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Applications of IoT in Green Environment

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ABSTRACT

IoT (Internet of Things) is a current trend in technological world because of its applications spreading across various domains in IT and non IT fields. Basically IoT helps in producing more at less time and automate things without the involvement of human in between and very important thing about IoT is, it is connected to the internet, so that anything can be done in mobile from anywhere for any information and from any smart device. With the exponential growth in the number of users of internet and devices connected to the internet, IoT is the booming technology and will be in the near future. Survey by Cisco quotes that "number of devices connected to the internet by 2020 will be 50billion". This number is the proof that IoT will rule the world and makes leading life even simpler and tech-savvy. In this article, more stress is given to the environment domain of the IoT. By integrating IoT with the environment makes detecting so many problems in it and around it and can solve some more problems of it. With the increase in the population of the countries, effect on the environment and burden on the resources of it is huge. Problems in the environment include air pollution, water pollution, sound pollution, increase in the waste generated by the people including e-waste, soil pollution and so many. So, IoT will try to solve this important problems associated with the environment by making the environment much brighter, greener and smarter.

Keywords: Internet of Things, Cloud Computing, Environmental Pollution monitoring.

I. INTRODUCTION

IoT can be explained as the networking of physical objects/things with the use of embedded sensors that can communicate with other sensors or things to achieve the common goal. Sensors collect information about the things and their surroundings and communicate this information to other stations which are connected through wired or wireless networks. Things/Objects can communicate/speak with one another because of IoT which helps in controlling devices in real time which has led to movement of making things more intellectual. All these devices/things are able to communicate with each other even without the intervention of human beings. A wide range of industrial and domestic IoT applications have been developed and deployed in recent years such as automated monitoring, control, management, and maintenance and many more. Actuators and Sensors are becoming more and more powerful, cheaper and smaller, which makes their use pervasive. The information collected by sensors is transformed into information with intelligence, thus environment around us too becomes intelligent. The Internet of things is a 'hot topic' that is rapidly being integrated into almost every walks of human life leading to another term called the "Internet-of-Everything". People and Computers are already

connected to internet, main aim of IoT is to connect each and every available object to internet and make it intelligent. IoT helps in overcoming inefficiencies of human abilities in collecting accurate data over longer times with low costs.

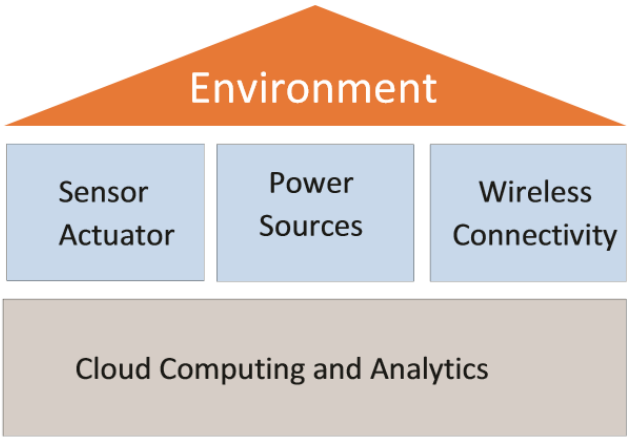

Fig. 1. Components of IoT (Source: Paper of 2015 IEEE 4th Global Conference on Consumer Electronics (GCCE)

Figure 1 depicts the components of IoT which are sensors, actuators, wireless connectivity, power sources along with cloud computing and analytics launched in an appropriate environment. Sensors, Actuators deployed in an environment are connected through wired/wireless networks to cloud. Data collected by these devices are analysed remotely in real time in cloud. Figure 2 gives an overview of IoT and gives a basic idea of IoT working.

