A Technical Approach for Overcoming Toxic and Radiation Hazards due to Non-decomposable Garbage and E-Wastes

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Abstract— As the world is growing towards urbanization the garbage and e-waste generation is thus becoming one of the major problems for the growing world. The overflow of garbage in public areas creates the unhygienic condition as well as the E-waste comprising of a multitude of components, some containing toxic substances causes an adverse impact on human health and the environment, if not handled properly. It degrades the valuation of the area. It may also provoke several serious diseases like dengue, malaria etc. amongst the nearby people. To avoid this and to enhance the cleaning, we are proposing a 'Smart Garbage Management System' in this paper. In this proposed system, the level of garbage in the dustbins will be detected with the help of the Sensor systems, and then will be informed to the authorized control room through GSM system. Microcontroller will be used to interface the sensor system with GSM system. A GUI is also developed to monitor the desired information related to the garbage for different selected locations. Therefore it will help in managing garbage collection efficiently.

Key words: E-Wastes, GSM system, Toxic

I. INTRODUCTION

Though the world is in a stage of up gradation, there is yet another problem [1] that has to be dealt with, that is Garbage and e-waste!

Pictures of garbage bins being overloaded and the garbage being spilled out from the bins can be seen all around. This leads to various diseases as large number of insects and mosquitoes breed on it. Thus, it brings on an alarming stage to create an awareness for solid and e-waste management amongst the people. Hence, smart dustbin is a system which can eradicate this problem or at least reduce it to the minimum level. Looking at the current scenario, our present Prime Minister of India, Sri Narendra Modiji has now introduced the concept of implementing 100 smart cities in India. "Swachh Bharat Abhiyan" was initiated to ensure a clean environment.

Majority of viruses and bacterial infections develop in polluted environment. Safeguarding the environment using technology sources is needed at present. Our public environment seems to be polluted with the lots of garbage and waste material. So, modernization is needed by imparting the smart technology [2].

Amounts of waste is largely determined by two factors: first is the population in a particular given area, and second is the consumption patterns.

According to the UN, between now and 2025, the world population will increase by 20% to reach 8 billion inhabitants. With this increase in population, our responsibilities towards the solid and e-waste management also increases. Our waste administration is lacking behind with economic situations and are unequipped for taking care of the developing measures of waste universally. So until and unless a new paradigm of global co-operation and governance is adopted, a tidal wave of uncontrolled dumpsites will be the principle waste management method, especially in Asia.

On the west coast of America, San Francisco is leading with a landfill disposal diversion rate of 72% and the city has now set itself a target of zero waste to landfill by 2020. This paper, thus, sets to be one of the most efficient ways to keep our environment clean and green. Dustbin is a common means and a basic need everywhere. It has been observed that often the garbage gets collected due to non-removal of garbage present in the dustbin. In this proposed paper, a new model for the municipal dustbins, which intimates the center of municipality for immediate cleaning of dustbin has been proposed [3].

– Incineration of Waste

Incineration of waste materials is one of the largest sources of air pollution in India. It doesn't surprise us to know that 20 percent of Mumbai's air pollution is caused by trash fire. Not segregating the bio-degradable waste from degradable waste is making the situation even more pathetic.

– Challenges

1) Management cost for planning and collection of waste for transportation and recycling is very high.
2) Door to door collection of waste and garbage is also rare in some parts of the cities because of the inadequate facilities and lack of awareness amongst the people. A large number of people prefer to dump waste in empty plots or land instead of paying for the provided services.
3) As per estimates, in the regions with people having low income, waste is not at all collected. Clogged sewers and streets littered with garbage and wastes are breeding grounds for most of the diseases and pollution.

– Possible Solutions

1) Public awareness and participation can play a significant role. People must be asked to follow the basics of waste management rules.
2) A culture of waste segregation in the household itself needs to be established.
3) We need to segregate the garbage and waste at the point of collection. Most of the waste that can be recycled will stop reaching the landfill keeping these free for other waste.
4) In fact, people should join hands with experts on innovative solutions to manage the growing problem of waste.
5) Civic agencies should take a proactive role in creating awareness amongst the people on sanitation and waste management.

Waste Reduction: Do Not Throw Things Out

A simple and obvious choice is to cut back on the amount of waste by using and throwing out less in the first place. Many of the states have now adopted regulatory strategies so as to discourage dependence on the landfills.

