

Implementation of Automated Waste Segregator at Household Level

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ABSTRACT: Industrialization, modernization, rapid advancements and increase in population have led to large generation of waste. Lack of improper disposal scheme in the country has headed the problem of accumulation of wastes. Due to this waste lies littered in the surrounding, dumped on open lands and this becomes major home for various types of disease causing bacteria and viruses which is why waste management is of vital importance. Segregation makes it possible to reuse and recycle the waste effectively. This paper proposes implementation of an automated waste segregator at household level using PIC16F877 microcontroller, to control the entire process with ease and simplicity. The sensing unit consists of an IR (Infrared) sensor, a moisture sensor and a metal sensor used to detect and identify various types of waste respectively. The main architecture of the segregator comprises of three prominent stages consisting of an IR sensor, a metal sensor, a moisture sensor and the segregation bins. The IR sensor detects the arrival of waste. Identification and separation of waste is done by sensors. The microcontroller controls all the activity of sensors. Results have presented segregation of waste into metal, wet and dry waste.

KEYWORDS: IR Sensor, Waste Detection, Waste Identification, Waste Segregation, PIC

I. INTRODUCTION

As we move towards a more digitalized future, it is directly proportional to increase in urbanization and industrialization. This is the main cause of generation of large amount of waste. As per the report published by World Bank, approximately 1.3 billion tones of municipal waste is generated every year and it is expected to rise to approximately 2.2 billion tones per year by 2025. So the waste management becomes an important concern for the health and well-being of the society. Presently, the waste segregation is done manually by installing different bins for collecting different type of waste such as wet, dry and metal etc. But this method has lot of discrepancy, one being the unawareness of most people towards waste management. Due to lack of proper segregation methods, a large amount of untreated waste is dumped as landfills. So our idea is to make a garbage segregator which can identify the type of waste and put them in different bins accordingly and automatically. Implementing our project at household level will reduce the expenditure on waste disposal, manual effort required for waste segregation and the waste could be easily be recycled, reused and reduced.

II. LITERATURE SURVEY

Recent studies have shown the amount of untreated waste that is dumped on waste land and how it harms the various ecosystems. The National Geographic Magazine on E-Waste rightly points out the harmful disposal methods of hazardous wastes [1]. This inspired us to look into a method that helps in segregation of the basic wastes generated at the household level itself. This simple piece of technology helps in distinguishing the various waste materials even for children who are unaware of waste management system.

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III. BLOCK DIAGRAM DESCRIPTION

As shown in figure 1 block diagram of an Automated Waste Segregator consists of following sections:

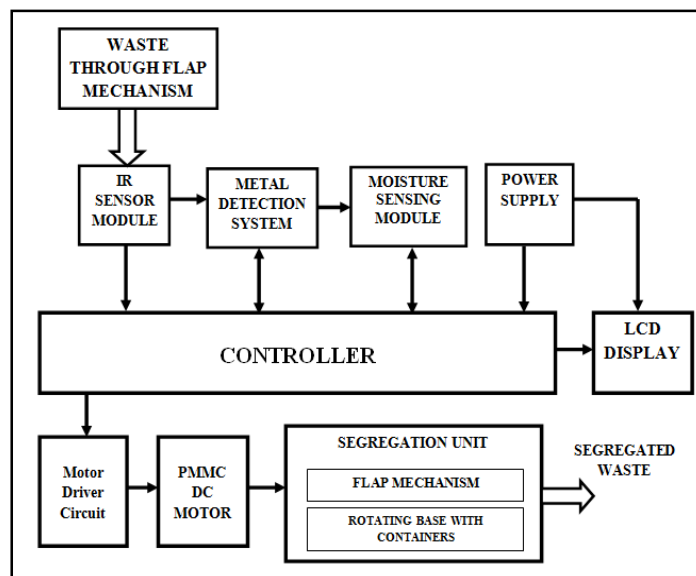


Figure 1: Block Diagram of Automated Waste Segregator

A. CONTROLLER UNIT:

PIC16F877 is one of the most frequently used microcontrollers primarily in sector of Automotive, Industrial appliances & consumer application. It has several advantages over other microcontrollers such as high operating frequency, high performance, RISC architecture, etc. According to the output of sensors it generates control signals to drive desired motors [2].

B. SENSOR UNIT: This unit includes three sensors:

IR SENSOR:

An IR proximity sensor works by applying a voltage to a pair of IR light emitting diodes (LED's) which in turn, emit infrared light [6]. This light travels through the air and once it comes in contact with an object, it is reflected back towards the detector. The waste is dumped into the AWS and comes in proximity of IR proximity sensor module which marks the entry of the waste. When the IR sensing unit becomes active, it sends a corresponding signal to controller which in turn activates the other sensors.

METAL SENSOR:

The object moves over the incline and falls over the metal sensor. The sensor is made up of inductive oscillator circuit which monitors high frequency current loss in coil. The circuit is intended for any metallic body detection by distinguishing the variations in the high frequency Eddy current losses. They act as oscillators with aid of external tuned circuits. Output signal level is changed by an approaching metallic object.