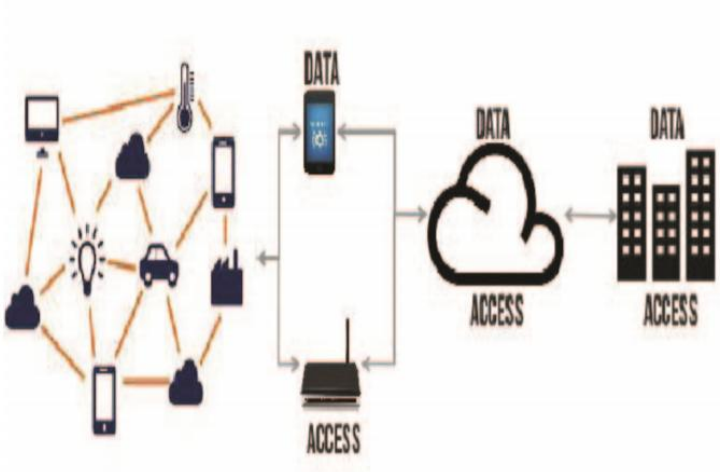

Fig. 2. Overview of IoT(Source: International Conference on Communication and Signal Processing, April 6-8, 2016, India)

II. IOT IN ENVIRONMENTAL DOMIAN

Saving the environment and its resources are the main idea behind every technological innovation across the globe. Imbibing IoT with other current technologies will make this achieve easily with good results. IoT has range of applications across domains like environment, industry, retail, agriculture, energy, logistics, and so on. India being a developing country has not so much practical applications of IoT in environmental domain when compared to other developing and developed countries who give more importance to conservation, preservation and restoration of the nature. IoT in the environmental domain can be used to measure air pollution, sound pollution and monitor water resources and manage waste and grids smartly in the real time and that to importantly remotely.

Environmental applications of IoT are:

- Smart Environment:

I. Air pollution: Measuring emissions of CO2 from factories and automobiles and toxic gases generated in farms.

II. Sound pollution: Detecting the sound pollution and giving alerts to reduce it.

III. Earth Quake early detection.

- Smart Water:

I. Pollution levels in sea: Control real time leakages and wastages in the sea.

II. Potable water monitoring: Measuring the quality of tap water in cities.

III. Chemical leakage detection in rivers: Detect leakages and wastes of factories in rivers.

IV. River Floods: Monitoring the water levels in reservoirs and rivers.

- Smart Metering:

I. Smart Grid: Energy consumption measurement and monitoring.

II. Tank Level: Monitoring of level of oil, water and gas levels in tanks.

III. Water Flow: Measurement of water pressure in water transportation systems.

- Smart Grids: Spontaneous evacuation of workers by detecting the presence of poisonous gases in the mining grid.
- Smart Waste management.

III. AIR POLLUTION

Industrial revolution has increased the quality of life of people and has decreased the quality of air we breathe across the globe. Air pollution is the biggest problem nowadays, lack of real time monitoring system for measuring the air quality is another challenge faced by highly polluted cities across many countries. Walter Fuertes, et al [1] has built up an IoT application using Arduino platform to measure the air quality with low cost. Figure 3 gives a multi-layered model of the application. Sensors to determine carbon monoxide, carbon dioxide and power density are being used. C++ programming language is being used for API building. These sensors helps in measuring the air quality in real time by using physical objects with the required sensors all are connected through wireless networks.

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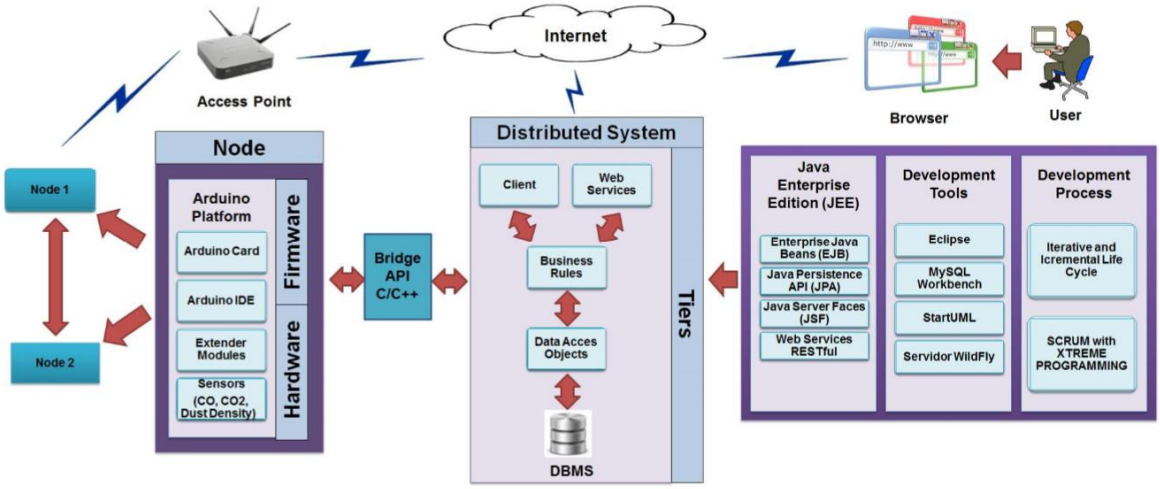

