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Smart Trash

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***Abstract*-- Waste has been a major environmental issue everywhere. Besides the waste we create at home school and other public places, there are also those from industries, farm and other sources. Generally waste could be liquid waste or solid waste, both of them could be hazardous to human, plant and animal life. The segregation, handling, transport and disposal of waste are to be properly managed to minimize the risk. Currently there is no system for segregation of dry, wet and metallic wastes at household level. Smart trash: smart system for waste segregation and monitoring is designed to sort the refuse into metallic, dry and wet waste. The proposed system is cheap, easy to use at households, schools, public places etc. and can be monitored effectively.**

***Keywords*—Automation, waste segregation, metal detection, Smart Trash Bins**

I. INTRODUCTION

Waste are items we (individuals, offices, schools, industries, hospitals) don't need and discard. Sometimes there are things we have that the law requires us to discard because they can be harmful. Waste comes in infinite sizes—some can be as small as an old toothbrush, or as large as the body of a school bus. The common method of disposal of the waste is at landfill sites which is hazardous to human, plant and animal life.

Generally, waste could be liquid or solid waste. Both of them could be hazardous .Liquid and solid waste types can also be grouped into organic, re-usable and recyclable waste. Solid waste also includes garbage, construction Debris, commercial refuse, and sludge from water or waste treatment.

The environmental effects are:

1. Surface water contamination*:** Waste that end up in water bodies negatively change the chemical composition of the water. Technically, this is called water pollution. This will affect all ecosystems existing in the water. It can also cause harm to animals that drink from such polluted water. ***2. Soilcontamination*:** Hazardous chemicals that get into the soil (contaminants) can harm plants when they take up the contamination through their roots. If humans eat plants and animals that have been in contact with such polluted soils, there can be negative impact on their health. ***3. Pollution: Bad waste management practices can result in land and air pollution and can cause respiratory problems and other adverse health effects as contaminants are absorbed from the lungs into other parts of the body.

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. 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 [4]. Waste management simply means the collection, transport, processing or disposal, managing and monitoring of waste materials to minimize its' consequences on humans and environment. Efficient and effective waste management is best achieved at household levels. If every person gets involved, we can have a powerful effect on the our environment in a positive way.

Fig1.Environmental effects of waste

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II. TECHNICAL BACKGROUND

Drum screen system-then the refuse is sorted based on its size by using large rotating drums which is perforated with holes of a certain size. Materials smaller than the diameter of the holes will be able to drop through, but larger particles will remain in the drum. *Eddy current or electromagnets*-for metallic objects electromagnets or eddy current based separators can be used [3].

Fig 2. Drum screen

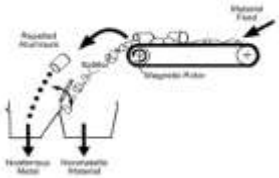

Fig 3 .Eddy Current

Nir Sensors-Near Infrared Scanners Are Used To Differentiate Between Various Types Of Plastics Based On The Ability Of The Material To Reflect Light**.**

Fig 4. NIR Manual sorting-larger items are removed by manual sorting.

III. IMPLEMENTATION

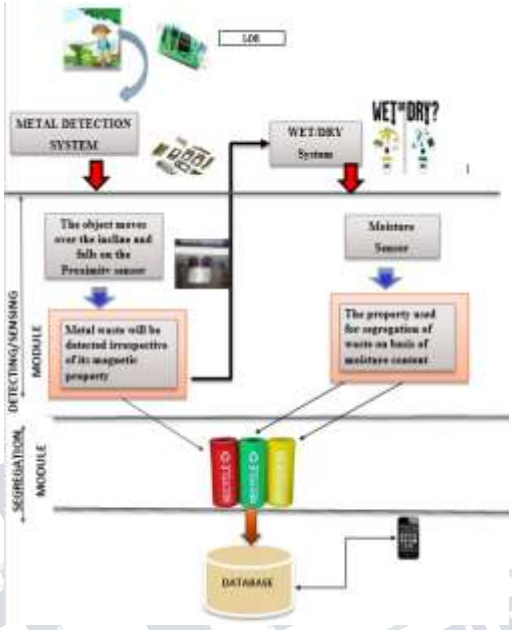

Fig 5.System Architecture Of The Smart Trash.

A. Entry System and Initialization

When the waste is dumped in by pushing the flap, the ir sensor module gets activated and brings the microcontroller out of low power mode. The object slides over the incline to fall on the proximity sensor which is used to sense any metal object.

B. Metal Detection System

When the waste on the proximity sensor it scans the object .if the detected object is metal then it falls in the respective bin. If the waste which is not metal then it continues to sensing for wet waste. The main advantage of this method is it senses any conducting material irrespective of its magnetic property. Dust around coil have no effect on the capability. The dimensions of the coil have to be such that it should detect a very small metallic waste.