Waste Reduction: Use less Packaging:

Packaging is one of the major sources of waste paper and plastics. According to Earth Works Groups, approximately one-third of all the garbage Americans send to landfills. Packaging should be minimal. Its production should be environmentally clean and hygienic. Also it should be made up of materials that can be reused or recycled. Smart buyers can support the use of environment friendly packaging by purchasing the products with minimal packaging and also with packaging which is made up of recycled or recyclable materials.

Recycling:

Recycling works in several ways. It not only reduces the monetary cost but also the environmental costs of landfilling and incineration. It substitutes the used materials in place of virgin materials, thus reducing the demand for the natural resources. It conserves energy. And it creates jobs in the community.

Many U.S. communities now actively recycle. Common programs include

Curbside recycling containers. The community provides containers in which individual families deposit their garbage and waste materials such as newspapers; tin and aluminum containers; glass bottles and jars; mixed waste paper (cardboard, phone books, magazines, junk mail, brown bags); and motor oil. The community provides pickup and delivery facilities for the containers.

Drop-off recycling zones. Many of large recycling bins have been installed on public property in one or more area throughout the community.

Recycling centers. The community considers itself the center and encourages the residents to drop off or sell waste materials there.

Green waste diversion and composting programs. Leaves, grass clippings, and other organic waste materials are composted and used to enrich soil or as mulch or landfill cover.

Electronic waste or e-waste is also known as e-scrap, or Waste Electrical and Electronic Equipment (WEEE) describes loosely discarded, surplus, obsolete, or broken electrical or electronic devices. Those electronic devices can be computers, mobile phones, iPhones, Air Conditioners, Laptops, digital music recorders/players, refrigerators, washing machines, televisions (TVs) and many other household consumer items. Drill Machines, Telephone, Irons, Trade mills, Printers, Mouse and many other household consumer items. The production of electrical and electronic equipments are the fastest growing global manufacturing activities.

"Electronic waste" or "E-Waste" may also be defined as discarded computers, office electronic equipment, entertainment device electronics, mobile phones, television sets, and refrigerators. This includes used electronics which are destined for reuse, resale, salvage, recycling or disposal. Others are re-usable (working and repairable electronics) and secondary scrap (copper, steel, plastic, etc.) to be "commodities", and reserve the term "waste" for residue or material which is dumped by the buyer rather than recycled, including residue from reuse and recycling operations, because loads of surplus electronics are frequently commingled (good, recyclable, and non-recyclable), several public policy advocates apply the term "e-waste" broadly to all surplus electronics. Cathode Ray Tubes (CRT's) are considered to be one of the hardest types to recycle. CRTs have relatively high concentration of lead and phosphors, both of which are necessary for the display. The United States Environmental Protection Agency (EPA) which includes discarded CRT monitors in the category of "hazardous household waste". Rapid economic growth, coupled with urbanization and a growing demand for consumer goods, has increased both the consumption and the production of EEE. Electronic wastage is harmful to the environment and it is making a vast and irrevocable loss to the environment. Rapid changes in technology, changes in media (tapes, software, MP3), falling prices, and planned obsolescence have resulted in a fast-growing surplus of electronic waste around the globe. Technical solutions are available, but in most of the cases, a legal framework or a collection, logistics, and other services are needed to be implemented before a technical solution can be applied.

In general, E-waste is different from municipal waste as e-waste contains many valuable and precious materials along with hazardous materials. In fact, up to 60 elements from the periodic table can be found in complex electronic equipment. By using personal computer (PC) as an example – a normal Cathode Ray Tube (CRT) computer monitor contains many valuable as well as many toxic substances. One of the major toxic substance is Cadmium (Cd), which is generally used in rechargeable computer batteries, contacts and switches in older CRT monitors.

RADIATION - "Personal Computers contain some of the components that are highly toxic that are chlorinated and brominated substances, toxic metals, toxic gases, biologically active materials, plastics and plastic additives and acid. E-toxic components present in the computers include circuit boards which contains heavy metals such as lead(Pb) and cadmium(Cd),

batteries containing cadmium, cathode ray tubes with lead oxide(PbO) and barium, brominated flame retardants used in cables, printed circuit boards(PCB), plastic casing, poly vinyl chloride (PVC) with coated copper cables.

"Computer waste that is landfilled produces contaminated leachates that is responsible for polluting the groundwater. Acids and sludge which are obtained from melting computer chips, when disposed on the ground, causes acidification of soil. Mercury also leaches from certain electronic devices such as when circuit breakers are destroyed and cadmium may leach into the soil and groundwater. Guoyu in Hong Kong is a thriving area of illegal e-waste recycling is facing acute water shortages due to the contamination of water resources," the study added.