Fig. 3. An overview of the conceptual framework [1]

This IoT application has widely being used in many South American countries for measuring the air quality.

IV. WATER RESOURCES MONITORING AND MANAGEMENT

Water resources monitoring and management system is to manage and monitor water resource in real time in order conserve and preserve it. Mo Xiaocong, et al [2] has proposed an IoT based system for this purpose. Figure 4 gives framework of the proposed system. Proposed system consists of equipment perception layer, information transmission layer and data application layer. Sensor network for monitoring water information is constructed in equipment perception layer, real-time information transmission is done in information transmission layer and in data application layer, information regarding water resource is saved, managed, applied and shared on internet by users.

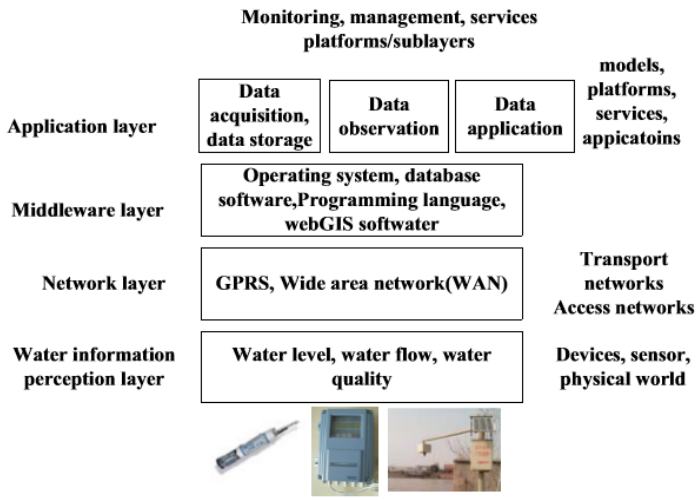

Fig. 4.Framework of the proposed system [2]

This kind of IoT applications can be used by administrative authorities and public for efficient and effective use of resources like water.

V. WASTE MANAGEMENT

Managing waste is a biggest problem faced by developing as well as developed countries because of the increase in the population, change in the lifestyle and so many causes. Managing the waste by the municipal authorities is difficult currently because of the lack of technological help. Mohammad Aazam, et al [3] has proposed an IoT based effective, efficient and innovative method for waste management through cloud computing in real time.

