ISSN (Online) 2321-2004
ISSN (Print) 2321-5526

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING
Vol. 3, Issue 5, May 2015

Microcontroller Based Automatic Waste Segregator

M.K.Pushpa[1], Aayushi Gupta[2], Shariq Mohammed Shaikh[3], Stuti Jha[4], Suchitra V[5]

Associate Professor, Department of Electronics and Instrumentation Engineering, MSRIT, Bengaluru, India[1]

Student, Department of Electronics and Instrumentation Engineering, MSRIT, Bengaluru, India[2,3,4,5]

Abstract: The rising population of India poses serious threats with regard to the availability of living space, utilization of natural resources and raw materials, education and employment. But another serious peril that follows is the escalating amount of waste generated each minute by an individual. An astounding 0.1 million tonnes of waste is generated each day in India. Sadly, only 5% of this colossal amount of waste is recycled.One possible solution for this problem could be segregating the waste at the disposal level itself. In India, the collection, transportation and disposal of MSW are unscientific and chaotic. Uncontrolled dumping of waste on outskirts of towns and cities has created overflowing landfills which are not only impossible to reclaim because of the haphazard manner of dumping but also has serious environmental implication in terms of ground water pollution and contribution to Global warming [1].This has found to reduce the average life span of the manual segregators. Developing a mechanized system to help save the lives of many and making the world a cleaner and a greener place is the noble objective of our project.We have thus proposed an automatic waste segregator that aims at segregating the waste at the disposal level itself. It is designed to sort the waste into 3 major categories, namely metallic, wet and dry, thereby making waste management more effective. To set the ball rolling, we have proposed this project to give back to our nation, making our India a 'Swachh Bharath'.

Keywords**:** Automation,Conveyor belt system,Inductive Proximity Sensor,High speed Blower,Waste segregation.

I. INTRODUCTION

Razzle dazzle big puzzle, where will the global guzzle lead us to! Technology is growing at an unimaginable rate! There are new products, facilities, and luxury elements that are developed every day. But the dark side is that this boon has always been accompanied by a tremendous production of waste.

The Philosophy of "Waste management Hierarchy" has been adopted by most industrialized nations as the menu for developing Municipal Solid Waste management strategies. [2] Every city is grappling with the menace of escalating amounts of waste.

The situation calls for an efficient system that can sort waste at the primary stage thus making waste management more efficacious and fruitful [1]. Mechanizing such a system is of paramount importance as is clearly indicated in Aidan's work [2].We have thus come up with an Automatic waste segregator that categorizes the waste as wet, dry or metal.

This will not only help in dealing with the situation in a clever manner but will also improve the economy of our country. Ready to convert trash to cash?. An introduction to the proposed system was given in section I of the paper. A view of the model can be seen in Fig 1.

The methodology of the model is explained in section II where the working is elucidated. Section III gives a vivid picture of the results and discussions based on the same. A brief conclusion consisting of limitations and future scope is provided in section 4. This is the organization of the paper.

Fig. 1. Microcontroller based Automatic waste segregator Model

II. METHODOLOGY

An explication of the working of the microcontroller based waste segregator is illustrated below with a block diagram as shown in Fig 2.

A simple 8051 microcontroller forms the heart of the system. It controls the working and timing of all the sub sections so as to sort the waste into the three primary categories.

Fig. 1. Microcontroller based Automatic waste segregator Model

ISSN (Online) 2321-2004
ISSN (Print) 2321-5526
INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING
Vol. 3, Issue 5, May 2015

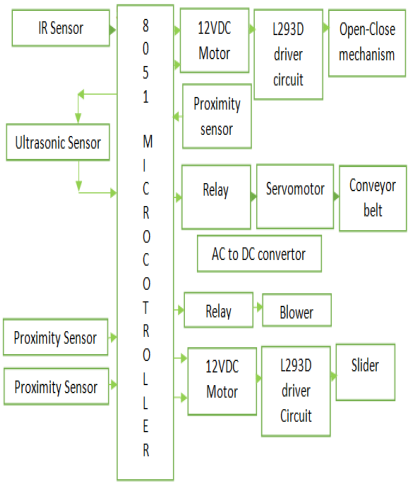

Fig. 2. Block Diagram of the proposed model

A. Open Close Mechanism

The open close mechanism acts as a regulator to control the waste that falls on the belt. A 12V 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 a driver IC to provide the necessary current to the motor. This mechanism is initiated only if the IR sensor detects a waste in its vicinity.

Fig.3.A view of the funnel withopen close mechanism at its mouth

Fig.4. Open close plate with three inductive proximity sensors for metal waste detection

B. Inductive Proximity Sensor

An inductive proximity sensor based on the eddy current principle suitable for metallic targets has been used. [3] Three 12V inductive proximity sensors are used to detect if the incoming waste is metallic or not. Thenpn sensor givesa 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.

C. Conveyor Belt Mechanism

A 12V DC servomotor is used to move the belt. This high torque motor derives the necessary 12V and 2A current from an AC to DC converter. The start and stop of the belt is controlled using a relay. The relay makes and breaks the circuit between the converter and motor to start and stop it respectively.