Vivek Rathod from NGO Trendsetters, which is associated with environment welfare and solid waste management, said, "In India, e-waste is not recycled or disposed properly but is burned to extract the minute amount of gold and metals like copper from old electronic gadgets. One of the most hazardous form of burning e-waste is open-air burning of plastics. This incineration of e-waste emits toxic fumes and gases, which eventually causes air pollution. Unscientifically done e-waste landfill can cause environmental hazards, polluting the soil and water. Uncontrolled fires emitting toxic fumes because of anaerobic decomposition may also occur at landfills."

Radioactive Contamination:

Radioactive contamination, also called radiological contamination, is the deposition of, or presence of radioactive substances on surfaces or within solids, liquids or gases (including the human body), where their presence is unintended or undesirable (from the International Atomic Energy Agency - IAEA - definition).

Such contamination results in the hazardous situations due to the radioactive decay of the contaminants, which generally emits harmful ionising radiations for example alpha particles, beta particles, gamma rays and also neutrons. The degree of hazard is determined by the concentration of the contaminants, , the type of radiation the energy of the radiation being emitted, and the proximity of the contamination to organs of the body. It is important to be clear on the fact that the contamination is responsible for these radiation hazards.

Contamination may affect a person, a place, an animal, or an object such as clothing. Due to an atmospheric nuclear weapon discharge, the air, soil, people, plants, and animals present in the vicinity will more likely to become contaminated by nuclear fuel and fission products.

II. LITERATURE SURVEY ON SMART DUSTBIN

The surveys show that many Consumer awareness programmes and efforts are already going in G-8 countries for the recycling of e-waste materials. Electronics is the most effective solution to the growing e-waste problem. Most of the electronic devices contain a variety of materials, including metals that can be recovered for future uses. By the provision of reuse possibilities, most of the intact natural resources are conserved while the air and water pollution caused by the hazardous disposal is being avoided. Additionally, the recycling of the waste reduces the amount of greenhouse gas emissions caused by the manufacturing of new products.

The benefits of recycling e- waste are extended when various efficient recycling methods are used. In India also, efficient recycling aims to minimize the dangers to human health and the environment that are created by the disposed and dismantled electronics. The efficient recycling of the waste ensures the best management practices of the electronics being recycled. The safety and the health of the workers is also taken care by the authorities. Several agencies and collection centres like E- Par Sara Pt. Ltd. (Bengaluru), A2Zgroup (Gurgaon), Eco Recycling Ltd. (Mumbai), Hi-Tech Recycling India Pvt Ltd (Pune) etc. are already working on it.

By considering all these causes and being a responsible citizen, we should not throw E-waste anywhere; rather we should give it to any of the approved recycling agencies so the garbage and the e waste can be recycled and disposed off properly. This should be treated as our prime social responsibility.

A quantitative analysis between existing dustbins and their serving population is made by the authors in [4]. The first analyses came out to be the spatial distribution of dustbins in some areas of the Dhaka city by using the average of the nearest neighbor functions of GIS. Remarkably, the spatial distribution of the current dustbins by the analysis has appeared to be dominatingly in clustered pattern. Next analysis was done for the calculation of an optimal number of additional dustbins. Thus, the whole analysis showed that the number of existing dustbins is insufficient in the study area.

The spatial analyst functions of GIS were used to calculate the extent of pollution that is caused by the existing dustbins. It is found that the garbage present in the dustbins is being burnt which causes pollution to the environment. The final result which was obtained helped the management of the Dhaka city to understand the present scenario of the area and also to place the required number of dustbins through the analysis to prevent further pollution.

The smart bins were then equipped with ultrasonic sensors which is used to measure the level of dustbin being filled up. This was done by the authors in [5]. The container will be divided into three levels of garbage being collected in it. Every time, as the garbage will cross a particular level, the sensors will receive the data of the filled level. This data will further be send to the garbage analyzer as an instant message using the GSM module.

Placing of three ultrasonic sensors at three different levels of the container may prove to be disadvantageous as this will increase the cost of the dustbin and the sensors may be damaged due to their rough action by the users.

