Sensor Based Smart Dustbin for Waste Segregation and Status Alert

Shubhanka S P[1], Megha Closepet[2], Sirish G[3], Shrivatshan R S[4] and Sowmya M S[5]
[1,2,3,4]Student, Dept of E&IE, JSS Academy of Technical Education, Bangalore.
[1]shubhanka.sp@gmail.com, [2]megha.closepet@gmail.com
[5]Assistant Professor, Dept of E&IE, JSS Academy of Technical Education, Bangalore.
[5]sowmyamshankar@gmail.com

Abstract— **Continuous urbanization and industrialization has to led to increase in volume and type of waste generated. This poses a problem for local and national governments to ensure sustainable and effective waste management. Technology always helps mankind in making life easier. In public places, proper disposal of waste is not being followed which causes overflow of waste in dustbins that has become a threat to the environment. Segregation, management, transport and disposal of waste plays an important role to minimize the risk to the public and environment. This paper is an innovative way to revolutionize the waste management system using Embedded System Technology to continuously monitor public dustbins in order to determine whether the dustbin is full or not. Segregation is also achieved using respective automated sensors. The measure of waste is best realised once it's properly segregated. Presently there's no such system for segregation of dry and wet wastes at urban level or social unit level. This paper proposes an automated sensor based waste management and segregation system which is cost effective and easy to use system. It is designed to sort the refuse into 2 categories: wet and dry.**

Index Terms— **segregation, management, embedded system technology, dustbin, automated sensors.**

I. INTRODUCTION

The rising population of India poses serious threats with regard to the availability of living space, utilization of natural resources and raw materials, education and employment. But another serious peril that follows is the escalating amount of waste generated each minute by an individual. Every city is grappling with the menace of ever increasing waste. An astounding 0.1 million tons of waste is generated each day in our country. Sadly, only 5% of this colossal amount of waste is recycled. In India, the collection, transportation and disposal of MSW are unscientific and chaotic. Uncontrolled dumping of waste on outskirts of towns and cities has created overflowing landfills which are not only impossible to reclaim because of the haphazard manner of dumping but also has serious environmental implications. One possible solution for this problem could be segregating the waste at the disposal level itself [14]. When the waste is segregated into basics streams such as wet, dry [14]. Currently there is no such system of segregation of dry, wet and metallic wastes at a household level [15]. This paper proposes an Automated Waste Segregator (AWS) which is a cheap, easy to use solution for a segregation system at households, so that it can be sent directly for

processing. It is designed to sort the refuse into metallic waste, wet waste and dry waste[15]. Complete segregation of waste at the source is not done properly. Even though there are large scale industrial waste segregators present it is always much better to segregate the waste at the source itself. The benefits of doing so are that a higher quality of the material is retained for recycling which means that more value could be recovered from the waste [3].

II. LITERATURE SURVEY

Most smart dustbin techniques so far only used IR sensors, Ultrasonic sensors and RFID tags and only concentrated on waste management. A technique was first used which was divided into three stages: Garbage bin: The sensor node attached to the bin helps in the collection and transmission of data. Remote gateway: This uses X-Bee Pro that acts as a transmitter to send the collected data to the next stage. Monitoring system: A web based control system which is used to interface the system [4].

Waste collection and transportation, is the maximum price level in waste management software. In this paper, usually used answers to enhance waste collection structures had been mentioned and an IOT based technique has been proposed as a new answer. The methodology proposes use of infrared sensors to acquire actual time facts from the waste bins and that of raspberry pi2 improvement board to speak these facts to the waste managers. The waste managers can efficaciously use this data to optimize the scheduling and routing of series manner [7].

In another framework, the paper proposed to design an electronic machine, which allows you to offer a way to abnormal waste disposal gadget. The designed gadget uses biosensor sensor, weight sensor and height sensor to locate overflow of the waste within the dust bin and the quantity of pollution caused by unwanted toxic gases from the bin. It included a GSM module to alert municipality about the overflow of the waste [10].

The main theme of the work was to create a smart intelligent garbage alert system for garbage management[6] .This paper proposed an alert system for garbage collection by giving an alert signal to the municipal web server for instant cleaning of dustbin with proper verification based on level of garbage filling[6]. This process is done by the ultrasonic sensor which is interfaced with Arduino UNO to check the level of garbage filled in the dustbin and sends the alert to the municipal web server once if garbage is filled [6].Thus we can device an extra feature so that it can automate the process of waste segregation at initial level itself, as proposed in this paper.

