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SMART DUSTBIN USING IoT

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Abstract — Every person in this world throws waste in the form of plastics, wet waste, dry waste and etc. Also, every person looks for a place or a plastic container to dispose that waste, that plastic container is the Dustbin which they look for. Dustbin is a plastic container where everyone can dispose their waste. The main components they used in making this prototype are Arduino, Servo Motor and Ultrasonic Sensors.

The software component is the application named as Blynk which is used to get notification. In the recent decades, Urbanization has increased tremendously. At the same phase there is an increase in waste production, keeping in focus the crucial issue of waste management and recycling, a smart dustbin is built on a micro controller based plat from Arduino Uno board which is interfaced with embedded systems, which enables us to segregate wet and dry waste automatically and collecting both type of waste in individual containers. In this project, a system has been proposed which reduces the collection of wet waste and dry waste altogether in household as well as in public which is non-recyclable. The dry waste that will be collected separately can be recycled efficiently and lessen the chances of air and soil pollution

Keywords— Internet of Things, Arduino UNO, Ultrasonic Sensors, Smoke Sensor**.**

I. INTRODUCTION

Internet and its applications have become an integral part of today's human lifestyle. It has become an essential tool in every aspect. Due to the tremendous demand and necessity, researchers went beyond connecting just computers into the web. These researches led to the birth of a sensational gizmo, Internet of Things (IoT). Communication over the internet is grown from user-user interaction to device - device interactions these days. Typically, IOT offers advanced connectivity of devices, systems, and services that go beyond machine-to-machine communications (M2M) and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices (including smart objects) is implemented in nearly all fields of automation enabling advanced applications like a Smart Grid. The term-things in the IoT refers to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, electric clams in coastal waters, automobiles with built-in sensors, or field operation devices that assist fire-fighters in search and rescue. Current market examples include smart home and smart cities.

The world is in a stage of upgradation, there is one stinking problem we have to deal with. Garbage! In our daily life, we see the pictures of garbage bins being overfull and all the garbage spills out. This leads to the number of diseases and insects and mosquitoes breed on it. A big challenge in the urban cities is solid waste management not only in India but for most of the countries in the world. Hence, such a system has to be build which can eradicate this problem or at least reduce it to the minimum level. The waste collection process is a critical aspect for the service providers. The traditional way of manually monitoring the wastes in waste bins is a complex, cumbersome process and utilizes more human effort, time and cost which is not compatible with the present-day technologies. In order to overcome all these problems, we are proposing the idea of a waste management system which helps in the management of waste with the least human interaction in order to maintain a clean environment.

The people who need dust bins near their location can request it through logging onto our website. IoT Garbage Monitoring System monitors the garbage bins and informs about the level of garbage collected in the garbage bins via an SMS. We are making use of various sensors to scan type of garbage and then categorize them to different bins by automatically opening the door. It also uses ultrasonic sensors placed over the bins to detect the garbage level. Our system works on solar energy. If the dustbin is not cleaned in a specific time, then the record is sent to the higher authority who can take appropriate action. This system also helps to monitor the fake reports and hence can reduce corruption in the overall management system. It will stop overflowing of dustbins along roadsides and localities as smart bins are managed at real time. The filling and cleaning time of smart bin will also be reduced thus making empty and clean dustbins available to common people.

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II. LITERATURE SURVEY

Adil Bashir, Shoaib Amin Banday, Ab.Rouf Khan and Mohammad Shafi [1], are integrated to use as Smart Trash System embodies an electronic device known as Smart Trash Bin which consists of Sensors (Load sensor and IR proximity sensor) and a Radio Frequency (RF) transmitter. An automated GSM module, Load sensor, Microcontroller, DC motor, LCD, Web Camera, and Power supply are the essentials for collection, monitoring, and management of garbage. Implementation of this project helps in avoiding overflow of garbage from the container in a residential area which is previously either loaded manually or with the help of loader in traditional trucks. It reduces the productivity of the vehicles and manpower deployed and thereby helps in minimizing the threat to the health of the sanitation workers as the waste is highly contaminated. B. Chowdhury and M. U. Chowdhury, has proposed some smart trash research consider "pay as you throw"'[2] weight-based billing for residential collection, which could motivate residents to reduce their waste. It uses the load sensor. F achmin F olianto, Y ong Sheng Low and Wai Leong Yeow, are presented a system which is designed to collect data using the ultrasonic sensor and to deliver the data through the wireless mesh network. The system also employs a duty cycle technique to reduce power consumption and to maximize operational time. The Smart bin system was tested in an outdoor environment. Through the tested, they collected data and applied sense-making methods to obtain litter bin utilization and litter bin daily seasonality information. With such information, litter bin providers and cleaning contractors are able to make better decision to increase productivity [3]. Dr. K. R. Nataraj and Meghana K. C [4], has proposed the system which concentrates on eradicating the issue of ignorance of cleanliness which is spoiling our environment and then reduce it. The smart trash consists of two sensors namely IR and gas sensors.

