



## WASTE SEGREGATION USING SMART DUSTBIN

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### ABSTRACT

*Continuous increase in populace is increasing waste generation. Waste generated in India is in the range of 200-870 grams per day and its rate is rising by about 1.3% per capita per year in India. In addition to this, some portion of waste is burnt openly on dumpsites or streets. Consequently, dioxins and furans are emitted in the lower atmosphere deteriorating the environment. Some of the materials present in wastes have markets, so it is expedient to take them out of waste for reuse and recycling. This is possible only if waste is segregated which leads to exigency of a mechanism that could separate the waste. Thus, aim of our project is to make a municipal waste management system useful at domestic level. Dry, wet, metallic are the categories in which waste is compartmentalized.*

**Keywords :** *Conveyor belt, Electromagnet, Blower, Waste segregation, Automation*

### I. INTRODUCTION

As the production and consumption is proliferating, extensive amount of solid materials are generated as well as rejected by people on regular basis. Garbage mountains are a commonly seen today. The waste dumped is ubiquitous in the form of rotting mound that dot our terrains and make our rivers, wells, lakes abhorrent. 68.8 million tons municipal solid waste is generated per year in India. Unsorted waste, when collected, is dumped openly that leads to generation of leachate and gaseous emissions contaminating the nearby environment.

Around 30% to 50% of total staff in municipalities is allocated for waste sorting. Segregation is a critical task, if not done properly, problems regarding health, sanitation and environment may arise. Waste pickers have to suffer health problems as they have to handle the waste manually. Segregation of waste at its originating site reduces their health risks and threats to the ecosystem around disposal sites. When waste is separated, inorganic waste (non-degradable) such as paper, plastic, glass, metal can be sold to waste bankers or waste traders who then become suppliers to the manufacturing sectors. Then products are made from this recycled plastic and metal. The organic waste (degradable) such as leftover food, vegetable peel is converted into compost or methane gas which is usable in biogas and compost can be used as a substitute of chemical fertilizers. Thus, we can proceed to circular economy by systematic segregation. The situation calls for an efficient system that can sort waste at the primary stage thus making waste management more efficacious and fruitful [1].

The effects of waste segregation are dominant when performed at source. Currently there is no system of segregation of dry, wet and metallic wastes at a source level. J.S. Bajaj[2] has recommended that a least cost, most appropriate technological option for safe management should be developed. 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]. This system employs a conveyor belt having a blower and an electromagnet in its periphery. When waste is dumped on conveyor belt, blower blows off dry waste out of conveyor belt in the dry bin and electromagnet coil attracts all metallic waste. Wet bin is placed at the end of conveyor belt so that all the wet waste on the conveyor will be dumped into it.

## II. HARDWARE IMPLEMENTATION

This project is based on pic18 microcontroller. It controls operation of entire system. It is illustrated below with a block diagram shown in Fig 1.

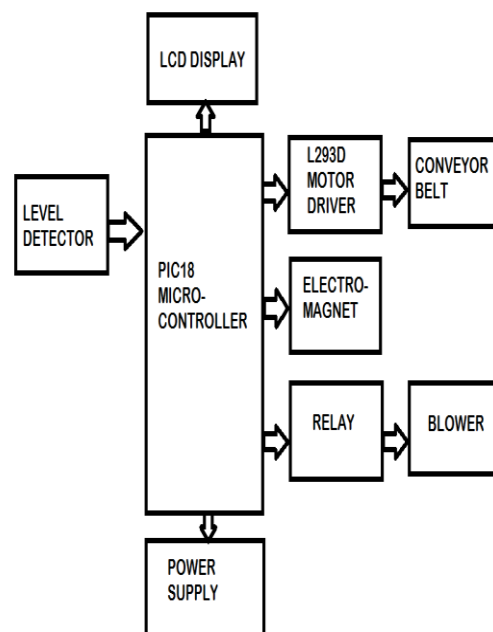


Fig.1 Block Diagram

### 2.1 Level Detector

It is an IR sensor incorporating an IR LED and a photodiode. IR LED consistently emits light on photodiode which is interrupted if any obstacle comes in between. This gives indication if main garbage is completely filled.