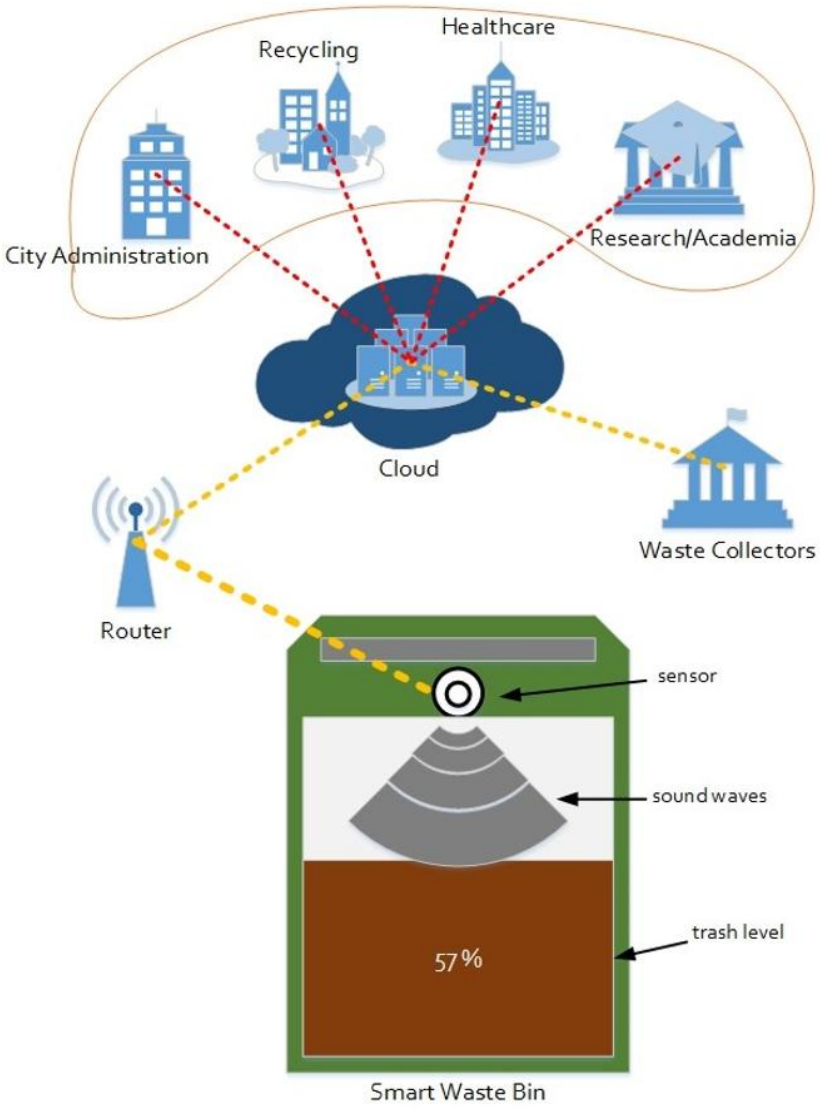

Fig. 5.Cloud based smart waste management architecture [3]

Figure 5 shows the overall architecture of Cloud based smart waste management architecture. Smart waste bin having the capability of informing the trash level through network connectivity.

It is shown that ubiquitous availability of data stored in the cloud can be useful for different entities and stakeholders in different ways. Analysis and planning can start from as soon as waste starts gathering and up to when recycling and import/export related matters are conducted.

