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IOT BASED GARBAGE MONITORING SYSTEM

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Abstract

In the present scenario as the population is increasing day by day, the environment should be clean and hygienic. In most of the cities, the overflowed garbage bins creating an unhygienic environment. This will further lead to the arise of different types of unnamed diseases. This will degrade the standard of living. To avoid all such situations this paper gives a clear picture of IOT based garbage monitoring system to keep environment clean and safe.

This project IOT based Garbage monitoring system is a very innovative system which will help to keep the cities clean. This system monitors the garbage bins and informs about the level of garbage collected in the garbage bins via a web page. Also it indicates the status of toxic gas formation inside the bin as well as the weight of the bin. For this, the system uses ultra sonic sensor placed over the bins to detect the garbage level and compare it with the level of the garbage bin's depth. The system makes use of Advanced Virtual Reduced (AVR) Instruction Set microcontroller, Organic Light Emitting Diode (OLED) screen, Global system for mobile communication (GSM) modem for sending data and a buzzer. The system ispowered by a solar cell and battery. The Organic Light Emitting Diode (OLED) screen is used to display the status of the level of the garbage collected in the bins, whereas a web page is built to show the status to the user monitoring it. The web page gives a graphical view of the garbage bins. The display shows the condition of the trash stage and the other feeler information. The system puts on the buzzer when the level of garbage composed crosses the set limit or if there is occurrence of toxic gases. Thus this scheme helps to maintain the city sparkling by informing about the trash levels of the bins by providing graphical representation of the bins via a web page.

Key words: IoT garbage monitoring system, Toxic gas formation, Advanced Virtual Reduced (AVR) Instruction Set Micro Controller, Organic Light Emitted (OLED) Screen.

Introduction:

For the realisation of the topic of research, relevant information in the international scientific arena was collected through studies of the diverse literature from text books/literature, international scientific journals, environmental progress report from different agencies, internet website, reports by governmental agencies, substantial knowledge was gathered and a review of what other scientist have written on issues concurring with the research topic was made. Literature review was then undertaken to gather information on the research in the field of impact of urban waste on the quality of ground water and soil in different areas. The characteristics and composition of the urban waste i.e. sewage and municipal solid waste was studied by various workers in the world. Literature shows evidences of the work carried out on the health risk assessment due to urban waste. The impact of urbanization on the water quality as well as soil quality was also studied by various researchers in the different parts of the world.

At International level, there are various organizations including private and government which are working in the field of environment and are engaged in research and development in the field of waste management. The international agencies like World Health Organization (WHO), Environmental Protection Agency (EPA) and United Nations Environment Program (UNEP) are engaged in developing new technologies for waste management and its disposal including its characterization. The clear idea about literature review at national and international level is given below.

Management of Municipal Solid Waste for various cities and towns has been widely studied throughout the world. As the huge quantities of solid waste generated in the urban areas is the major problem, majority of researchers concentrated on this issue. Numbers of researchers have tried to find out new techniques for solid waste management. Mahar et.al., 2007[1] reported the review and analysis of solid waste management situation in urban areas of Pakistan. According to him poor solid waste management is one of the major causes for environmental degradation in Pakistan. According to Rajput et.al., 2009[2], municipal firm squander production displayed divergent fashion and a beneficial parallel with monetary development in expression of kg/capita/day firm waste production at humanity weighing machine.

Yadav and Devi, 2009[3] conducted studies on the solid waste management in Mysore city. Shivayoginath et.al., 2007[4] standard out a look into on neighborhood firm ravage supervision in Raichur city. They methodically deliberate all the mechanism of metropolitan rock-hard squander administration and also optional technical administration. Agarwal et.al., 2005[5] investigated recycling of the unrestricted firm waste (MSW) in the Indian capital city of Delhi. They establish that an unceremonious division comprising waste recyclists and a pecking order of eco-friendly dealers plays an

significant position in the administration of firm waste. Sharholy et.al., 2008[6] reviewed the location of community firm waste association in Indian cities. They reported that civic firm waste supervision (CFWS) is one of the chief ecological harms of Indian cities. Upadhyay et.al., 2005[7] belongings to perceive the in progress state of affairs of waste institute and the options accessible to swap these wastes into obliging foodstuffs.