C. Wet/Dry Detection System

If the is not sensed has metal then it falls on moisture sensor. This moisture sensor senses the waste based on moisture content Moisture sensor consists of two plates when the waste falls on the sensor it detects it's a wet waste.

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If the object is not wet waste then it is considered has dry waste.

D. Segregation Module

To achieve the segregation, two DC geared motors are used. They are cheaper as compared to the stepper motor and provide a solution suitable for this application. The containers are placed on a circular base which is mounted on the axle of a DC geared motor. The circular base rotates as the axle of the DC geared motor rotates. If the container corresponding to the type of garbage is not under the flap then the motor is rotated clockwise or anticlockwise. An IR sensor module is positioned under the circular base such that it generates an interrupt when the required container positions itself under the flap. This interrupt is used to stop the motor by the microcontroller.

After this the microcontroller is put to low power mode until the entry of the next waste material into the system.

IV. CONTROL FLOW DIAGRAM

There are many different types of flowcharts, and each type has its own repertoire of boxes and notational conventions. The two most common types of boxes in a flowchart are:

- a processing step, usually called *activity*, and denoted as a rectangular box
- a decision, usually denoted as a diamond.

Flowcharts depict certain aspects of processes and they are usually complemented by other types of diagram.

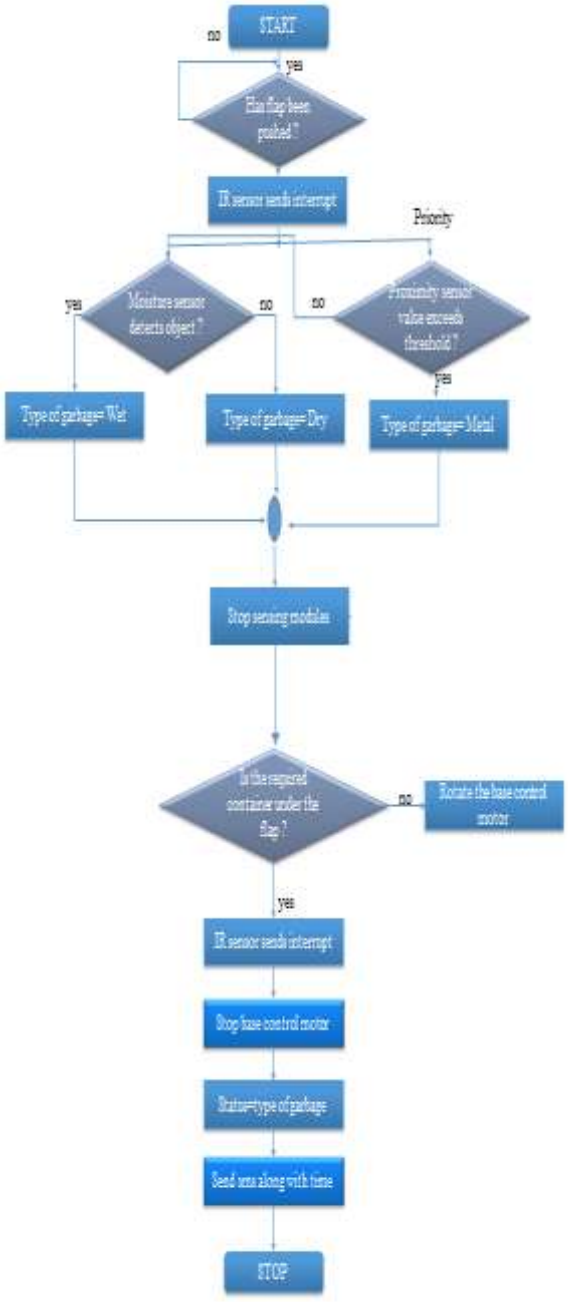

Fig 6. Flow Chart

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V. TEST CASES

Smart Trash has been tested with different objects for dry, wet and metal. Depending on the category the object will be dropped to corresponding bins. Once it reaches to particular volume(count) , message will be triggered, information will be sent to mobile phone. Indicating date, time and volume

Type of Waste	Object	Status of bin
Dry	Paper	Dry
	Plastic ball	
	Dry cloth	
Wet	Dry lemon	Wet
	Potato peel	
	tomato peel	
Metal	Metal ball	Metal
	Paper clips	