VI. SMART GRIDS

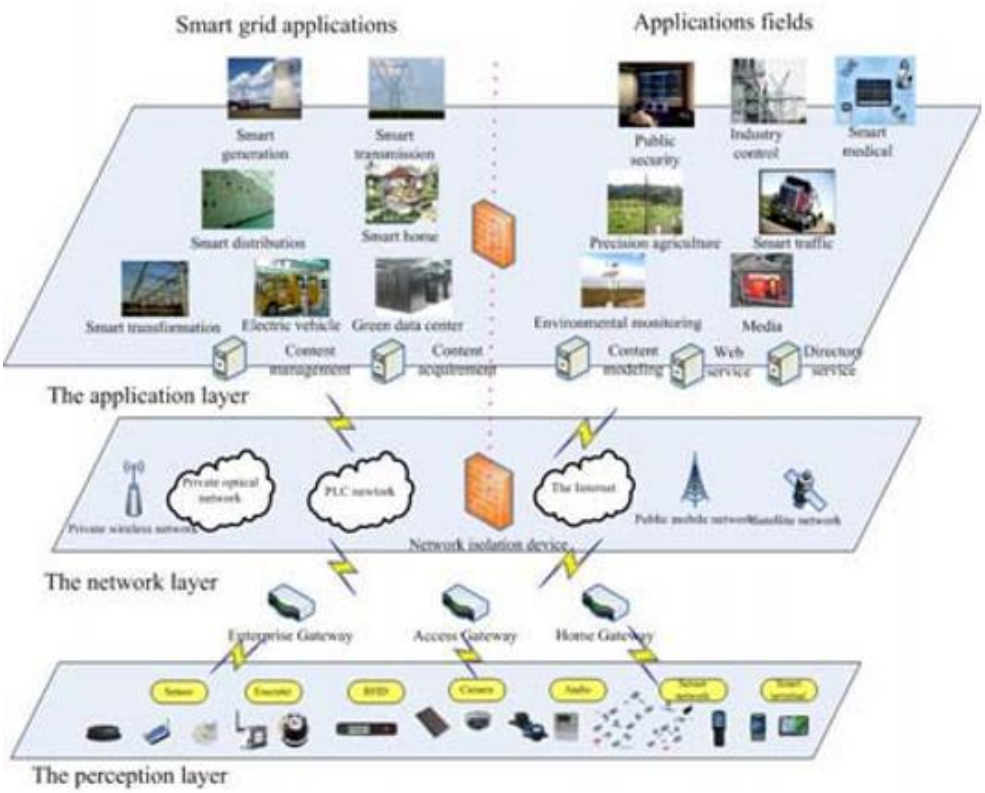

Fig. 6. Architecture of IoT enables smart grid [4]

Xi Chen, et al [4] has proposed and discussed the basic requirements of IoT in smart grids. Figure 6 gives the architecture of IoT having three layers which helps in making power grids smarter.

Anjan K. Koundinya, et al [11] has included security aspect for the smart grids which will have a centralised control in an IoT based applications. Figure 7 gives a description of smart grid environment and figure 8 shows configuration of SCADA systems which does energy management.

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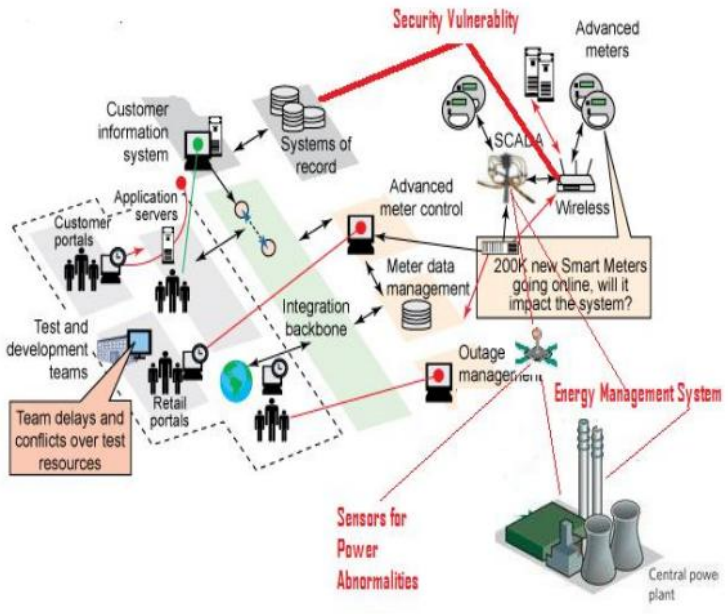

Fig. 7. Smart Grid Environment [11]

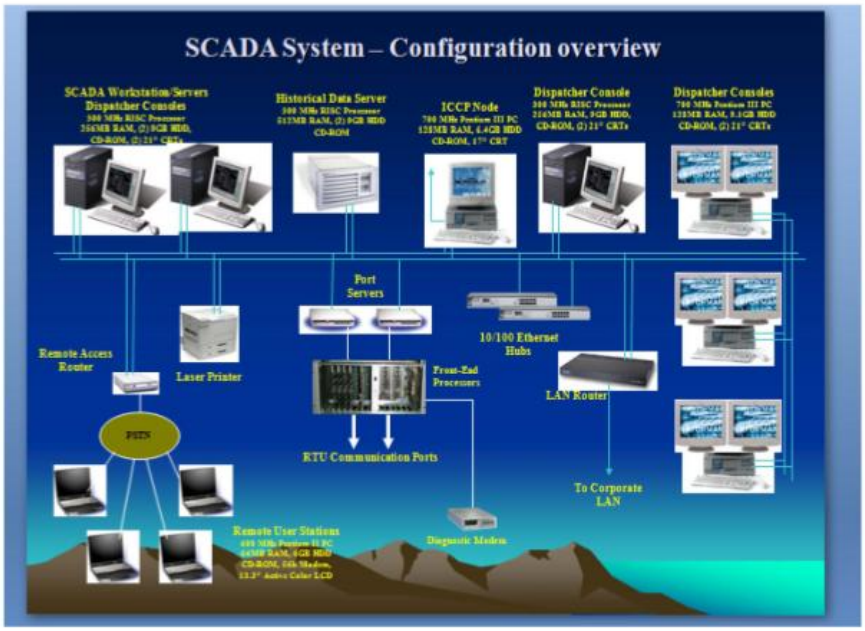

Fig. 8. Configuration of SCADA Systems [11]

SCADA systems helps in monitoring and controlling of network devices remotely. Integration of SCADA systems with smart grids are done to achieve reliability and efficiency in the smart grids.