III. PROPOSED WORK

Segregation is the initiative to complete waste management. Studies show that majority of the population in urban and rural areas don't segregate wastes being a reason that they notice it inconvenient. Management or assortment of waste is secondary. There are effective systems of waste management for smart alert system for garbage clearance by giving an alert signal to the municipality for fast assortment of garbage in trash bin with correct verification based on level of garbage filling. Here we propose a project that makes use of different sensors and actuators to manage the waste in a locality and also segregate it in the initial stages itself. The main components that will be used for implementation is as listed below and as shown in the block diagram (figure 1) below.

A. Arduino Uno microcontroller

A simple Arduino Uno microcontroller forms the heart of the system [14]. The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet)[16]. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button[16][13].

B. IR sensor

This is used to detect whether there is any kind of waste present in the dustbin. IR Sensor works using a particular light sensor to detect a single light wavelength in the Infra-Red (IR) spectrum. By using an LED which produces light at the same wavelength as what the sensor is expects, the intensity of the received light is recorded. When waste is put near the IR sensor, it means waste is present and it is ready for segregation. The light from the LED reflects from the object and into the light sensor. A huge change in the intensity is created, which denotes that an object is present. This sensor gives a logical 1 output which denotes that there

is a presence of an object and logical 0 output in the absence of the object. This is fed as input to the microcontroller.

C. Moisture sensor

The Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium. In wet waste, dielectric permittivity is a function of the water content [9]. The sensor creates a voltage corresponding to the dielectric permittivity, and hence the water content of the waste [9]. Thus it helps to differentiate between wet waste and dry waste.[12]

IR sensor for level detection- An IR sensor will detect the presence of waste and detects the level of waste. This detects the level and communicates to the microcontroller if the level crosses a particular threshold.

D. Gear motor

Gear motors are mainly used to reduce speed in a series of gears, which in turn creates more torque. This is accomplished by an integrated series of gears or a gear box being attached to the main motor rotor and shaft via a second reduction shaft. The second shaft is then connected to the series of gears or gearbox to create what is known as a series of reduction gears. Generally speaking, the longer the train of reduction gears, the lower the output of the end, or final, gear will be[11]. This motor is attached to the primary dustbin and it helps in clockwise and anticlockwise movements of the bin.

E. Motor Driver

Motor drivers act as current amplifiers, this higher current signal is used to drive the motor. This is used to provide bidirectional drive voltage from 5V to 36V. It has a high noise immunity and provides protection against high temperature. The gear motor needs 12V supply but the maximum voltage at which Arduino uno works is 5V. Thus to meet the required 12V, L293D is used.

F. GSM

GSM stands for Global System for Mobile Communications.

A GSM Modem is a device that modulates and demodulates the GSM signals. The modem used is SIMCOM SIM300.As soon as the IR sensor for level detects that the dust bin is full, it sends a message to the local waste management department or municipality indicating that the bin is full and the garbage needs to be collected.

As we have explained earlier, the proposed system is divided into two categories. The methodology that we have followed is as shown in figure 2 and figure 3.

The figure 2 as shown below represents the flowchart of waste management process. We have declared a variable ir which represents IR sensor output. If ir variable is found to be high, it indicates that the dustbin is full and initiates the GSM to send a message to the municipal groups. If it is low, then no action is taken
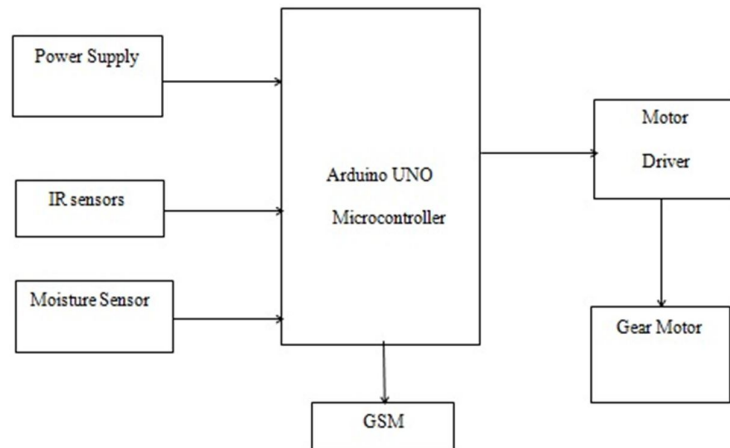
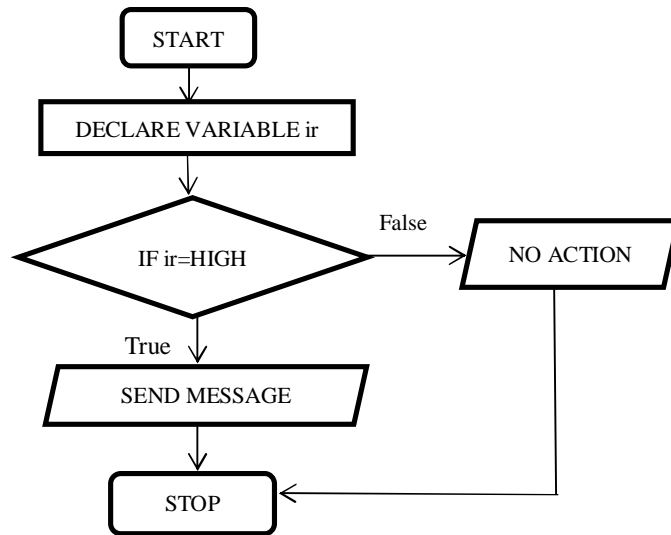Figure 1. Block diagram of the setup