Zhu Minghua et.al., 2009[8] studied the management practices carried out for the solid waste from Pudong New Area, China. They have illustrated important aspects of waste management, such as the current status of waste collection, transport and disposal in Pudong area. Moqsud and Hayashi, 2006[9], evaluated solid waste management practice in Japan and found that 20.3% of total solid waste generated in Japan is land filled, including ash from incineration. According to Moqsud and Hayashi, the "waste management hierarchy" (minimization, recovery, transformation and disposal) has been adopted by Japan in recent times as the menu for developing solid waste management strategies.

According to Nath (2014)[10], there are many ways to treat with waste. Paper wastes are treated with repulping technique to convert paper and paperboard products. Plastic waste are treated with the help of Extruder Machine, Injection moulding, Blow moulding, Film blowing and depolymerisation Process The Government has notified the Plastic Waste Management Rules, 2016[11], in suppression of the earlier Plastic Waste (Management and Handling) Rules, 2011.

The Minister of State for Environment, Forest and Climate Change, Shri Prakash Javadekar[12], said here today that the minimum thickness of plastic carry bags has been increased from 40 microns to 50 microns. The Minister alleged that alerting the new Plastic Waste Management Rules is a part of the refurbishing of all Waste Management Rules. "This will help in achieving the vision of our Prime Minister of Swacchh Bharat and cleanliness is the essence of health and tourism", an eco-friendly product, which is a complete substitute of the plastic in all uses, has not been found till date.

In the absence of a appropriate alternative, it is impractical and disagreeable to impose a blanket ban on the usage of plastic all over the country. The real contest is to progress plastic waste management systems.

Waste means any material either solid, liquid, semisolid, containing gas or other forms resulting from industrial, commercial, mining or agricultural operations or from community and household activities that is devoid of usage and discarded.

Fig.1: conditions in the city

Types of wastes:

The classification of wastes varies and depends on country by country. Waste can be divided into many different types. On behalf of the most widespread technique of categorization is by their corporeal, compound, and organic distinctiveness. They are: Solid, Liquid, Sludge and Hazardous.

Solid Waste:

Solid waste includes harmless industrial, commercial and domestic trash including household organic trash, street sweepings, hospital and institutional garbage, and construction wastes; generally sludge and human waste are viewed as a liquid waste problem outside the scope of Master of Super Work (MSW). These are fritter away resources so as to restrain a lesser amount of than 70% water.

Example of this sort of waste are the domestic garbage, approximately industrial wastes, around mining wastes, and oilfield wastes for example drill cuttings etc. figure. 2 depicts the solid waste.

Fig. 2: Solid waste.

Liquid waste:

These are usually waste waters that may contain high concentration of dissolved salts and metals. A liquid waste is often classified into two board types: sewage and toxic wastes. Generally, there are several types liquid waste caused in inner-city centers like human excreta, domestic wastes produced in households, hospital wastes, industrial wastes, agricultural fluid wastes and nuclear wastes. When improperly held, and disposed of, liquid wastes pose (present or constitute) a solemn threat to human health and the environment because of their facility to cross the threshold watersheds, contaminate ground water and drinking water. The below fig. 3 shows the liquid waste.

Fig. 3: liquid waste.

Sludge:

The figure.4 describes the sludge. It is a class of leftover between liquid and solid. They usually comprise between 3% and 25% solid, while the rest of the substantial is dissolved water.

Fig. 4: Sludge.

Hazardous Waste:

perilous wastes are wastes which by themselves or subsequent to approaching into make contact with other wastes, chemically reactivity, toxicity, corrosiveness or a tendency to explode, that pose a risk to human health or the environment. Hazardous waste is generated from a wide range of industrial, commercial, agricultural, and to a much less extent, domestic activities. They may take the form of solids, liquids or sledges, and can pose both acute and chronic public health and environmental risks. The figure.5 depicts the hazardous waste.

Fig. 5: Hazardous Waste.

Overview of the project:

The basic idea in this project is to design a smart Garbage detection system which would automatically notify the officials about the current status of various garbage bins in the city, with a real time monitoring capabilities, and a remote controlled IoT technique, which is depicted in fig. 6.

