

Design and Development of Smart Dustbin

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Abstract: One of the main concerns with our environment has been waste segregation which in addition to disturbing the balance of the environment also has adverse effects on the health of the society. The segregation and monitoring of wastes is one of the primary problems of the present era. The traditional way of manually segregating and monitoring the wastes in waste bins is a complex process and utilizes more human effort, time and cost which are not compatible with the present day technologies in any way. This paper proposes an advanced method in which waste segregation is automated. GSM module and various sensors are one of the most promising and anticipated technologies in recent years. The system makes use of Arduino, Microcontroller along with Proximity Sensor, IR Sensor, Level Sensor, Smell Sensor, Resistive Plate, GSM Module and two Servo Motors. This work presented here certainly provides a novel approach in separating and disposing off wastes in an efficient and easy way. The system consists of three main subsystems namely Automatic Waste Detection system (AWDS), Waste Segregation System (WSS) and Smart Monitoring System (SMS). The proposed system would be able to automate the waste monitoring process and separation process. The technologies that would be used in the proposed system are good enough to ensure the practical and perfect for waste segregation process and monitoring and for green environment.

Keywords — *Smart dustbin, Automatic Waste Detection System, Smart Monitoring system, Waste Segregation System, GSM Module.*

I. INTRODUCTION

The trend of making the manually controlled things automatic has become a common practice these days. The process of making the things automatic is being exploited in almost all the major fields of life. Making things automatic reduces burden on the humans. The cost and effort used in manually controlled products is much higher than the automated systems. Considering the fact, that the problem of efficient waste management is one of the major problems of the modern times, there is an utmost need to address this problem. The proper waste management system is must for the hygienic society in general and for world as a whole. Waste which is one of the sources and causes of environmental pollution has been defined under Resource Conservation and Recovery Act as any, semi-liquid or contained gaseous materials discarded from industrial, commercial, mining or agricultural operations and from community activities. Waste also includes garbage, construction debris, commercial refuse, and sludge from water or waste treatment plants or air pollution, control facilities and other discarded materials. In order to protect human health and the environment from the potential hazards of delayed waste disposal and environmental pollution a systematically supervised and

controlled handling of these wastes is must [1-2]. The type of wastes which constitute environmental pollution and which this work emphasizes on is domestic refuse consisting of degradable food wastes, leaves, dead animals and non-degradable ones such as plastics, bottles, nylon, medical and hospital wastes, generated in households, hospitals, industries and commercial centers [3-4]. The complexity of issues involved in municipal waste management necessitates development and application of new tools capable of processing data inputs of varying formats, numerical models and expert opinions in multi objective decision making scenario [5].

Waste management is a continually growing problem at global and local levels. The present day waste management system is not as efficient as it should have been taking into consideration the advancements in the technologies that arose in the recent years [6-7]. There is no surety about the proper segregation of waste. To overcome this problem a new approach, Design and Development of Smart Dustbin is proposed. It is a step forward towards making the waste segregation process automatic and efficient in nature. Whenever the waste bin gets filled this is acknowledged by placing a level sensor at the waste bin, which transmits it to the receiver at the desired place in the area or spot. The received signal

indicates the waste bin status at the monitoring and controlling system.

II. DESIGN AND DEVELOPMENT OF SMART DUSTBIN

Design and Development of Smart Dustbin is designed by using Arduino Microcontroller along with Proximity Sensor, IR Sensor, Level Sensor, Smell Sensor, Resistive Plate, GSM and two Servo Motor etc.

Smart Dustbin segregate the waste into metallic, dry, wet waste, and check the smell. It also check the level of waste material in dustbin, when dustbin is full then it sends the message to the nearest control room.

Arduino Microcontroller is the main part of this paper. It connects with all the peripheral devices and also controls all the devices. The systematic block diagram is shown in fig.1 Inductive proximity and IR sensor will be used to check incoming of waste material. The level sensor will be used to check the level of waste material. Smell sensor will be used for check the smell of waste material. Servo motor will be used for movement of dustbin and waste material with the help of belt.

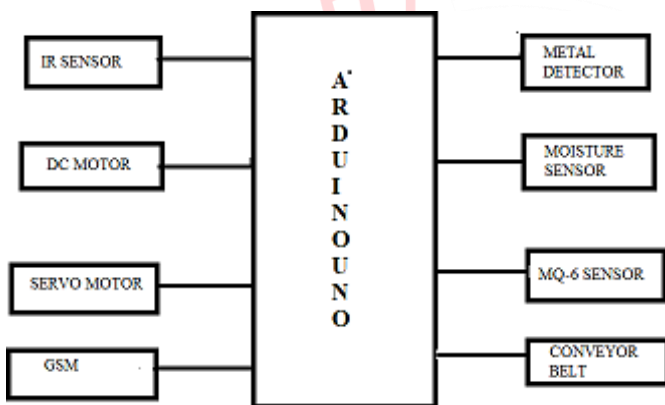


Fig.1 Block diagram of DDSD

Smart dustbin will be used in segregation of waste material. It may be used in hazardous area. It provides smart way to collect and monitor of waste management. Less men power required for waste management, it improves the lifestyle of human.