MOISTURE SENSOR:

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The Soil Moisture Sensor is used for measuring the moisture in soil and similar materials. The two large exposed pads is used as probes for the sensor, acting as a variable resistor. It measures the volumetric moisture/water content indirectly by using some properties of the object such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as electric conductivity, temperature, or soil type.

C. DRIVERS AND DISPLAY UNIT:

The direct current (DC) motor is one of the first machines devised to convert electrical power into mechanical power.. Permanent Magnet Direct Current Motor (PMDC) converts Electrical energy (DC) into mechanical energy through the interaction of two magnetic fields. Out of these two fields, one field is developed by permanent magnet assembly and another field is yielded by an electrical current flowing through motor windings. These two fields result in a torque which tends to revolve the rotor. From microcontroller we cannot connect a motor directly because microcontroller cannot give sufficient current to drive the DC motor. Hence DC motor driver is required. It is current enhancing device and it can also act as a switching device. LM293D is a motor driver IC that can drive two motors simultaneously. It is a dual H-bridge motor driver IC [4].After receiving the input signal from motor driver microcontroller initiates and produces corresponding output for motor. 16X2 Liquid crystal display is used as display unit.

D. POWER SUPPLY UNIT:

In this project, circuits, sensors & motors are used, which require +12V & +5V (DC) supply. To fulfill this requirement we have used following circuit of power supply which provides regulated +12V & +5V (DC). Transformer (15V/1A) is used to down convert the AC up to 15V. For conversion of AC into DC, Bridge type rectifier is used made up of 4 diodes (1N4007) which is tied to secondary of the transformer [5]. Capacitors of value 1000 μ f & 1 μ f are used as filters. 7812 IC is used as 12V regulator. It converts 15V into regulated +12V DC. IC 7805 is used as 5V regulator. It converts 12V into regulated +5V [3].

E. SEGREGATION UNIT

This unit consists of flap mechanism and circular base along with three bins named METALLIC, DRY & WET. This is the third and final stage in the assembly. The microcontroller after identifying the type of material brings the particular bin below the outlet flap with the help of PMMC DC motor.

IV. MECHANICAL ASSEMBLY

The mechanical assembly for AWS is shown in figure 2.

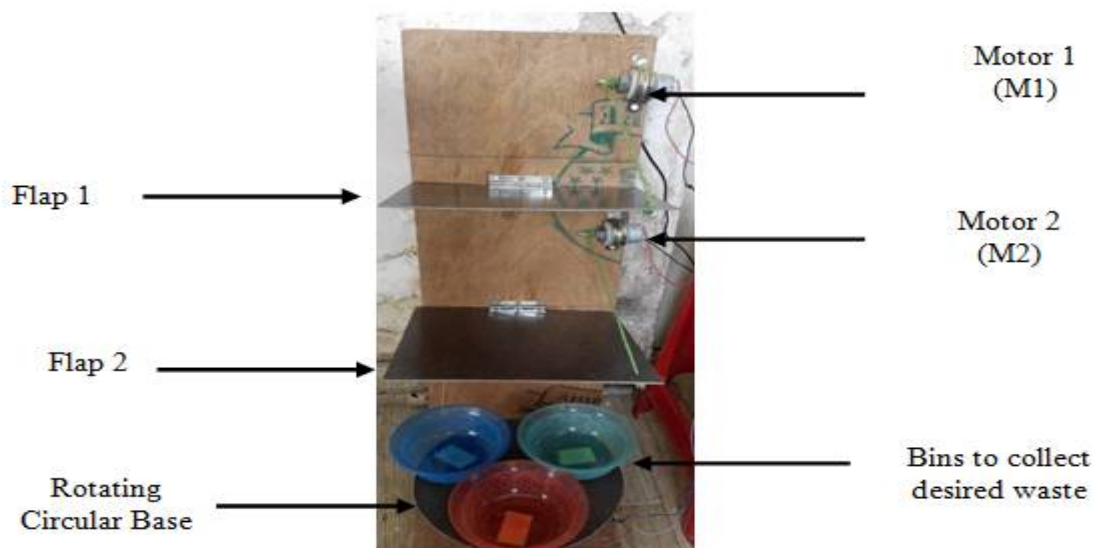


Figure 2: Mechanical Assembly

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It requires:

- Wooden container to assemble identification and separation module
Dimensions: 70cm x40cm x 17cm
- Flap mechanism: 2 Flaps
- 3 PMMC DC Motors:
M1: To control Flap 1
M2: To control Flap 2
M3: To rotate circular base
- Rotating base for containers
- 3 plastic containers/bins named Metallic, Dry, Wet

V. WORKING

Hardware Circuit for Automated Waste Segregator is shown below in figure 3.