The IR sensor placed inside the trash to sense the level of trash and gas sensor will sense the toxic gases. Once the trash is filled, alarm rings. S.S.Navghane, M.S.Killedar, Dr.V.M.Rohokale has shared the idea Moreover, this is not an original idea, for the implementation of smart garbage bin; the idea has existed for many years, After the IoT field finding its grip in our lives. This is an original plan for designing a smart garbage bin with a weight sensor, IR sensor and Wi-Fi module for transmission of data. This system assures the cleaning of dustbins soon when the garbage level reaches its maximum. If the dustbin is not cleaned in a specific time, then the record is sent to the higher authority who can take appropriate action against the concerned contractor. This reduces the total number of trips of garbage collection vehicle and hence reduces the overall expenditure associated with the garbage collection [5]. Gaikwad Prajakta, Jadhav Kalyani, Machale Snehal has proposed the automatic garbage collection and information gathering system which is based on Image processing as well as on GSM module. The main concept is that a Camera will be placed at every garbage collection point along with the load cell sensor at the bottom of the garbage can. The camera will take continuous snapshots of the garbage can. A threshold level is set which compares the output of the camera and load sensor. The comparison is done with the help of microcontroller. After analyzing the image, they get an idea about the level of garbage in the can and from the load cell sensor they get to know the weight of garbage. Accordingly, information is processed and checks if the threshold level is exceeded or not. The controller sends a message with the help of a GSM module [6] to Garbage collection local central office to notify that garbage can be exceeded its capacity and disposal of waste is required. Accordingly, the authority sends the garbage collecting vehicle to collect the garbage, which is done with the help of a robot mechanism which tilts the can. Vishesh Kumar Kurre shared an idea in which a sensor (Infrared sensor/proximity sensor) Is placed under the dustbin. When the sensor signal reaches the threshold value, a mail notification (like email, twitter, WhatsApp message) will be sent to the respective Municipal / Government authority person. they can also see the density of the Dustbin through the internet on a Dashboard, this is a GUI (Graphical User Interface) dashboard so any of the authenticate person will easily check the present condition of the dustbin. So then that person can send the collection vehicle to collect the full garbage bins or dustbins [7].

III. PROPOSED SYSTEM

The primary objective of this research project is, the system will sense the type of garbage by using some sensors and it will segregate it to a different compartment. A system consists of an inductive proximity sensor on the conveyor belt and ultrasonic sensors at the top of the dustbin, a smoke sensor to detect fire. Each smart bin is assigned with GPS (Global Positioning System) to provide the location and a GSM (Global System for Mobile) to send the message to the workers.All the sensors and modules are connected directly to Arduino and they are controlled by the Arduino board. Arduino's program monitors sensors and issues action based on the status of the bin.

Ultrasonic sensor

The suggested system with the help of sonar sensor can be used to identify the depth of the dustbin. A sonic transducer used for the ultrasonic sensor, which allows alternate transmission and reception of sound waves. The sonic waves emitted by the transducer are reflected by, an object and received back in the transducer after having emitted the sound waves, the ultrasonic sensor will switch to receive mode the time elapsed between emitting and receiving is proportional to the distance of the object from the sensor.

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Smoke sensor

A smoke detector is a device that senses smoke, typically as an indicator of fire. Smoke detectors are housed in plastic enclosures, typically shaped like a disk about 150 millimeters (6 in) in diameter and 25 millimeters (1 in) thick, but shape and size vary. Smoke can be detected either optically (photoelectric) or by physical process (ionization); detectors may use either, or both, methods. Sensitive alarms can be used to detect, and thus deter, smoking in areas where it is banned. Smoke detectors in large commercial, industrial, and residential buildings are usually powered by a central fire alarm system, which is powered by the building power with a battery backup. Domestic smoke detectors range from individual battery-powered units to several interlinked mains-powered units with battery backup; with these interlinked units, if any unit detects smoke, all trigger even if household power has gone out.