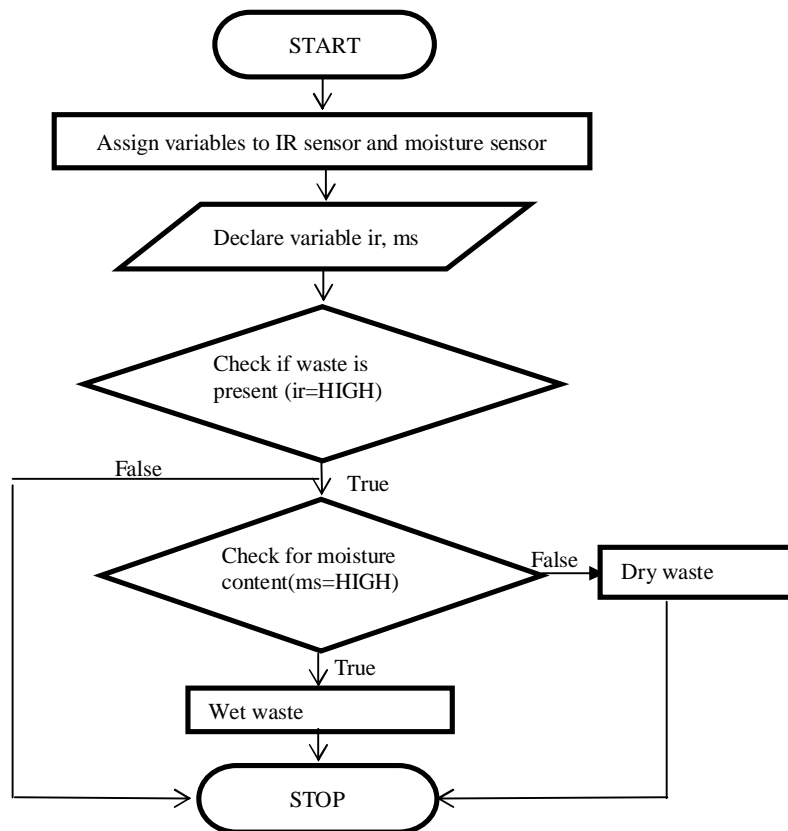Figure 2. Flowchart representation for waste management

Figure 3. Flowchart representation for segregation

Similarly, flowchart representation for waste segregation process is as shown in figure 3. According to the flowchart, variables ir and ms are declared which represent IR sensor and moisture sensor input respectively. If ir and ms variables are high, it indicates that waste is detected and the detected waste is wet. If ir variable is high and ms variable is low, it indicates that waste is detected and the detected waste is dry. If both variables are low, then it indicates that there is no waste present for segregation.