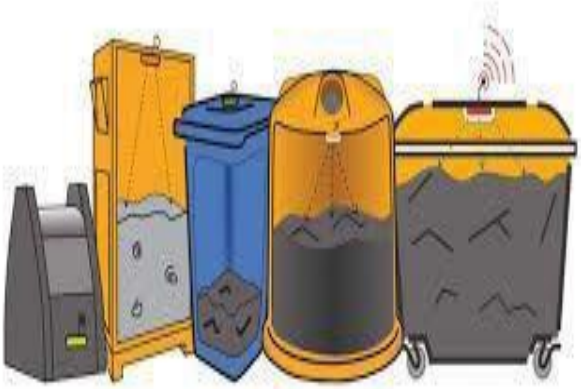

Fig. 6: Overview of the project.

Pune city's current waste collection considered here as a case work, logistics is carried out by emptying containers according to predefined schedules and routes which are repeated at a predefined frequency. Such a System has major disadvantages:

Time consuming, High costs, Greater traffic and congestion, Unnecessary fuel consumption, Increased noise and air pollution as a result of more trucks on the road.

All the above disadvantages are a result of lack of real time information resulting in unsuccessful collection of waste. The Pune Municipal itself finds this as a big problem and a big hurdle in between Pune's Smart City initiative. There is an urgent need to optimize the management of this service to reduce infrastructure, its operating and maintenance costs, as well as reducing contamination directly associated with waste collection.

Sources of wastes:

Medical/clinical sources of waste:

Medical/clinical waste normally refers to waste produced from health care facilities, such as hospitals, clinics, surgical theatres, veterinary hospitals and labs. They tend to be classified as hazard waste rather than general waste. Items in this group include surgical items, pharmaceuticals, blood, wound dressing materials, needles and syringes.

Agricultural sources of waste:

Typically, this is waste generated by agricultural activities. These include cultivation, fruit growing, seed growing, cattle breeding, market commons and seedling plant sales outlet.

End-of-life Automobiles:

When cars are all old and not working again, where do they end up? Many people just leave them to rust in the fields, but there is a better way to deal with them. In many cities, these vehicles are sent to the plant, where all the removable parts are taken out for recycling. The rest is flattened up and shredded into pieces for recycling. The last bit that cannot be used again is sent to a landfill. The figure.7 depicts the End-of-automobiles.

Fig. 7: End-of-Life Automobiles.

Block diagram of proposed system:

The IOT garbage monitoring system is built on Arduino board platform and IOT gecko web development platform as shown in figure.8. It is interfaced with Wi-Fi modem and compost is fortified with ultrasonic sensor. The hardware such as AVR family microcontroller, LED's, LCD display, 12V transformer, Resistors, Capacitors, Diodes. The software provisions are Arduino compiler, IOT Gecko, MC Programming Language C.

The block diagram includes transformer, rectifier, regulators, wifi Modem, AVR microcontroller and Ultrasonic sensors. The Ultrasonic sensors are placed over the garbage bins to detect the level of the garbage collected in the bins and are interfaced with the Ultrasonic sensors. The wifi modem also interfaced with the microcontroller. The supply (230V 50 Hz ac) is given to the step down transformer it step downs 230V into 12V ac and its output is given to the rectifier. The rectifier converts alternating current into direct current (AC to DC). The rectifier output is given to the both of the regulators. The purpose of regulator is to maintain output voltage constant. One of regulators output is directly given to the micro controller and the regulator output is given to the microcontroller through wifi modem. The fig. 8: depicts the Block Diagram.

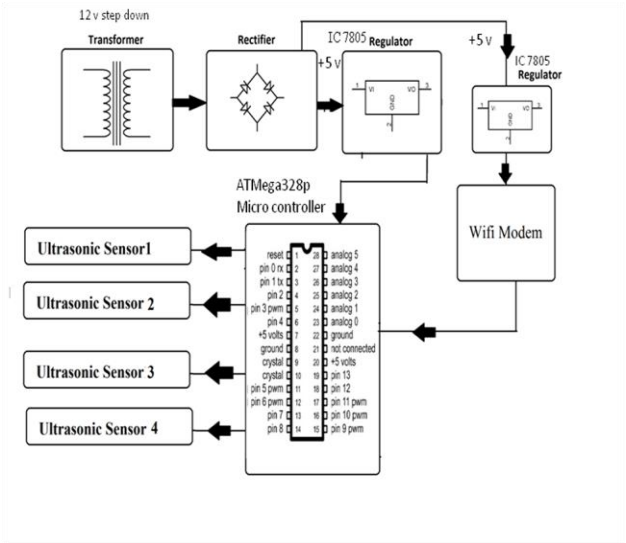

Fig. 8: Block Diagram.