GPS module

GPS stands for Global Positioning System, in the proposed system GPS is used to keep track of the location of the smart bin. The Global Positioning System consists of a network of 24 broadcasting satellites orbiting the earth at a height of 20,200km. GPS also consists of receivers on the ground, which listen to and interpret the transmissions of the satellite. Stations on the earth carefully monitor the orbit of each satellite, maintaining a highly accurate record if the satellites instantaneous position. The knowledge of the precise position of the satellites allows them to use as reference points, from which GPS receivers on earth can determine their position. This technique of determining the position of an object is called ranging.

Inductive proximity sensor

Inductive proximity sensors are used for non-contact detection of metallic objects. Their operating principle is based on a coil and oscillator that creates an electromagnetic field in the close surroundings of the sensing surface. The presence of a metallic object (actuator) in the operating area causes a dampening of the oscillation amplitude. The rise or fall of such oscillation is identified by a threshold circuit that changes the output of the sensor.

DC motor

DC stands for “direct current,” and they were the first type of motors that were commonly used because they could be powered from a pre-existing power distribution system. The speed in a DC motor can be adjusted through the intensity of its current. The current is carried through an armature or stator. The armature contains the coiled (star-formation for a stator) copper or aluminum wiring (commonly referred to as “windings”), and they both provide points for the wire to connect to the rest of the motor so that the electricity can continue to flow properly.

GSM Module

GSM is a cellular network, which means that cell phones connect to it by searching for cells in the immediate vicinity. There are five different cell sizes in a GSM network macro, micro, pico, femto, and umbrella cells. The coverage area of each cell varies according to the implementation environment. Macro cells can be regarded as cells where the base station antenna is installed on a mast or a building above the average rooftop level. The Micro cells are cells whose antenna height is under average roof top level; they are typically used in urban areas. Picocells are small cells whose coverage diameter is a few dozen meters; they are mainly used indoors. Femtocells are cells designed for use in residential or small business environments and connect to the service provider’s network via a broadband internet connection. Umbrella cells are used to cover shadowed regions of smaller cells and fill in gaps in coverage between those cells.

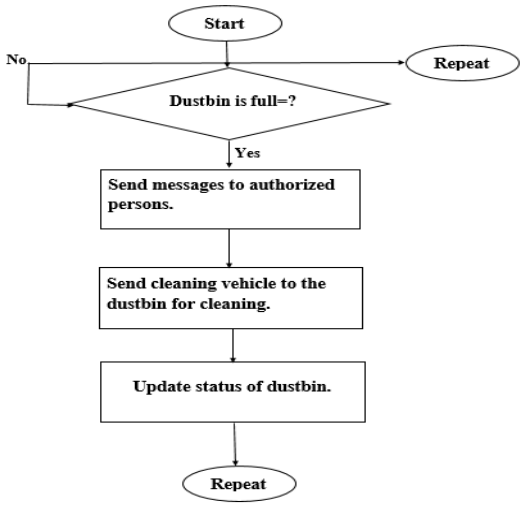

Fig: 1 Flow chart of smart dustbin

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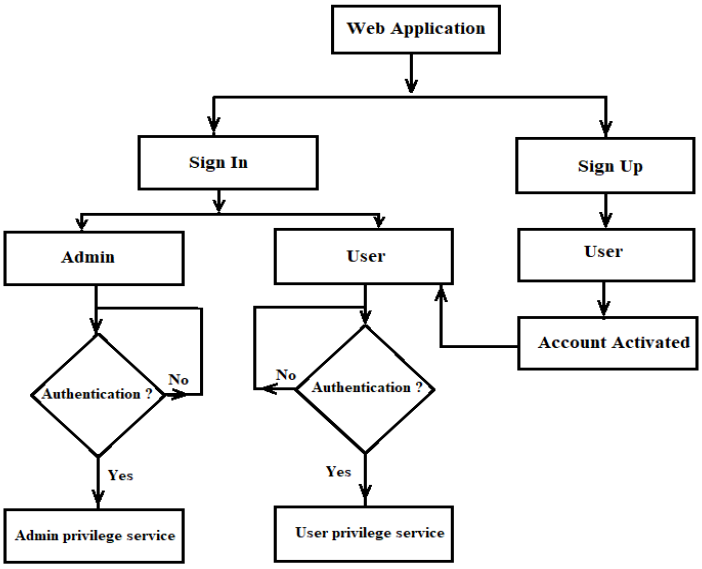

Fig: 2 Flow chart of the web application

IV. SYSTEM DESIGN AND IMPLEMENTATION

A system consists of an inductive proximity sensor on the conveyor belt and ultrasonic sensors at the top of the dustbin, a smoke sensor to detect fire. Each smart bin is assigned with GPS (Global Positioning System) to provide the location and a GSM (Global System for Mobile) to send the message to the workers. All the sensors and modules are connected directly to Arduino and they are controlled by the Arduino board. Arduino's program monitors sensors and issues action based on the status of the bin.