IV. RESULTS

Every component as explained earlier is interfaced with Arduino UNO microcontroller. The representation of the whole setup is as shown in the figure 4. We use Arduino IDE software to program this system and results are found to be accurate. i.e,

- Waste management is done by sending a SMS using GSM to the municipality group.
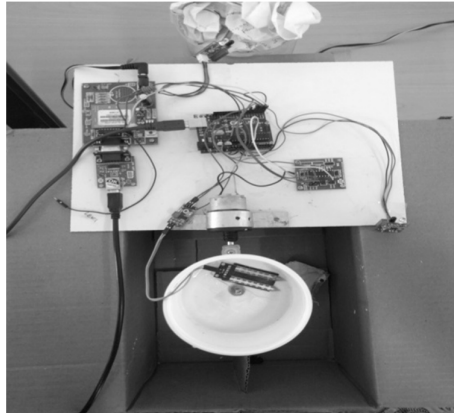- Waste segregation is automated precisely with moisture sensor.

Figure.4 Circuit setup of the whole system

A. Waste management

This mainly indicates if the dustbin is full or not. We use IR sensor and a GSM module. IR sensor detects the level of waste. If the waste in dustbin exceeds a certain threshold, it indicates that the bin is full.

GSM module sends a message to the respective officials when IR sensor detects that the waste in the dustbin has exceeded a certain threshold. The message will indicate that the bin is full. The figure 5 as shown below represents the system of waste management.
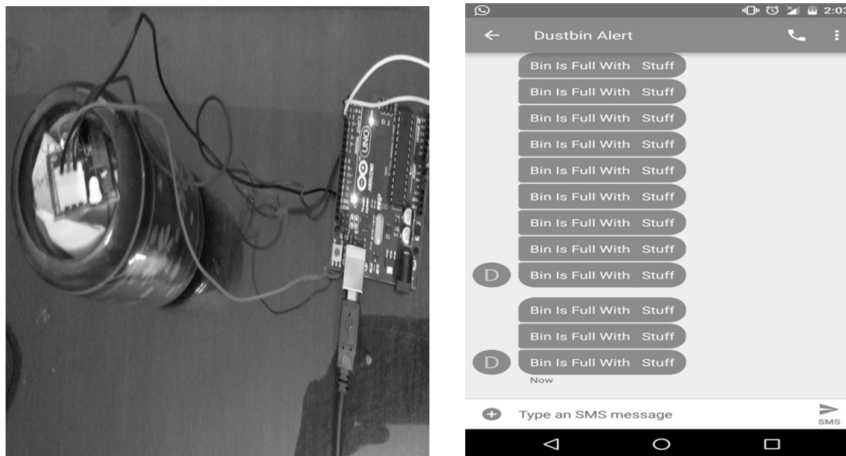

Figure 5. Representation of waste management

B. Waste segregation

In this, we try to differentiate between different types of waste such as dry waste and wet waste. We use moisture sensor along with IR sensor to differentiate between the type of waste present and a gear motor to segregate into respective dustbin.

IR sensor detects the presence of an object and moisture sensor detects the type of waste by the amount of moisture content present in that object. As soon as the moisture senor detects the type of waste, gear motor turns clockwise or anticlockwise for wet waste and dry waste respectively. In figure 6, dry waste dumping is depicted as the motor turns in anticlockwise direction. In figure 7, wet waste dumping is depicted as the motor turns in clockwise direction. In figure 8, rest position is depicted indicating that waste is not present for segregation.
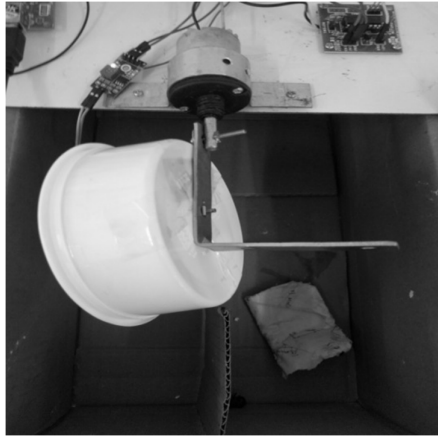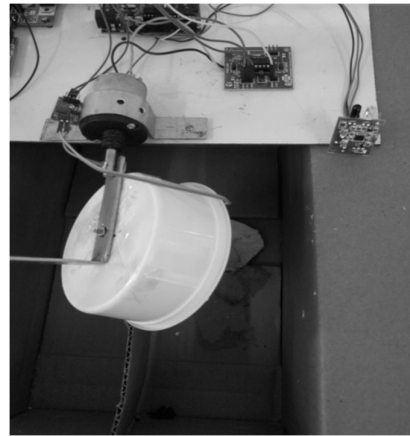
Figure.6. Dry waste dumping
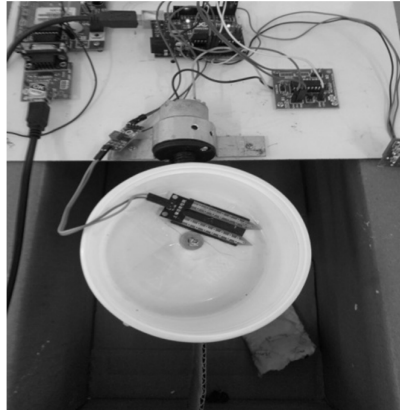
Figure.7. Wet waste dumping