An IoT-based smart garbage system (SGS) is proposed in this paper so as to reduce the amount of food waste by the authors in [6]. Furthermore, the SGS will be including various skills which will consider user convenience and will be increase the battery lifetime through two types of energy-efficient operations of the SGB that are stand-alone operations and co-operation-based operations. The SGS that has been proposed in this paper has already been functioned as a pilot project in

Gangnam district, Seoul, Republic of Korea, for a period of one year. After the functioning of this pilot project, the normal measurement of food waste was estimated to decrease by 33%.

The authors in [7] have built a framework in which a camera will be used. This camera will be placed at each of the garbage collection point alongside the load cell sensor at the base of the trash can. The camera will be taking continuous snapshots of the garbage can. A threshold level is already been set set which compares the output of the camera and the load sensor.

This comparison between the output of the camera and the load sensor is done with help of a microcontroller. After analyzing the image, an idea about the level of garbage in the can is determined. The weight of the garbage present in the can or bin is determined by the load cell sensor. Then this information is processed accordingly to check whether the threshold level is exceeded or not. This process is very convenient to use but economically, it is not reliable.

Waste is a big problem in the world, but new endeavours are planning to use garbage as a useful resource. One of these resources is to convert the garbage and waste into electricity.

There are many items around us that can generate heat, and surprisingly waste products are one of these. Heat generated from the waste products creating electric power is useful to the earth because it can eliminate materials that depletes the ozone layer. Molecular thermoelectric devices can help in harvesting energy from the sun and also reducing the need for photovoltaic cells which are used in solar panels.

There is plenty of garbage and electronic waste on the planet that many of countries dump their waste in lesser developed countries. This garbage is considered very useful resource in generating power. Biofuel is made from the processed garbage, which replaces gasoline and thus decrease global carbon emissions by 80 per cent. Biofuels is produced from living organisms or by metabolic by-products (which is organic or food waste products). For fuel to be regarded as a biofuel it must contain over 80% renewable materials.

The EGG Machine:

The action of turning your garbage into power by making an EGG – Electricity from Garbage Generator. This machine can produce electricity without causing any harm to the environment. It is very easy to make and also the major advantage is that you can recycle your garbage again and again instead of throwing it away in the bins.

III. PROPOSED SOLUTION

A. Technical Details:

In this project, GSM 900A modem will be used to send the messages. It will be consisting of a GSM/GPRS modem with standard communication interfaces like RS-232 (Serial Port), USB, so that the modem can easily be connected to the other devices. The ultrasonic sensor will be used to find the height of garbage filled. However, this sensor can be placed at height 'h', where 'h' is the height of the bin. 8051 board will be used as microcontroller platform. Interfacing will be done between GSM modem and 8051 board by connecting RX pin of the modem to TX pin of board and vice versa. ECHO and TRIGGER pins of the ultrasonic sensor will be connected to the digital pins of 8051 board. The 8051 board will be working at a power supply of 5V and the GSM modem will require 2A to power ON. During the course of garbage accumulation, whenever the garbage will reach the height 'h', where the sensor will be placed, the GSM modem will get activated and will send an alert signal to the concerned authorities through an SMS. As soon as an SMS alert will be received, concerned authorities can place orders to the workers for the cleaning of the filled bins on time before the garbage gets spilled out of the bins.

B. Working of Ultrasonic Sensor:

The ultrasonic sensor module has 4-pins out of which Pin-1 and Pin-4 are +Vcc and GND respectively. Pin-2 is the TRIGGER pin and Pin-3 is ECHO pin. When a high pulse of 10us is applied at TRIG pin, the transmitter of the ultrasonic sensor sends 8 consecutive pulses of 40 KHz frequency each. As the Eighth pulse is sent, the ECHO pin of the sensor becomes high.

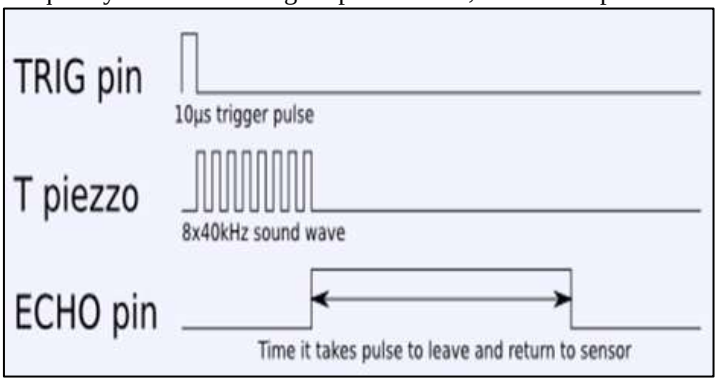

Fig. 1:

When the ultrasonic waves will reflect from any surface, they are received by the receiver pin which in turn results the ECHO pin to become low. The time those waves take to leave and return to the ultrasonic sensor is in turn used to find the distance from the reflecting surface.