HARDWARE USED:

Arduino Uno Board:

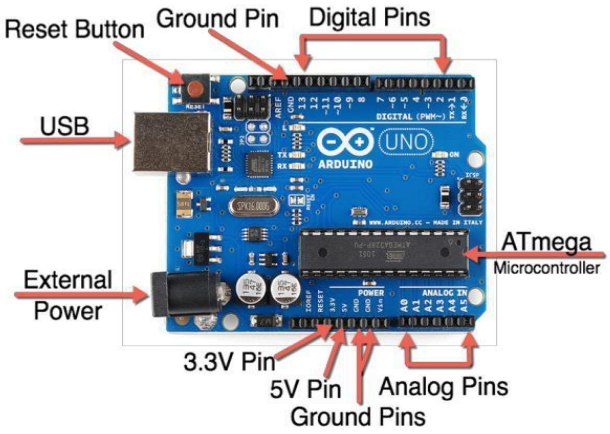

Fig. 9: Arduino Uno Board.

Ultra Sonic Sensor:

The Ultrasonic feeler is worn to compute the detachment with high precision and constant readings. It can evaluate detachment from 2Cm to 400Cm or from 1 inch to 13 feet at the frequency of 40 KHz in the air and if the article will come in its way then it will spring back to the feeler. The fig.10 shows the Ultrasonic Sensor.

Fig.10: Ultra Sonic Sensor.

GSM modem:

GSM modem shown in figure.11 is used to send message to the garbage depots if the Garbage Can exceeds the set threshold level. With the help of GSM module interfaced, we can send short text messages to the required municipal office. GSM module is provided by sim using the mobile service provider and send sms to the respective authorities as per programmed. It operates at either the 900 MHz or 1800 MHz frequency band.

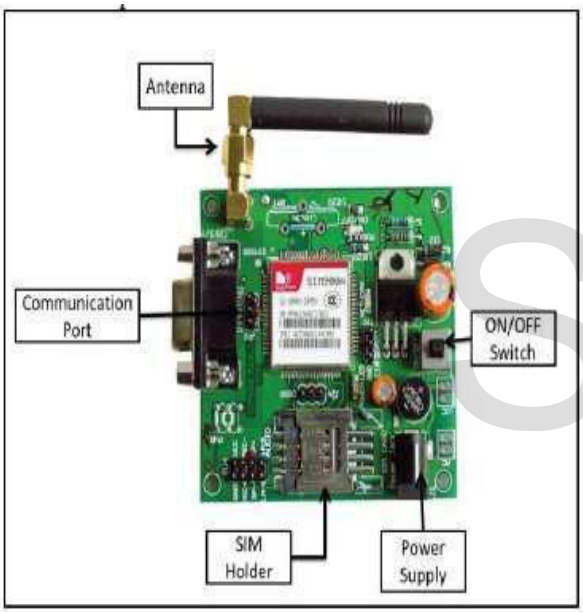

Fig. 11: GSM Modem.

MICROCONTROLLER:

It gets information from sensor and process on it. It compares the received data with the threshold level set and accordingly output is generated. The LPC131/32/34//38 microcontrollers are based on a 16/32-bit ARM7TDMI-S CPU with concurrent emulation and entrenched outline holdup, that unite the microcontroller with 32KB, 64KB, 128KB, 256KB and 512KB of entrenched. prompt blaze reminiscence. A128-bit wide reminiscence interface and sole accelerator structural design facilitate 32-bit code carrying out at greatest clock rate.

WI-FI MODEM:

This unit is authoritative enough onboard processing and storage capability that allows it to be integrated with the sensors and other application explicit devices through its GPIOs with minimal development upfront and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 provisions APSD for VoIP claims and Bluetooth co-existence confines, it comprises a self-calibrated RF leasing it to vocation beneath all operational conditions, and involves no peripheral RF parts. There is an approximately immeasurable spray of in sequence accessible for the ESP8266, all of which has been provided by amazing community support. The properties using the ESP8266, even instructions on how to renovate this module into an IoT (Internet of Things) solution is elaborated. ESP8266 Module is not capable of 5-3V logic shifting and will entail an external Logic Level Converter. Note: Do not power directly from 5V dev. board.