VII. CONCLUSION

IoT integrating with all the recent trending technologies will help reduce man power, and time required to achieve something and increases the efficiency and effectiveness in each and every domain in which IoT can be applied. IoT in the environmental domain can effectively help in managing waste by providing clean environment to live in and water being a precious resource will be conserved and managed properly and certain areas like mining, grid which requires real time observations of the scenarios will reduce deaths and helps in mining and grids little smarter and safer place to work. Air being one more precious natural resource is polluted by industries and automobiles, IoT helps in detecting where the pollution is more and informs the concerned higher authorities to take action to reduce it. In this way, IoT has so many applications and relevance in the current world.

REFERENCES

1. Walter Fuertes, Diego Carrera, César Villacís, Theofilos Toulkeridis, Fernando Galárraga, Edgar Torres, and Hernán Aules, "Distributed System as Internet of Things for a new lowcost, Air Pollution Wireless Monitoring on Real Time", 2015 IEEE/ACM 19th International Symposium on Distributed Simulation and Real Time Applications (DS-RT).
2. Mo Xiaocong, Qiu Xin Jiao, Shen Shaohong, "An IoT-based system for water resources monitoring and management", 2015, 2015 7th International Conference on Intelligent Human-Machine Systems and Cybernetics, IEEE.
3. Mohammad Aazam, Marc St-Hilaire, Chung-Horng Lung, Ioannis Lambadaris, "Cloudbased Smart Waste Management for Smart Cities", 2016 IEEE 21st International Workshop on Computer Aided Modelling and Design of Communication Links and Networks (CAMAD)
4. Xi Chen, Jianming Liu, Xiangzhen Li, Limin Sun, Yan Zhen, "Integration Of Iot With Smart Grid", IET International Conference on Communication Technology and Application (ICCTA 2011), IEEE
5. Chen Xiaojun, Liu Xianpeng, Xu Peng, "IOT- Based Air Pollution Monitoring and Forecasting System", 2015 International Conference on Computer and Computational Sciences (ICCCS),IEEE.
6. Yash Mehta, Manohara Pai M.M., Sanoop Mallissery, Shwetanshu Singh, "Cloud enabled Air quality detection, analysis and prediction- A smart city application for smart health", 3rd IEEE International Conference on Big Data and Smart City (ICBDSC) 2016.
7. Baihaqi Siregar, Ahmad Badril Azmi Nasution, Fahmi Fahmi, "Integrated Pollution Monitoring System for Smart City", 2016 International Conference on ICT For Smart Society (ICISS)
8. Radek Fujdiak, Pavel Masek, Petr Mlynek, Jiri Misurec, Ekaterina Olshannikova, "Using Genetic Algorithm for Advanced Municipal Waste Collection in Smart City" 2016 10th International Symposium on Communication Systems, Networks and Digital Signal Processing (CSNDSP)

9. Abhimanyu Singh, Pankhuri Aggarwal, Rahul Arora, "IoT based Waste Collection System using Infrared Sensors", 2016 5th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO), IEEE.
10. Ankur Ravindra Bodhe, Rahul Singh, Abhishek Bawa, "An Internet of Things Solution for Sustainable Domestic Water Consumption", 2016, 2016 International Conference on Computation System and Information Technology for Sustainable Solutions (CSITSS), IEEE
11. Anjan K. Koundinya, Sharvani G.S, K. UmaRao, "Calibrated security measures for centralized loT applications of smart grids", 2016 International Conference on Computation System and Information Technology for Sustainable Solutions (CSITSS),IEEE.