Table 1: Test cases for Different Objects

VI. SNAPSHOTS

Fig 7. Top view of the model

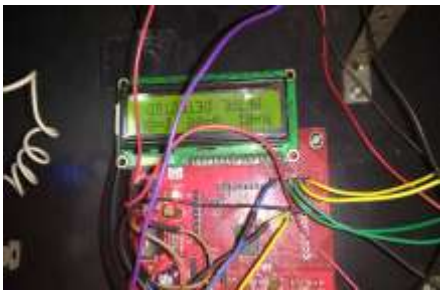

Fig 8. Metal detected

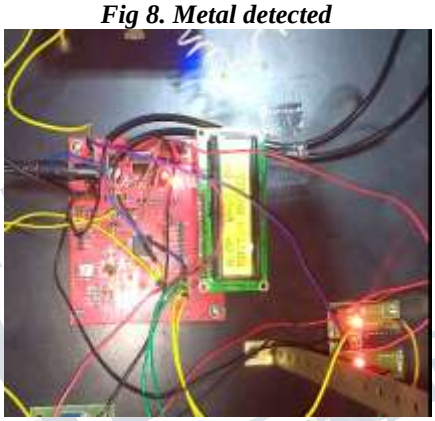

Fig 9. Rotation of bins

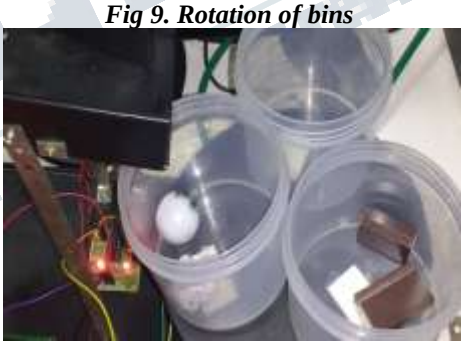

Fig 10. Collection of waste in the bins

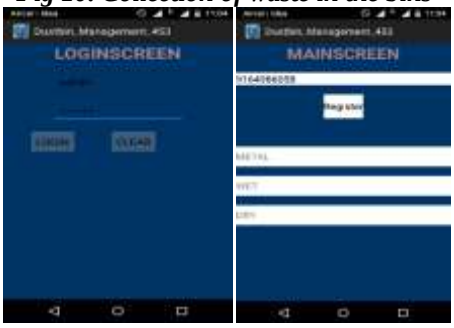

Fig 11. Login Screen and Sign Up Snapshot

Fig 6. Shows the top view of the smart trash, where all the hardware parts will be integrated together. Fig 7.

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Shows display of message metal detected, wet detected and dry detected when it flows through flap. Fig 8. Shows display of message about the rotation of the bin. It rotates in clockwise and anticlockwise direction.

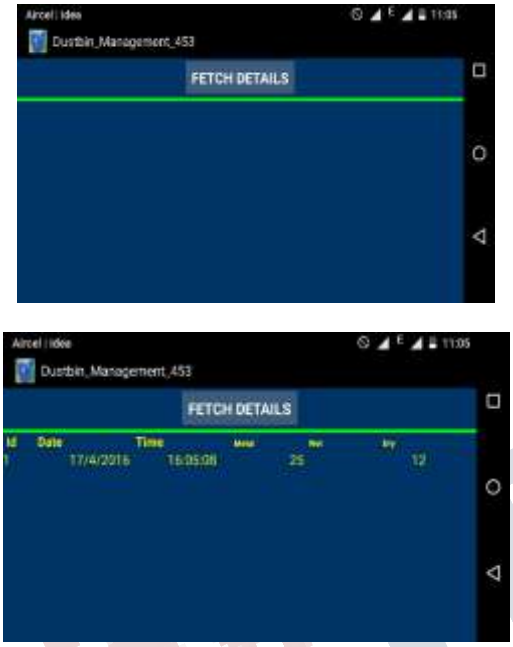

Fig 12. Snapshot of Database Details

Fig 9.Shows the collection of particular waste in the particular bins. Fig 10.Shows the snapshot of login screen, which consist of username and password and two button: login and clear. Main screen consist of entry of number with register button. It also shows the count of metal, wet and dry waste. Fig 11.Snapshot of database details which consist of ID, Date, Time, Metal count, Wet count, Dry count.

VII. CONCLUSION

Smart trash has been successfully implemented for the segregation of waste into metallic, dry and wet waste at a domestic level. The system can segregate only one type of waste at a time with an assigned priority for metal, wet and dry waste. The notifications are sent to the user, this gives the count (volume) of number of items that is dropped into the container. Since, the time for sensing metal objects is low the entire sensing module can be placed along a single platform where the object is stable to ensure better result.

VIII. FUTURE WORK

With the ongoing changes taking place in today's technology the entire unit can be made into simple and compact device. Flexible solar power developed on a plastic strip can be attached to the unit as the source of power supply.

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