LCD DISPLAY:

LCD (liquid crystal display) is the technology used for display in notebook and other smaller

computers like light-Emitting diode (LED) and gas-plasma technologies. The fig. 12 shows the LCD display screen.

Fig. 12: LCD display screen.

System Architecture:

The IOT Garbage Monitoring system is a very innovative system which will help to keep the cities clean. This arrangement monitors the garbage bins and notifies about the level of garbage collected in the garbage bins via a web page. For this the scheme uses ultrasonic sensors positioned over the bins to detect the garbage level and relate it with the garbage bins depth. The system makes use of Arduino family microcontroller, LCD screen, Wi-Fi modem for sending data and a buzzer. The scheme is powered by a 12V transformer. The LCD screen is used to display the status of the level of garbage composed in the bins. Whereas a web page is built to show the status to the user monitoring it. The web page gives a graphical view of the garbage bins and climaxes the garbage collected in colour in order to show the level of garbage collected.

The LCD monitor shows the condition of the trash level. The scheme puts on the signal when the level of trash composed crosses the customary limit. Thus this scheme aids to remain the city spotless by updating about the trash levels of the bins by providing graphical representation of the bins via a web page. The ESP8266 Wi-Fi Module is a self-contained SOC with combined TCP/IP decorum stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is talented of either hosting an submission or unburdening all Wi-Fi networking functions from another application processor. Each ESP8266 Module comes pre-programmed with an AT command customary firmware. The ESP8266 module is an extremely price effective board with an enormous, and ever increasing, community. Fig. 13 shows the architecture of the proposed system.

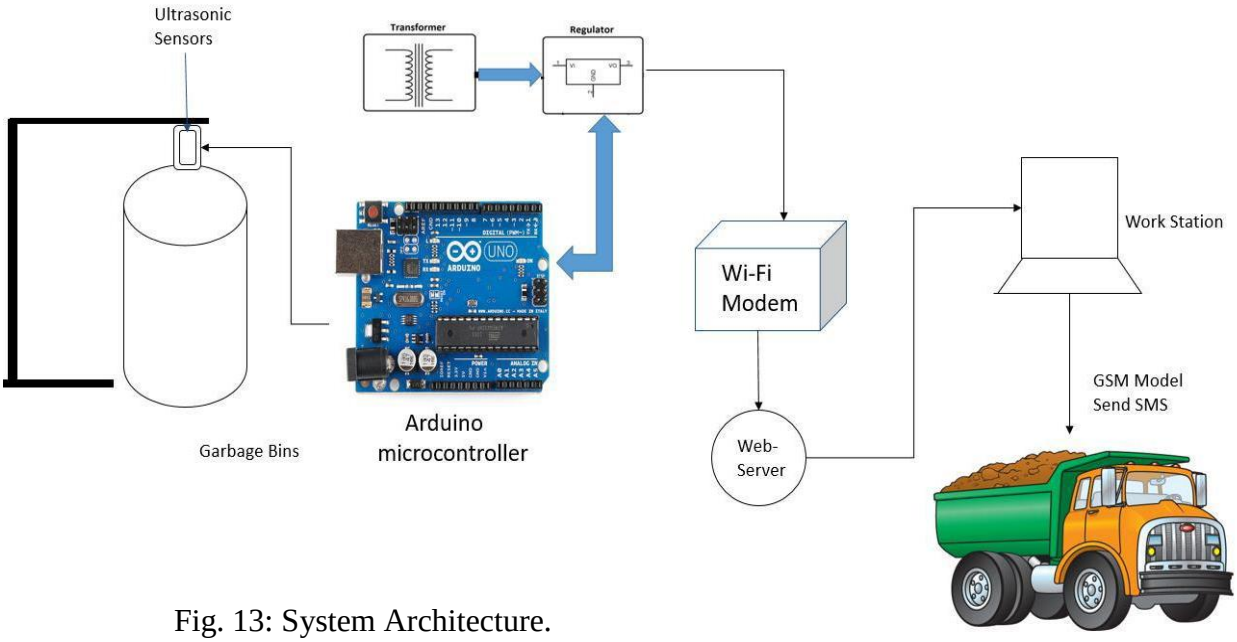

Fig. 13: System Architecture.