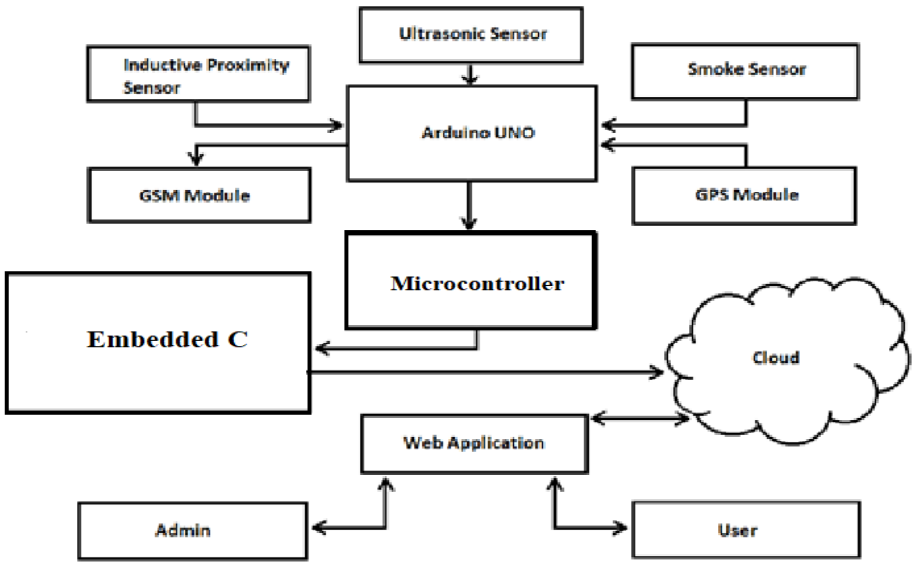

Fig: 3 General architecture of the smart dustbin

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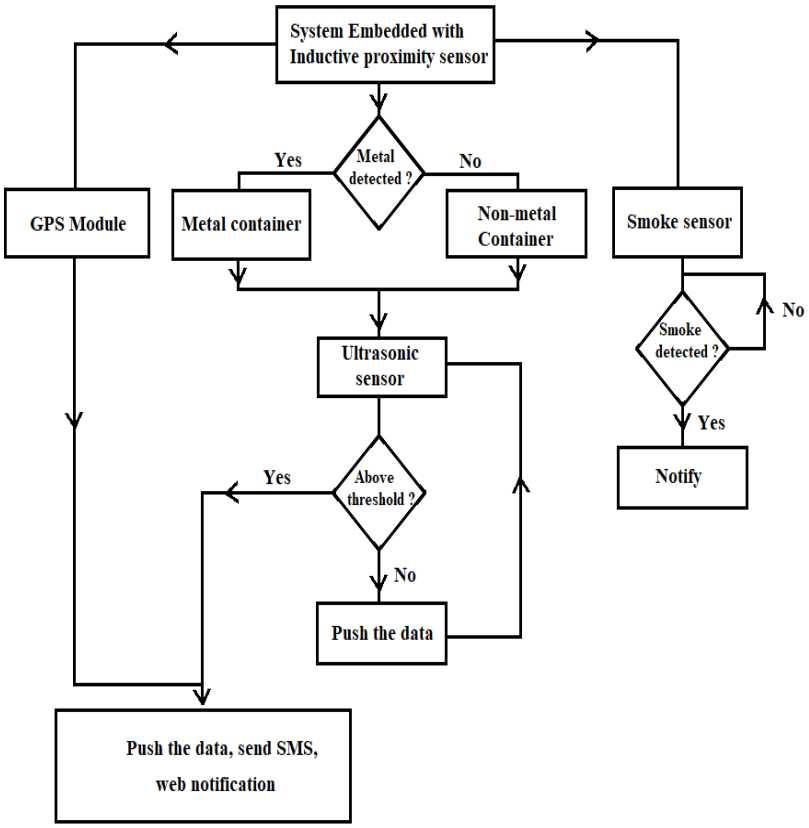

