <li>• Reduction in Crime</li> <li>• Better Education For All</li> </ul>
<b>Smart Environment</b>	<ul style="list-style-type: none"> <li>• Resource Management</li> <li>• Smart Buildings</li> <li>• Sustainable Planning</li> </ul>	<ul style="list-style-type: none"> <li>• Reduction in Energy Consumption</li> <li>• Safe Atmosphere</li> <li>• Cleaner &amp; Healthier Cities</li> </ul>

## 5. Conclusion

In this paper we analyzed how Internet of things can be used to develop a smart city. We also threw light on the amazing benefits on the society and common people by the development of a smart city. The discussion was also carried on how the world is behaving to the technological advancements and continuously improving IOT. The IOT has matured to a level that it is now a great platform to work on and make new exciting additions to it for the purpose of better and efficient lifestyle.

## References

- [1] Andrea Zanella, Nicola Bui, Angelo Castellani, Lorenzo Vangelista, and Michele Zorzi: "Internet of Things for Smart Cities" *IEEE Internet OF Things Journal*, Vol. 1.,pp 22-32, Feb 2014.

- [2] John A. Stankovic, "Research Directions for the Internet of Things", *IEEE Internet Of Things Journal*, Vol.1, 18, pp 3-9, Mar 2014.
- [3] ACM Sacramento Chapter, <http://sacramento.acm.org/blog/internet-of-things?searchterm=internet+of+things>
- [4] Gerd Kortuem, Fahim Kawsar, Daniel Fitton, Vasughi Sundramoorthy, "Smart Objects as Building Blocks for the Internet of Things", *IEEE Computer Society*, pp 44-51, 2010
- [5] Sotirios Paroutis a, Mark Bennett, Loizos Heracleou, "A strategic view on smart city technology", *The case of IBM Smarter Cities during a recession*, Aug 2013.
- [6] Business Today', Article, <http://www.businesstoday.org/articles/2015/03/a-new-way-of-living-smart-cities-and-the-internet-of-things-2/>
- [7] Satish Phakade Pawar, 'Smart City with Internet of Things (Sensor networks) and Big Data', Dec 2013
- [8] Hans Schaffers, Nicos Komninos, Marc Pallot, Brigitte Trousse, Michael Nilsson, Alvaro Oliveira, "Smart Cities and the Future Internet: Towards Cooperation Frameworks for Open Innovation", *SpringerLink.com*.
- [9] Charith Perera, Arkady Zaslavsky, Peter Christen, Dimitrios Georgakopoulos, "Sensing as a Service Model for Smart Cities Supported by Internet of Things", *Transactions on Emerging Telecommunications Technologies*, Volume 25 Issue 1, Pages 81-93, January 2014.
- [10] Robert R. Harmon, Enrique G. Castro-Leon, Sandhi Prakash Bhide, "Smart Cities and the Internet of Things", *Management of Engineering and Technology (PICMET)*, Portland International Conference on 2-6, pp 485-494, Aug 2015
- [11] Tomas Gea, Josep Paradells, Mariano Lamarca, David Roldan, "Smart Cities as an Application of Internet of Things: Experiences and Lessons Learnt in Barcelona", 2013 Seventh *International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing*, pp 552-557, July 2013.
- [12] i2cat Foundation, "The Internet Decade: the i2cat claims", *Annual Report 2013*
- [13] Jiong Jin, Gubbi J., Marusic, S., Palaniswami, M, "An Information Framework of Creating a Smart City through internet of Things", *Internet of Things Journal, IEEE* (Volume:1, Issue: 2), pp112-121, May 2014.
- [14] 'Am-smart-erdam City', <http://amsterdamsmartcity.com/projects/living-labs>
- [15] Jurgita Bruneckiene, Jolita Sinkiene, "Critical Analysis OF Approaches to Smart Economy", 8th International Scientific Conference Business and Management, Vilnius, Lithuania, 2014,
- [16] Smart Brantford', <http://www.smartbrantford.ca/TheSixComponents/SmartPeople.aspx>
- [17] Hafedh Chourabi, Taewoo Nam ,Shawn Walker J. Ramon Gil-Garcia,Sehl Mellouli, Karine Nahon ,Theresa A. Pardo, Hans Jochen Scholl," Understanding Smart Cities", An Integrative Framework', 45th Hawaii International Conference on System Sciences, 2012.

## Authors' Profiles



**Ms. Humera Faisal** Assistant Professor, Department of Computer Science Official

**Email:** humerafaisal@ciitlahore.edu.pk

**Tel # (Off):** 111-001-007

Ms. Humera Faisal received Master degree in Computer Science from International University of Islamabad, Pakistan in 2001. she completed her MS( Adhoc Social Networks) from COMSATS Islamabad in 2010. In 2001, she joined the COMSATS Institute of Information Technology as Assistant System Analyst. She is currently working as an Assistant Professor in the COMSATS Institute if Information Technology (Lahore, Pakistan).

Her research interests include Social Networks, Adhoc Networks and Web Semantics and services.



**Ms. Sobia Zaheer** Assistant Professor, Department of Computer Science

**Official Email:** Sobia@ciitlahore.edu.pk

**Tel # (Off):** 111-001-007

Miss Sobia Zaheer earned a master's degree in Computer Science in 2003, from Institute of Management Sciences, Pak-AIMS, Lahore. In 2009, she completed her MS (Software Project Management) from National University, FAST, Lahore. Her research interests include Software Engineering, Software Project Management. She is serving as Assistant Professor in Computer Science department, CIIT Lahore. Her duties mainly include teaching courses to undergraduate students. She is also member of NCEAC committee, BSSE program.



**Syed Murtaza Zahid** COMSATS

**Email:** s.murtaza.zahid@gmail.com

Syed Murtaza Zahid has completed his Bachelors in telecommunication engineering from COMSATS Institute of Information Technology, Lahore Pakistan in 2016. He led a research oriented project to develop a small wearable cloud-connected glucose monitoring device with real-time non-invasive sensing and monitoring of blood sugar level through Wireless Sensor Networks and implemented efficient learning algorithm to analyze sensed data. He is currently working as an IT Analyst at LOWE'S Canada. His research interests are Wireless sensor networks, Big data and machine learning algorithms.

**How to cite this paper:** Humera Faisal, Sobia Usman, Syed Murtaza Zahid, "In What Ways Smart Cities Will Get Assistance from Internet of Things (IOT)", International Journal of Education and Management Engineering(IJEME), Vol.8, No.2, pp.41-47, 2018.DOI: 10.5815/ijeme.2018.02.05