A. Automatic Waste Detection System

Automatic Waste Detection System consists of Moisture Sensor, IR Sensor, Metal Detector and a Conveyor Belt shown in the fig. 2. The sensors sense the status and type of waste being collected. The motor is used in the AWDS to rotate the conveyor belt. The IR Sensor is used to sense the presence of the waste on the conveyor belt. The Resistive Plate Sensor is used as a moisture sensor whose function is to detect the wet waste. The Metal Sensor is used to detect the metal waste. The use of Conveyor Belt is to move the waste to the dustbin. The signal from the IR Sensor is transmitted only when the waste material is

detected. The signal transmitted by IR Sensor is received by microcontroller which gives signal to the motor to turn ON, the motor get activated and it rotates the conveyor belt that is fitted on it. The waste on the conveyor belt passes by moisture sensor and metal detector. The waste material is detected it is metallic, dry or wet. The motor stops automatically after 15 seconds.



Fig.2 Waste Detection System

B. Waste Segregation System

The Waste Segregation System is the next step after waste detection. In this step the waste is separated on the basis of dry metallic, dry or wet. This system consists of three bins i.e. bin 1- wet, bin 2- metallic ,bin 3- dry and a servo motor and shown in fig.3.

All the three bins are placed on the servo motor at different angles. When the waste is detected by the different sensors the signal is given to the microcontroller whether the waste is metallic, wet or dry. The microcontroller gives the signal to the servo motor at which angle it is to be rotated. One of the bin is set at the default angle.



Fig.3 Waste Segregation System

C. Smart Monitoring System

The Smart Monitoring System is a centrally monitoring hub for all the smart functioning of this management system. This is the heart of the entire system and always takes signals as input from the different sensors. The

Smart Monitoring System is shown in fig.4. The signal from various sensors are monitored and displayed on a 16X2 LCD. The signal from the sensors that invokes the monitoring hub to make a decision about the management of waste of some particular trash bin. All the three bins are equipped with Level Sensor and the wet bin also has smell detector. When the dustbin is filled at a certain level then the level sensors senses and gives signal to the GSM Module. Generally wet waste decomposes very fast and starts to smell foul, and then the smell detector detects the smell and gives signal to the GSM Module. As soon as the GSM Module gets the signal it contacts with nearest Municipal Corporation to dump the waste.

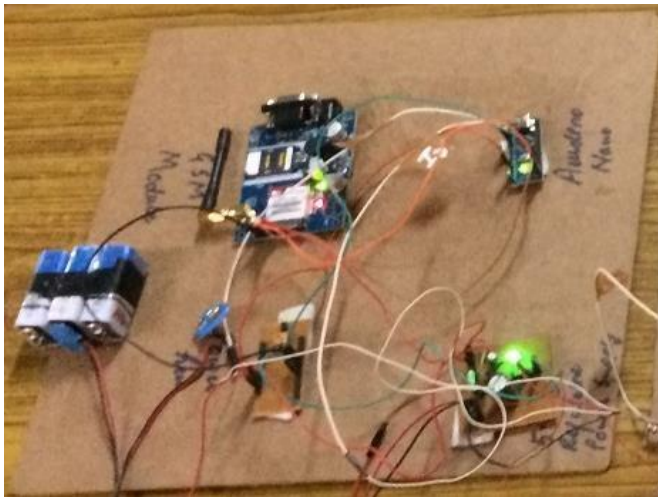


Fig.4 Smart Monitoring System

III. OPERATION OF SMART DUSTBIN

Since DDSD consists of three sub-systems on which the whole process of waste collection to waste segregation takes place. It consists of sensors, Arduino, microcontroller, motors, bins, conveyor belt, GSM Module. Sensors are used to detect the presence of waste material, the nature of material, the level of waste filled in dustbins. Whenever the waste is disposed, the sensor gets activated and generates a high signal which is given to the motor. The motor placed below the conveyor belt receives the signal and gets activated and starts rotating, which leads to rotate the conveyor belt. As the conveyor belt move the waste placed at the belt also starts to move. As the waste moves it passes by different sensors and gets detected whether it is dry, wet or metallic. When the nature of waste is detected the signal is given to the servomotor accordingly.

The servo motor rotates and the waste is filled in the dustbin accordingly. When the dustbin is filled the signal from the IR Sensor is given to the GSM Module. On receiving the signal from the sensor the GSM Module displays the message 'dustbin is full' and contacts with Municipal Corporation. In wet material dustbin the waste starts to decompose fast which leads to foul smell. When the smell is detected by the smell sensor the signal high is

generated and given to the GSM Module. On receiving the signal from the sensor the GSM Module contacts with Municipal Corporation.

IV. CONCLUSION

The DDSD system is a step forward to make the manual separation and detection of wastes automated in nature. The developed system integrated by using three sub systems the Automatic Waste Detection System (AWDS), the Waste Segregation System (ASS), Smart Monitoring System (SMS), in which it would pioneer work for waste detection, separation and monitoring process. This proposal for segregation of waste is efficient and time saving process than the currently employing method in which concerned municipal employee has to look for the filled waste bins and separate the waste manually across different spots in an area for checking regularly whether the waste bin is filled or not, which is a complex and time taking process. This automation of waste segregation also reduces the human effort. This system can be implemented on place where the waste segregation is hazardous to health. The overall method for detection and separation of waste become efficient and intelligent. The proposed system would solve lots of problem related to waste collection, detection, separation, and accelerate the management.

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