D. Blower Section

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 made use of 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 halts and dry waste is thrown out into the dry bin via a collecting chamber. Wet waste stays on the belt. It then falls off due to gravity at the end of the belt as it rolls.

Fig.5. Blower section

D. Slider Section

As and when the inductive proximity sensors detect a metallic waste, a slider movement is initiated which sweeps the waste away after it falls on the belt. A 12V DC geared motor is used. L293D acts as the motor driver to facilitate it's working. Permanent magnets within the metallic bin aid in sorting magnetic metals from non-magnetic ones.

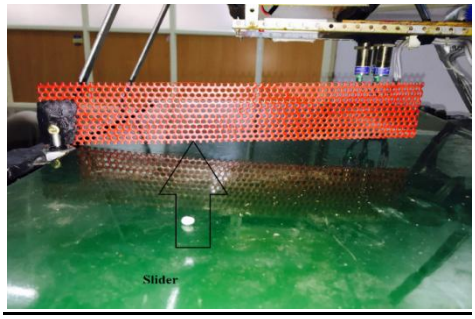

Fig.6. Slider for discarding metallic waste off the conveyor

ISSN (Online) 2321-2004
ISSN (Print) 2321-5526
INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING
Vol. 3, Issue 5, May 2015

Fig.7. Complete Picture of the bin collecting the Metallic Waste

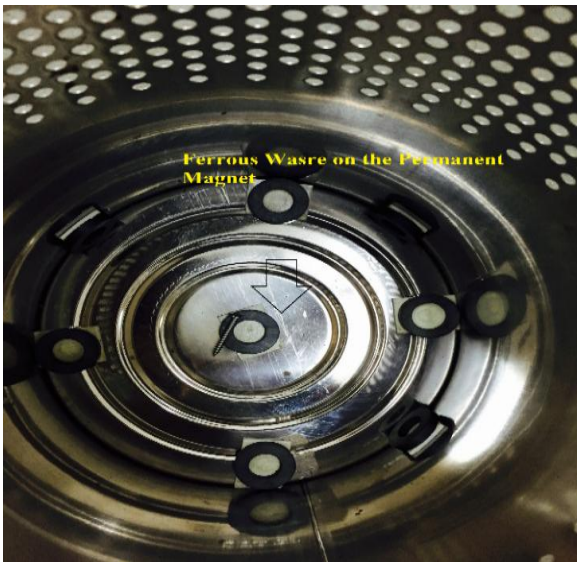

Fig.8. Base of the metal dustbin with permanent magnets to separate ferrous wastes

E.Ultrasonic sensor Section

An ultrasonic sensor will detect the presence of waste just before the blower section. If waste is detected, then the blower is switched on for a programmed duration and then switched of. This will prevent the blower from being on continuously.

The trigger pulses are provided to for ultrasound detection of waste. The echo received from theobstacle (waste) is received by the microcontroller to calculate the delay[4]

F. Software Implementation

The software used to program the 8051 microcontroller is Keil Microvision 3. The C program written to automate the process of waste segregation is downloaded using a tool called Flash magic.

The flow of the software implementation is depicted in Fig 9.

