

Eco-friendly garbage segregator using sensor

**Pooja Nighot, Ruchika Chowrasia, Pallavi
Parchake, Nalini Balki, Bhagyashree Tapre,
Payal Golghate**

*Department of Electronics and Communication
Engineering,
Tulsiramji Gaikwad-Patil College of Engineering
Technology, Nagpur*

Prof. Chandrashekhar Kalbande

*Assistant Professor Department of Electronics and
Communication Engineering,
Tulsiramji Gaikwad-Patil College of Engineering
Technology, Nagpur*

Abstract— Rapid increase in population has led to improper waste management in metro cities and urban areas which has resulted in spreading of diseases. It is estimated that 2.02 billion tones of municipal solid waste was generated universally in 2006. The segregation, transport, handling and disposal of waste must be managed properly to minimize the risks to the public, and the environment. An efficient method to dispose the waste has been designed in our project, “automatic waste segregator and monitoring system”. This paper proposes an automatic waste segregator (AWS) which is a cheap, easy to use solution for a segregation system at households, so that the wastes can be sent directly for processing. Automatic waste segregator is designed to sort the waste into three main categories namely; metallic, organic and plastic, thereby making the waste management more effective. Ultrasonic sensors are added for monitoring waste collection process. The sensors would be placed in all the garbage bins. When the garbage reaches the level of the sensor, then the indication will be given to a microcontroller. The microcontroller will give indication to the driver of garbage collection truck by sending SMS using GSM technology.

Keywords- Automatic waste segregator, waste management, microcontroller, SMS, GSM

Thus, we have proposed a cost effective “Automatic waste segregator and monitoring system” for proper management of waste. Automatic waste segregator categorizes the waste as plastic, metallic or organic. The monitoring system helps to monitor the waste collection process. The common method of waste disposal is by unplanned and uncontrolled dumping at landfill areas. This method is hazardous to human health, plant and animal life. When the waste is segregated into basic streams such as plastic, metallic and organic, the waste has a higher potential of recovery, and then, recycled and reused. The organic waste is converted either into compost or methane-gas or both. Compost can replace demand for chemical fertilizers, and biogas can be used as a source of energy. The metal waste could be reused or recycled.

Even if there are large scale industrial waste segregators present, it is always feasible to separate the waste at the source itself. The benefit of doing so is that the occupational hazard for waste workers is reduced. Also, the separated waste could be directly sent to the recycling and processing plant instead of sending it to the segregation plant then to the recycling plant.

I. INTRODUCTION

In India about 60 million tonnes of waste is being generated every year. Ten million tonnes of garbage is generated in metropolitan cities. The landfills of most of these cities are overflowing with no space for fresh garbage waste. The philosophy of “waste management hierarchy” has been adopted by most nations as the step for developing municipal solid waste (MSW) management strategies

According to a sanitation survey called “Swachh Survekshan-2016” conducted by the ministry of urban development under the swachh bharaat mission, it was found that about 50% people in India face the problem of improper waste collection and management. According to centre of science and environment, innovative disposal and recycling methods must be introduced instead of landfill sites.

II. PROPOSED SYSTEM

The whole system is controlled by an Arduino Uno board. All other parts like ultrasonic sensors, inductive proximity sensor, DC motors, blower and electromagnet are interfaced to the Arduino board.

Open-Close Mechanism

The open close mechanism acts as a regulator to control the waste that falls on the belt. A 12 V DC geared motor receives inputs from microcontroller to monitor the clockwise and anti-clockwise motion of the motor. As motor rotates, the rotary motion is translated to linear motion using a rack and pinion arrangement. L293D is used as the motor driver IC to provide the necessary current to the motor. This mechanism is initiated only if the ultrasonic sensor at the inlet detects a waste.

Conveyor Belt

It carries the waste from inlet to outlet sections. Four 12 V DC geared motors are used to move the belt.

Inductive Proximity Sensor

Inductive proximity sensor based on the eddy current principle is fixed in the inlet part to identify the presence of metals in the waste

[11]. The NPN sensor gives a logical 0 output in the presence of metal and logical 1 output in the absence of metal. This is fed as input to the microcontroller.

Geared DC Motor

A motor takes electrical energy and converts into mechanical energy. A geared DC motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM. The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. The DC motor works over a fair range of voltage. The higher the input voltage more is the RPM (rotations per minute) of the motor. For example, if the motor works in the range of 6–12 V, it will have the least RPM at 6 V and maximum at 12 V.

Blower

The blower separates plastic or paper wastes which are light weight. Dry and wet separation is based on their weight. Due to its high density and weight, wet waste refuses to be blown off even in the presence of a high speed blower. This technique is used to distinguish wet and dry waste. A relay will control the on and off of a high speed AC blower. As blower blows, the belt stops and dry waste is thrown out into the dry bin. Wet waste stays on the belt. It then falls off due to gravity at the end of the belt as it rolls.