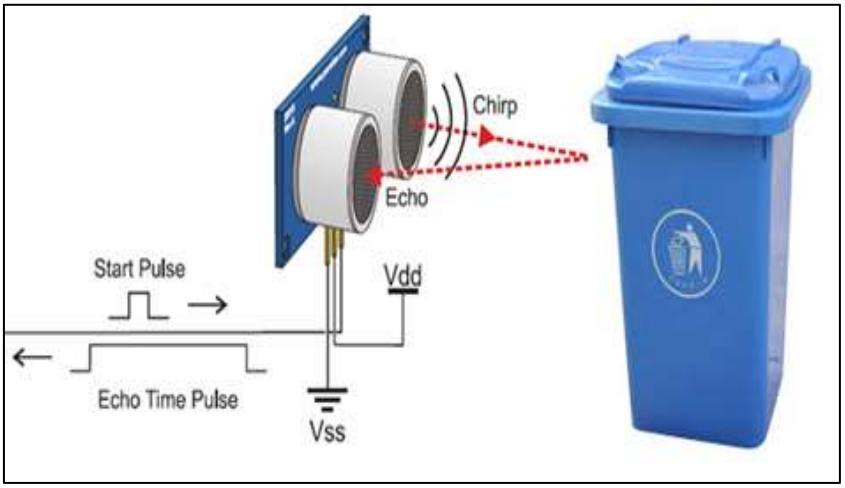

Fig. 2:

Distance in centimeters = (Time/58 or 48) cms

Frequency	Target Large Flat Reflector	Target 6 in. Radius Sphere	Decrease in Target Range For Spherical Target
200 kHz	5.2 ft	3.5 ft	1.7 ft (33%)
160 kHz	6.5 ft	4.0 ft	2.5 ft (38%)
100 kHz	10.5 ft	5.6 ft	4.9 ft (47%)
63 kHz	18.2 ft	7.8 ft	10.4 ft (57%)
40 kHz	30.2 ft	10.0 ft	20.2 ft (67%)

Table 1:

Block diagram:

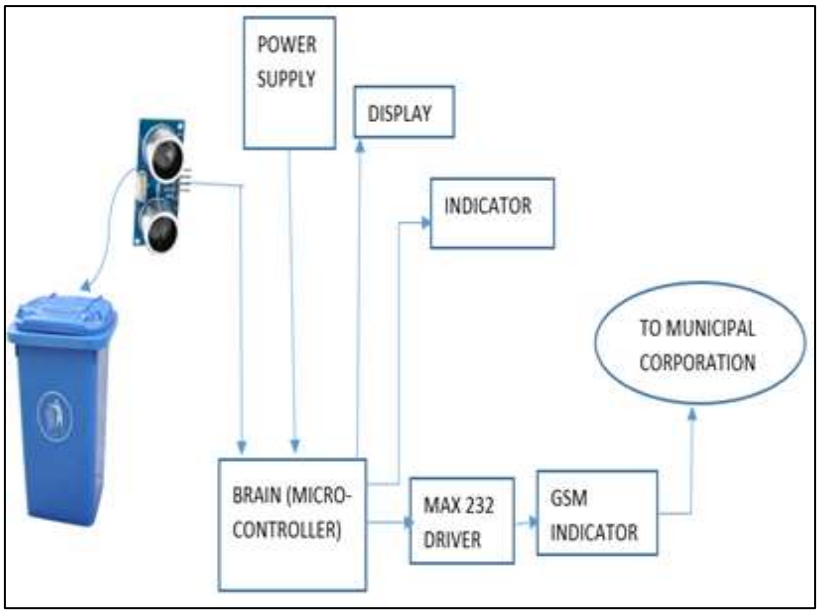

Fig. 3:

IV. CONCLUSION

When these smart dustbins are designed, various features are being addressed that are durability, affordability, prevention against damage and maintenance issues and most importantly this helps in creating awareness amongst people for healthy, clean and green environment and surroundings. This Smart Dustbin can contribute a lot towards clean and hygienic environment in building of a smart city.

But since this technology is quite new in India, thus proper awareness has to be created among the public before this technology is being implemented on a large scale. This is important as these sensitive devices like sensors might be damaged due to rough action of the users.