Fig: 4 System flowchart of smart dustbin

Figure 9 shows a system flow chart of Garbage monitoring system. If the inductive proximity sensor which is placed on the conveyor belt detects any metal it will trigger the servo motor to push the garbage content into metal bin else the servo motor will not trigger and allow the garbage content to fall into the non-metal bin. If the garbage level of the bin is above the threshold value it will trigger the GPS module. Then the GPS module will send the current location to the GSM module. The GSM module will send the message with the current location and status of the bin to the workers. A smoke sensor helps to identify the fire in the system.

Aim of the work— The rapid increase in volume and types of solid and hazardous waste due to continuous economic growth, urbanization, and industrialization, is becoming a burgeoning problem for national and local governments to ensure effective and sustainable management of waste. The ultimate destination of solid waste in India is at disposal. Thus, a practical answer could be separating the waste at disposal level.

There is no such system of segregation of dry and metallic wastes at the household level. So proposing system which aims to sort the waste into two major classes, namely metallic and non-metallic. So proposing an automated system to automate the solid waste identification, localization and collection process. The proposed system is involved in identifying key impact factor in the waste collection process and provide a systematic and automated solution to optimize the process to achieve higher efficiency. The proposed architecture is introduced to handle the waste collection process. The final outcome is a complete framework which compromises the inputs, outputs, guide and enables. The main objective is to implement an optimized automated waste collection system with the use of a vast sensor network capable of gathering waste data and by implementing an optimization algorithm in waste collection.

V. RESULT

Results basically refer to any particular output that comes as a result of the completion of the activities that have been performed as part of the project or a particular project component.

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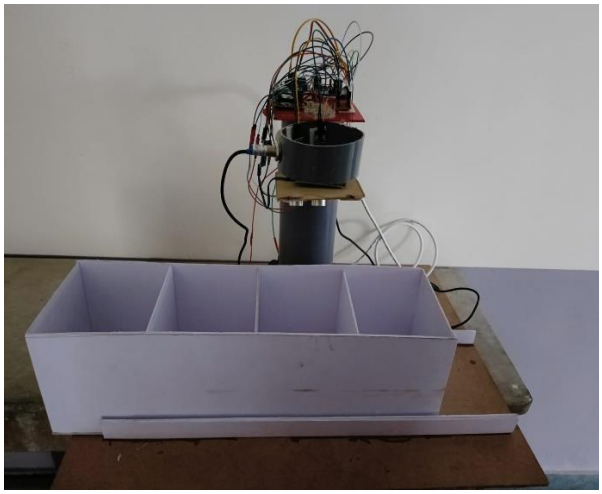

Fig: 5 Smart Dustbin

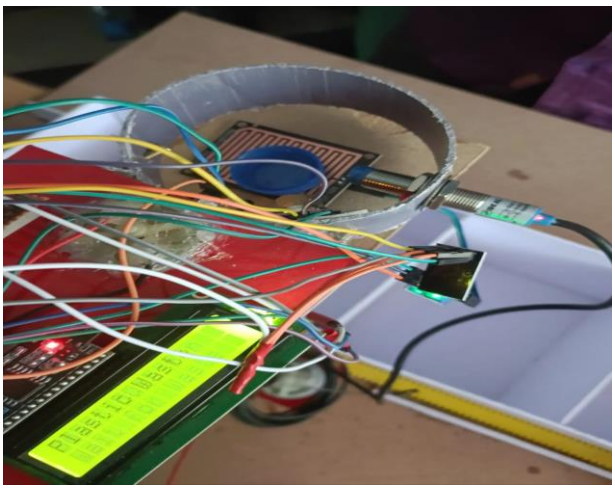

Fig: 6 LCD Display

The below snapshots show the status of the bin using an application named Remote XY, it senses the waste through sensors and detect the waste and shows the result through the indication of light and the dustbin status will update the level of the bin every time the waste is thrown into it.