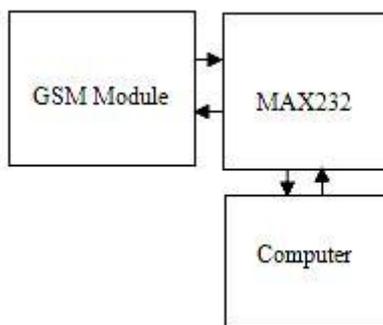


Fig. : Block Diagram of Monitoring System

Robotic Arm

Metal wastes are separated by a robotic arm with an electromagnet fixed on the arm. Robotic arm delivers fast, accurate, and repeatable movement. The robot features are: base rotation, single plane shoulder. When the metal is detected by the inductive proximity sensor; the conveyor belt stops. Control signal is given to robotic arm to extract the metal by the electromagnet attached to it and then turn around 180° and drop the metal particles into a bin. Robotic arm moves with the help of two 12 V geared DC motors.

Electromagnet

An electromagnet is a device used to generate a magnetic field with the help of an electric current. Electromagnet usually consists of a large number of closely spaced turns of wire that create the magnetic field. The wire turns are often wound around a magnetic core made from a ferromagnetic or ferromagnetic material such as iron; the magnetic core concentrates the magnetic flux and makes a more powerful magnet. The main advantage of an electromagnet over a permanent magnet is that the magnetic field can be quickly changed by controlling the amount of electric current in the winding.

However, unlike a permanent magnet that needs no power, an electromagnet requires a continuous supply of current to maintain the magnetic field. The principle that electromagnets work by is used in a wide range of electric and electronic devices such as electric motors, solenoids, tape drives and even speakers and microphones. The simplest electromagnet can be built with a simple metal wire through which electric current is being circulated.

Ultrasonic Sensors

Ultrasonic sensor is fixed in the inlet part so as to detect the falling of waste. The trigger pulses are provided for ultrasound detection of waste. The echo received from the waste is received by the microcontroller to calculate the delay. Ultrasonic sensors will also be placed on every outlet bins (metal bin, plastic bin, organic bin) to check whether they are filled or not. Whenever any of the bins are filled, corresponding information will be given to the monitoring system by a GSM module through short message service (SMS).

GSM Module

Global system for mobile communication (GSM) is an architecture used for mobile communication in most of the countries. GSM module consists of a GSM modem assembled together with power supply circuit and communication interfaces like RS-232, USB, etc. for computer. The modem is the soul of such modules. GSM modem is a class of wireless modem devices that are designed for communication of a computer with the GSM network. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also, they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification. A GSM modem can perform the following operations: receive, send or delete SMS messages in a SIM; read, add, search phonebook entries of the SIM; and make, receive or reject a voice call. Modem needs AT commands, for interfacing with processor or controller, which are communicated through serial communication. Different AT commands supported by the MODEM can be sent by the processor/controller/computer to interact with the GSM cellular network.

Monitoring System

The monitoring system consists of a GSM module and a computer. The SMS from waste bins will be fed into the computer by GSM module. MAX232 is an IC used for interfacing a serial communication system to the computer.

An SMS is sent from this monitoring system to the waste collector or to clean up the filled bin.

III. RESULTS AND DISCUSSION

- 1) The waste segregator as the name suggests segregates the waste into three major classes: plastic, organic, metallic.
- 2) The proposed system would be able to monitor the solid waste collection process and management of the overall collection process.
- 3) The inlet section is provided with open and close mechanism to regulate the flow of waste on to the conveyor.
- 4) Inductive proximity sensor is used to detect the metallic waste.
- 5) A blower mechanism is used to segregate dry and wet waste.

- 6) The timing and movement of the conveyor belt is controlled by Arduino Uno. Continuous and unnecessary operation of any particular section is thus avoided.

REFERENCES

- [1] Daniel Hoornweg, *et al.* What a Waste: A Global Review of Solid Waste Management. Washington, DC: Urban Development & Local Government Unit World Bank, No.15; Mar 2012.
- [2] Shuchi Gupta, Krishna Mohan, Raj Kumar Prasad, *et al.* Solid Waste Management In India: Options and Opportunities. In Resource, Conservation and Opportunities. Nov 1996; 24(2): 137p.
- [3] Sakai S, Sawell SE, Chandler AJ. World Trends in Municipal Solid Waste Management. *Environmental Preservation Centre*, Kyoto University, Japan. 1996; 16: 341p.
- [4] Amrutha Chandramohan, *et al.* Automated Waste Segregator. *National Level Analog System Design Contest, 2013–2014*; Conducted by Texas Instruments, India
- [5] Yamazaki S, Nakane GH, Tanaka A. Basic Analysis of a Metal Detector. *IEEE Instr Meas.* Aug 2002; 51(4): 810–814p.
- [6] Vicentini F, Giusti A, Rovetta A, *et al.* Sensorized Waste Collection Container for Content Estimation and Collection Optimization. *Waste Manage.* 2008; 29: 1467–1472p.
- [7] Waheed Ahmad Arbab. A USN based Automatic Waste Collection System. 14th International Conference on Advanced Communication Technology (ICACT). 2012.