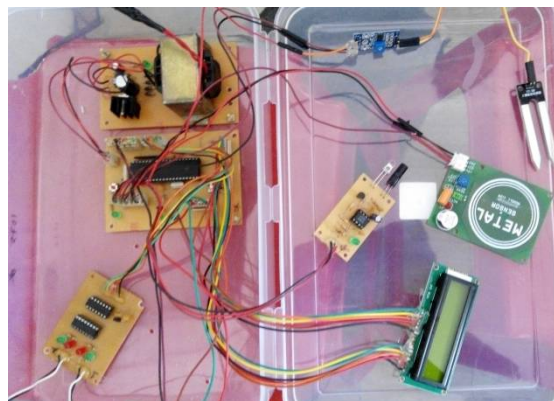


Figure 3: Hardware Circuit for Automated Waste Segregator

The mechanical assembly is quite elementary. It consists of vertical arrangements with three subdivisions i.e. waste detection, metal sensing/moisture sensing section (for metal and dry/wet waste) and the segregation section. Foremost of all, IR sensor marks the introduction of waste when waste comes in proximity of it. After identifying the entry of waste, metal sensing section starts with a 'flap opening' through which garbage goes into the assembly. The waste to be segregated comes in contact with the inductive oscillator circuit mounted in metal sensing section which monitors high frequency current loss in the coil. The output signal is defined by changes in supply current. According to the presence or absence of a close metallic object, the output is high or low, but this variation in the output signal is independent of supply voltage. If the metal object is in vicinity of searching coil, then supply current will flow more and vice versa. From the output signal of metal detector section, the waste is distinguished as metallic or non-metallic. At the end of this section, there is a Motor 1 (M1) installed which rotates in clockwise direction and waste falls down in next section. If above waste is identified as metal, then second section remains deactivated. After this action, Motor 2(M2) turns on and waste falls down in default bin named as 'METALLIC'. If identified waste is made up of non metallic components, then second section starts playing their role i.e. moisture sensing unit gets activated to identify nature of waste. The moisture sensor senses volumetric water content in waste and material is classified as wet or dry. After categorisation of dry waste, Motor (M3) rotates in clockwise direction by 120° and 'DRY' bin comes under outlet flap. So, Motor 2 (M2) starts revolving and waste gets collected in 'DRY' bin. As the collection process of dry waste gets completed, Motor (M3) revolves in counter clockwise direction by 120° to bring default (Metallic) bin under outlet flap. For accumulation of Wet waste, Motor 3(M3) whirls in clockwise direction by 240° and waste gets agglomerated in 'WET'

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bin. On completing segregation process M3 rotates 240° in counter clockwise direction and default (Metallic) bin comes under outlet flap.

VI. SOFTWARE REQUIREMENT

- The software tool that was used is Compiler :- PIC Basic Compiler
- Language:- PIC Basic
- Programmer Software:- PICKit3

VII. RESULTS AND CONCLUSION

Table1: Results of Automated Waste Segregator

Waste To Be Segregate	Type Of Waste	Angle Of Rotation From Default Bin	Bin Under Outlet Flap
Coin	Metal	0°	Metallic
Paper Ball	Dry	120°	Dry
Wet Handkerchief	Wet	240°	Wet
Plastic Bottle Cap	Dry	120°	Dry
Banana Peel	Wet	240°	Wet
Iron Rod	Metal	0°	Metallic

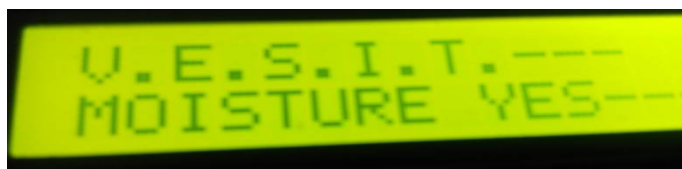


Figure 4: Result displayed on LCD for Wet waste detection

The project has successfully been executed by using PIC controller. It is an economical and user-oriented waste segregation method at household level.

The results can also be seen on the LCD display every time a new waste arrives. The LCD shows the type of waste that comes into the segregator and displays metal, dry and wet as the output.

VIII. FUTURE SCOPE

This project has been made using PIC controller and sensors such as metal, moisture and IR. The moisture sensor is not so efficient therefore we can make use capacitive plates to detect the wet and dry waste. Also the project can be done by using Arduino, MSP 430 or any other high end microcontroller. The project can further be implemented in industries on a bigger scale in order to make the correct choices for disposal of hazardous wastes and other types of harmless waste. With a designate primacy for metal, dry and wet waste, the system can isolate only one sort of waste at a time. Henceforth, advances can be made to separate the assorted type of waste by utilisation of buffer spaces.

REFERENCES

- [1] David W Wooddell E-Waste- National Geographic January, 2008.
[2] PIC16F87XA Data Sheet 28/40/44-Pin Enhanced Flash Microcontrollers, Microchip Technology Inc.,2003.



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- [3] Ramakant Gaikwad, "Op-amp and Linear Integrated circuits", 4th Edition, Prentice Hall/Pearson Education, 2001.
- [4] LM293D Datasheet, STMicroelectronics GROUP OF COMPANIES, 2003.
- [5] Louis Nashelsky and Robert Boylestad, "Electronic Devices and Circuit Theory", 11th edition, Pearson Education India, 2006.
- [6] Jon S. Wilson, Editor-in-Chief, "Sensor Technology Handbook", Elsevier Inc., 2005