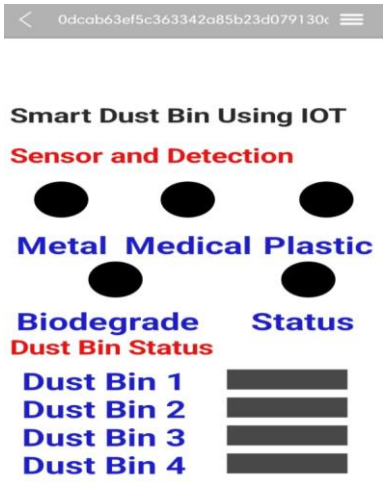

Fig: 7 Status of the bin

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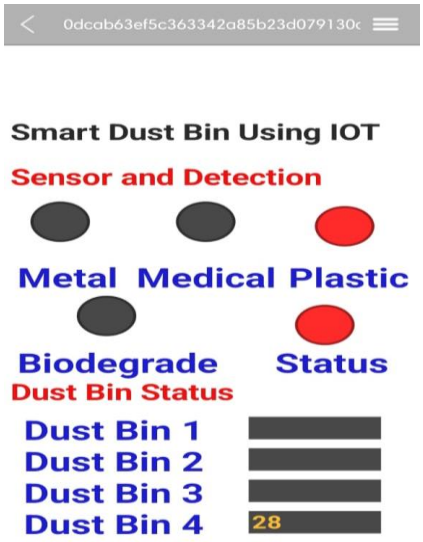

Fig: 8 Plastic waste

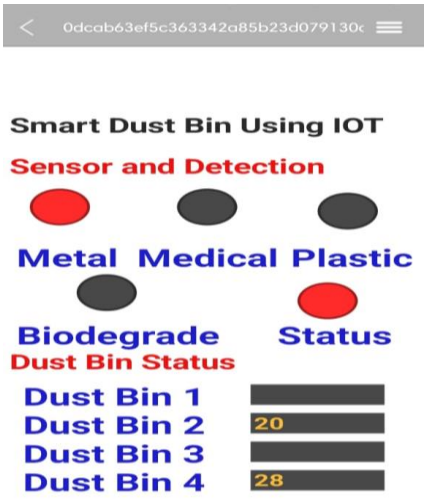

Fig: 9 Metal Waste

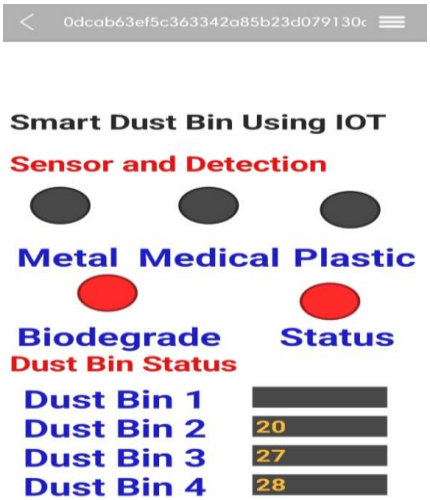

Fig: 10 Biodegradable Waste

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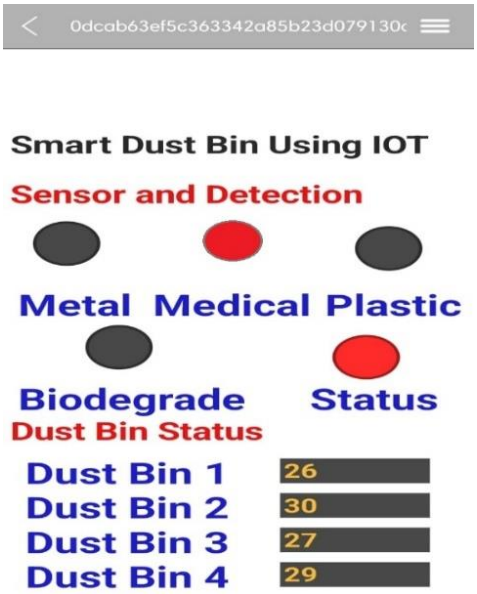

Fig: 11 Medical Waste

VI. CONCLUSION

The "Smart Dustbin Using IoT" provides rapid population and the increasing industrialization are considered to be the major causes of pollution. Garbage left in the streets and overflowing dustbins pose extreme health hazards to the surrounding people. Advancement in technology can be utilized to overcome these problems.

This project is initialized to aid smart city concept and swatch Bharat Abhiyan. It uses cheap and reliable Arduino as central control board and is interfaced with Arduino and sensors for smoke detection, Dustbin status, GPS module for identifying location and all the sensors data are stored in online database in real time, it also makes use of web and SMS notification in order to make the system more efficient and reliable.

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