Flow chart:

The Fig. 14 depicts the flow chart. At the start the garbage bin is unfilled and the sensors placed over the bins senses the level of the garbage composed in the bins. If the sensor senses no garbage in the bin then it does not refer information to the person who are monitoring in the control room. Else if the sensor senses any garbage in the bin and the level of the garbage is in between 0%-70% and it specifies the level in graphical view. If level is in between 70-100% and the buzzer will be on at every 10%. Then it sends information to the concerned person in the control room then directs the persons to collect the garbage.

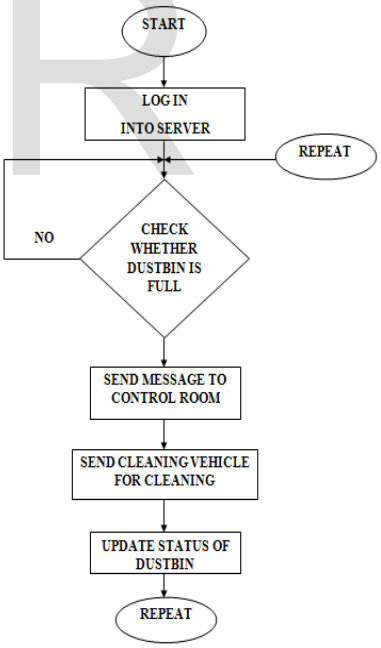

Fig. 14: Flow Chart.

Result:

The following are the results which obtained from this work.

- Waste level detection inside the dustbin.
- Transmit the information wirelessly to concern.
- The data can be accessed any time and from anywhere.
- The real time data transmission and access.
- Avoids the overflow of the dustbin. This IoT beached waste management is very useful for smart cities in diverse aspects. We have seen that, in cities there are dissimilar dustbins located in different areas and dustbins become over flown many times and the concerned people do not get info about this. Our system is designed to crack this issue and will offer complete details of the dustbins located in different areas throughout the city. The allocated authority can access the information from anywhere and anytime to get the details. Accordingly they can revenue the decision on this immediately. The fig. 15 depicts the garbage view of the garbage level.

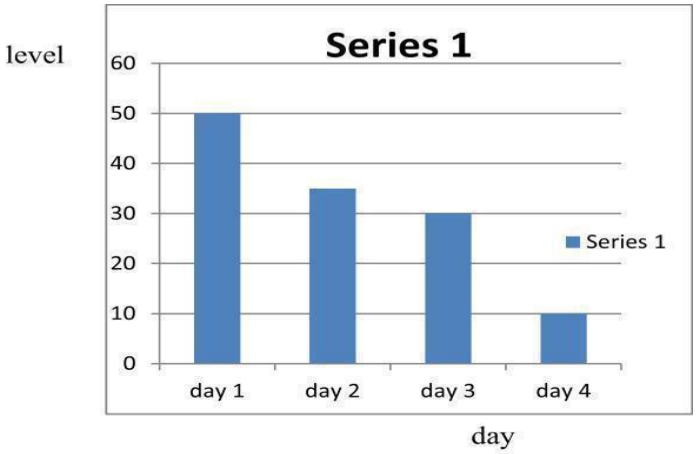

Fig.15: Graphical view of the Garbage level.

Disadvantages of the existing system:

Time consuming and less effective, high costs, creates unhygienic environment and look of the city, bad smell spreads and may cause illness to human beings.

Advantages of the proposed system:

Real time information on the fill level of the dustbin, development of the dustbin based on the actual needs, cost reduction and resource optimization, effective usage of dustbins.

Conclusion:

The IOT-Garbage monitoring system pays a lot towards clean and disinfected pollution less environment in building a smart city. As these technology is new in India there should be appropriate consciousness and alertness among the public before the operation of this technology. Otherwise, sensitive devices like sensors might be spoiled due to rough action of the users. It is an automatic dust bin monitoring system in order to sense the full condition of the garbage bins. This provides

the authorized users appropriate updates of the location of the garbage bins and thus eliminates the need of intermittent manual checks and overflowing garbage bins. This method finally helps in keeping the environment clean. Thus, the garbage collection is made more efficient, effective and operative.

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