Figure 8. Rest position

Thus the whole system is automated and human intervention is reduced. It is an efficient system which makes collection of waste convenient by alerting the municipal groups when required and also helps in achieving a healthier and environment.

V. CONCLUSION

The Automatic waste management system may be a leap forward to create the manual assortment and segregation of wastes automatic in nature. The developed system would pioneer work for solid waste management and segregation processes. This proposal for the management of wastes is economical associate degreed time saving method than the presently using methodology within which involved municipal worker

must seek for the crammed waste bins manually across totally different spots in an area/street for checking often whether or not the waste bin is crammed or not, that is advanced and time taking. This automation of waste conjointly reduces the human effort and consequently the price of the entire method. This technique will be enforced at anywhere with ease and among affordable quantity of your time. The implementation prices for the automation are additionally reasonable. The general methodology for the detection and management of waste becomes economical and intelligent. We have shown the appliance and implementation of the above system.

This planned system wouldn't solely operate for grouping and change knowledge mechanically and timely, however conjointly it might analyze and use knowledge showing intelligence.

The planned system would solve loads of downside concerning solid waste assortment, monitoring, minimizing value and accelerate the management. The Trash management system may be a leap forward to create the manual assortment and detection of wastes automatic in nature. It might pioneer work for solid waste assortment, observance and management processes. This project for the management of wastes is economical and time saving method than the presently using methodology within which involved municipal worker must seek for the stuffed waste bins manually across totally different spots in an area/street for checking often whether or not the waste bin is stuffed or not.

REFERENCE

[1] Daniel Hoornweg and PerinazBhada-Tata, "What a Waste", a global review of solid waste management,March 2012,no.15.

[2] AmruthaChandramohan, JoyalMendonca, Nikhil Ravi Shankar, Nikhil U Baheti, Nitin Kumar Krishnan,Suma M S, "Automated Waste Segregator", R.V.C.E

[3] Claudine Capel, "INNOVATIONS IN WASTE", Waste-management-world, Volume 11, Issue 2, Mar 2010

[4] TarandeepSingh ,NavreetinderKaur. "Smart Waste Management: An innovative approach to waste disposal and waste collection",PEC University of Technology Sector 12, Chandigarh, India.

[5] Faccio M, Persona A, Zanin G. "Waste collection multi objective model with real time traceability data".

[6] Dr.N.Sathish Kumar, B.Vijayalaksmi, R. Jenifer Prarthana , A .Shankar, "IOT Based Smart Garbage alert system using Arduino UNO"

[7] Abhimanyu Singh, PankhuriAggarwal, Rahul Arora," Iot based Waste collection system using IR sensors", sept 2016.

[8] http://www.hindustantimes.com/india/india-s-cities-are-faced-with-a-severe-waste-management-crisis/story-vk1Qs9PJT8l1bPLCJKsOTP.html.

[9] www.tvdsb.ca/uploads/ScienceProbeware/soilmoisture.pdf.

[10] WoikomReshmi, RamkumarSundaram, M Rajeev Kumar,"Sensor Unit for Waste Management: a Better Methodfor Frequent Data Updating System", Nov 2014.

[11] www.doityourself.com

[12] www.vernier.com

[13] digital.csic.es/bitstream/10261/127788/7/D-c-%20Arduino%20uno.pdf

[14] M.K.Pushpa , Aayushi Gupta , Shariq Mohammed Shaikh , StutiJha, Suchitra V,"Microcontroller Based Automatic Waste Segregator", International Journal Of Innovative Research In Electrical, Electronics, Instrumentation And Control Engineering Vol. 3, Issue 5, May 2015

[15] Automated Waste Segregator AmruthaChandramohan, JoyalMendonca, Nikhil Ravi Shankar, Nikhil U Baheti, Nitin Kumar Krishnan* Suma M S RashtreeyaVidyalaya College of Engineering (R.V.C.E.)

[16] Openlab.com.au