Our main motive of making this dust bin is to reduce the percentage of pollution which has been increasing rapidly since a couple of decades.

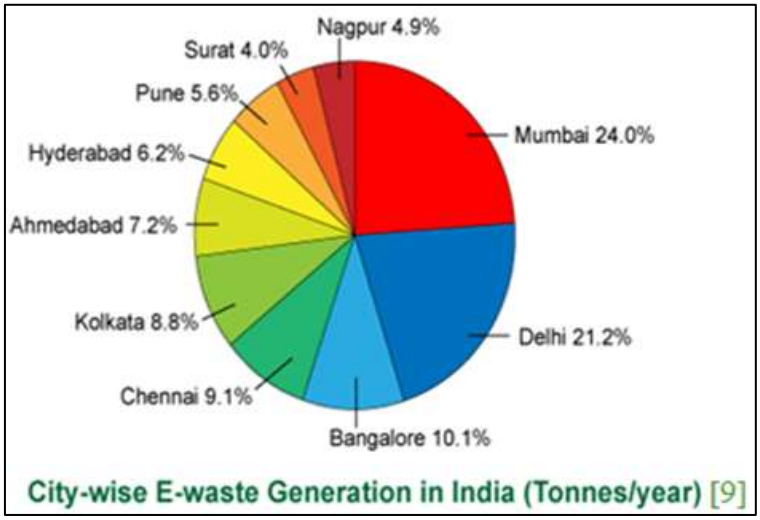

Fig. 4:

V. FURTHER WORKS

In this paper, we will be implementing this process only for a single bin. Integration of ample number of bins each with a unique ID can be done by implementing the principles of IOT and creating database for each bin which can be maintained by using SQL technology and then a login webpage is created so as to ensure only the authorized entries.

Apart from this, we can differentiate between dry waste bins and wet waste bins. The dry and the wet waste bins will be collecting plastic waste and biodegradable waste respectively. For this implementation, methane and smell sensors can be used. This will be helpful in distinguishing the waste at the source and hence will reduce the requirement of manpower.

To enhance this technology further, an automated system can be developed which will be designed in such a way that it would be able to pick the garbage spilled out of the bins, segregate and place them into the respective bins.

REFERENCES

[1] Narayan Sharma, NirmanSingha, Tanmoy Dutta, "Smart Bin Implementation for Smart Cities" , International Journal of Scientific & Engineering Research, vol 6, Issue 9, 2015,pp-787-789.
[2] K. Vidyasagar, M. Sumalatha, K. Swathi and M. Rambabu, "Eco-friendly Environment with RFID Communication Imparted Waste Collecting Robot", Journal of Academia and Industrial Research (JAIR) Volume 4, Issue 2 July 2015, pp.43-47.
[3] Twinkle Sinha,Mugesh Kumar, P.Saisharan, "Smart Dustbin", International Journal of Industrial Electronics and Electrical Engineering, SRM University, India, vol-3, Issue-5, 2015,pp.101-104.
[4] M.T.H. Shubho, M.T Hassan, M.R. Hossain and M. N. Neema, "Quantitative Analysis of Spatial Pattern of Dustbins and its Pollution in Dhaka City--A GIS Based Approach", Asian Transactions on Engineering (ATE ISSN: 2221-4267) vol. 03 Issue 04, September 2013, pp.1-7.
[5] Narayan Sharma, Nirman Singha, Tanmoy Dutta, "Smart Bin Implementation for Smart Cities", International Journal of Scientific & Engineering Research, Volume 6, Issue 9, September-2015, pp.787-791.
[6] Insung Hong, Sunghoi Park, Beomseok Lee, Jaekeun Lee, DaebeomJeong, and Sehyun Park, "IoT-Based Smart Garbage System for Efficient Food Waste Management", The Scientific World Journal, Volume 2014 (2014), Article ID 646953, 13 pages
[7] Prof. R.M.Sahu, AkshayGodase, PramodShinde, ReshmaShinde, "Garbage and Street Light Monitoring System Using Internet of Things", International journal of innovative research in electrical, electronics, instrumentation and control engineering Vol. 4, Issue 4, April 2016
[8] Vikrant Bhor1, Pankaj Morajkar2, Maheshwar Gurav3, DishantPandya,"Smart Garbage Management System", International Journal of Engineering Research & Technology, Mumbai, India ,vol. 4 Issue 03, 2015,pp.1117-1119.