### 2.2 Dumping Mechanism

A 12V DC motor manipulates the main bin. This motor tilts the main bin to dump waste on conveyor belt.

### 2.3 Conveyor Belt

It consists of a moving belt and two pulleys. 12V DC motors propel conveyor belt. A L293D motor driver is used to drive both the motors.

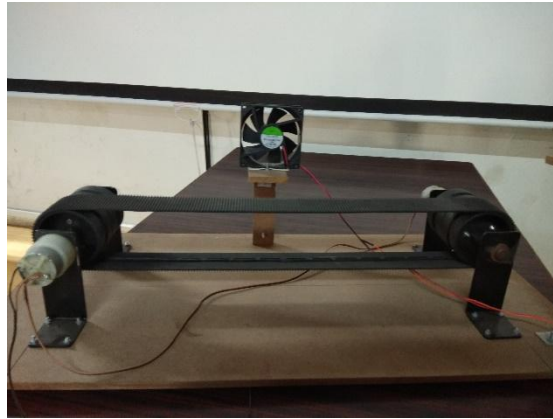


Fig.2 Conveyor Belt

## 2.4 Electromagnet Coil

It is a copper coil wound on a piece of metal. When the current is passed through coil, magnetic field is generated around it, magnetizing the metal which then acts as a permanent magnet.

## 2.5 Blower



Fig.3 Blower

Since dry waste weighs less than wet, blower blows off all the dry waste on conveyor belt to dry bin, It requires 12V DC to operate.

## III. SOFTWARE IMPLEMENTATION

The program is written in MPLAB IDE software. PIC Kit2 is used to burn the program in the microcontroller.

## IV. RESULTS

As this system is aimed deliver results at household level, municipal solid waste (msw) is its target. The waste is sorted out in three categories dry, wet and metallic. Wet waste at household level may be vegetable peel, garden leaves, weeds, dried fruits etc. That means the wet waste may not be literally wet. So, there is not an accurate technique which could separate the wet waste. That is why considering that all the remaining waste on conveyor belt after passing blower and magnet would be wet one, wet bin is placed at the other end of conveyor belt. Same is the case for dry waste, there is not a mechanism which could separate all the dry waste precisely. Also, the cost effectiveness of the system is important as it is to be used at household level as a dustbin.



Table 1,2,3 shows the outcomes of project. Some wastes have subtypes, depending on their weight. So, considering the subtypes discard percentage column is included.

**TABLE I Wet Waste Segregation**

Name of Waste	Separated/ Not Separated	Discard Percentage
Vegetable peels		80%
Fruit peels		90%
Used tea bags	yes	
Used coffee powder	yes	
Egg shells	No	
Rotten eggs	yes	
Coconut shells	yes	
Tender coconut shells	yes	
Meat and non veg remains	yes	
Floor sweeping dust and spoiled spices	no	
Leftover food	yes	

**TABLE II Metallic Waste Segregation**

Name of Waste	Separated/Not separated	Discard Percentage
Chocolate wrappers	yes	
Milk covers	yes	
Package of food items	yes	
Finger or toe nails	yes	
Thermocoal	yes	
Plastic bottles		90%
Small broken toys		90%
Tissue paper	yes	
Dishware		80%
Insulated cups	yes	
Broken stationers' like pen, pencil, eraser etc.	yes	



**TABLE III Dry Waste Segregation**

Name of Waste	Separated/Not Separated
Nails	Yes
Stapler pins	Yes
Paperclips	Yes
Safety pins	Yes
Soft drink cans	Yes
Batteries	no

## V. CONCLUSION

Waste segregation is successfully implemented on household level fulfilling its purpose. Blower separates the dry waste. Electromagnet is magnetized to attract metal waste and is then demagnetized to dump the waste. Remaining waste on conveyor belt, mostly wet one is dumped at the other end of conveyor belt. Furthermore, wet waste can also be segregated again to get the accurate results. PIC18 microcontroller makes the movement of conveyor belt constant and smooth.

### 5.1 Limitations

- Blower cannot separate heavy dry waste such as glass, wood etc.
- Metallic waste segregation require pick and place mechanism.
- After passing through blower and electromagnet, the remaining waste on conveyor belt may not only wet waste.

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