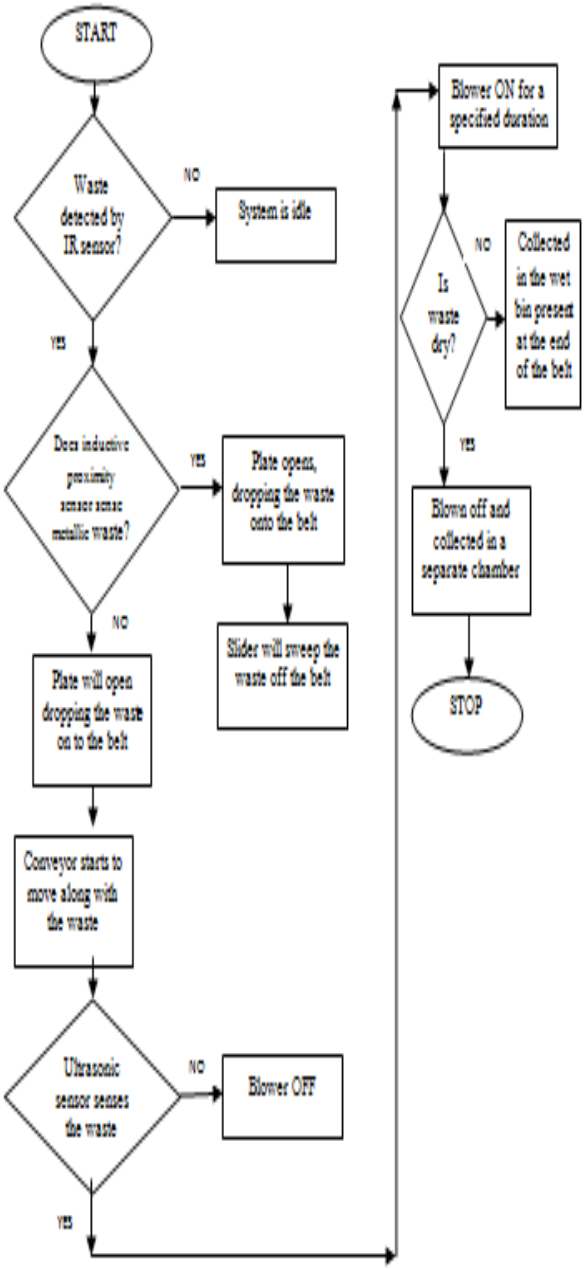

Fig.9. Flowchart of software implementation

III. RESULTS AND DISCUSSION

The proposed system, 'Automatic Waste Segregator' sorts wastes into three different categories, namely metal, dry and the wet waste. Waste segregation means division of waste into dry waste and wet waste. Dry waste includes paper, cardboard, glass tin cans etc. Wet waste on the other hand, refers to organic waste such as vegetable peels, left-over food etc. Separating our waste is essential as the amount of waste being generated today causes immense problem. Here, we have tested the household wastes which are generated in every home today and we have come up with the following result. The following tables show the tested sequel of the fate of the waste when exposed to our Automatic Waste Segregator.

Our project has been experimented with distinct categories of waste namely metal, dry and wet section. Each diverse

ISSN (Online) 2321-2004
ISSN (Print) 2321-5526
INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING
Vol. 3, Issue 5, May 2015

category has been pigeonholed with the acceptance and the rejection rate with our system. Here we have tabulated the list of the household waste that lives up to the system design of classification on the type of waste which will fall under true or false acceptance and rejection. Elaborating, True acceptance would mean a section that correctly identifies and sorts the waste. On the other hand True Rejection will be a section which would recognize a wrong waste and reject it.Also, False Acceptance is one in which it would identify a wrong waste to be correct. Lastly a False Rejection is when it should have identified and accepted it but it ends up rejecting the waste.

TABLE I: Result of Metallic waste separation

Sl No.	Types of metals	Discarded	Not discarded
1	Safety Pins	Yes	
2	Paper Clips	Yes	
3	Printed coke Cans	Yes	
4	Batteries	Yes	
5	Nails	Yes	
6	Tinned food cans	Yes	

TABLE II: Acceptance and rejection

Sl No.	Types of Metallic Waste	True Acceptance	True rejection	False Acceptance	False Rejection
1.	Safety pins	90%			10%
2.	Paper clips	90%			10%
3.	Printed Coke cans	100%			
4.	Batteries	95%			5%
5.	Nails	90%			10%
6.	Tinned food cans	95%			5%

TABLE III: Result of Dry waste separation

Sl no	Types Of Dry Waste	Discarded	Not Discarded
1	Papers	Yes	
2	Tissue Rolls	Yes	
3	Bottles	Yes	
4	Heavy Cartons		No
5	Milk Covers	Yes	
6	Tetra packs		No
7	Dried Leaves	Yes	
8	Stationeries	Yes	
9	Textiles	Yes	

TABLE IV:Acceptance and rejection of Dry waste

Slno	Blower Section	True Acceptance	True Rejection	False Acceptance	False Rejection
1	Paper	90%			10%
2	Plastic	95%			5%
3	Peels of veggies			100%	
4	Wet Waste		100%		
5	Dry Garden Waste	100%			
6	Heavy Carton boxes	15%			85%
7	Broken glass pieces				100%

Dry waste separation happens with great accuracy in this system. The blower will blow all the dry waste that is discarded. As it is blown off, a simple collecting chamber is built just opposite the blower. The waste hits the chamber and falls down into the dry waste bin. Wet waste is successfully segregated from the other types of waste in this system. They do not get blown off by the blower. Hence as the belt continues to rotate forward, the waste falls at the end, into the wet waste bin.

TABLE V:Result of Wet waste separation

Sl no	Types of Wet Waste	Discarded	Not Discarded
1	Kitchen Waste	Yes	
2	Rotten fruits and vegetables	Yes	
3	Garden Waste	Yes	
4	Leftover food	Yes	
5	Peels of fruits and vegetables	Yes	
6	Tea Bags	Yes	

TABLE VI: Acceptance and rejection of wet waste

Sl. No.	Blower Section	True Acceptance	True Rejection	False Acceptance	False Rejection
1	Kitchen Waste	100%			
2	Rotten fruits and veggies	100%			
3	Peels of veggies				100%
4	Dry Waste		100%		
5	Wet Garden Waste	100%			
6	Tea bags	95%			5%

IV. CONCLUSION

- The waste segregator as the name suggests, segregates the waste into three major classes: dry, wet, metallic. The permanent magnets placed within the metallic bin further sorts ferrous and non-ferrous metals.
- The inlet section is provided with open and close mechanism to regulate the flow of waste on to the conveyor.
- Inductive proximity sensor is used to detect the metallic waste. The signal from the proximity sensor initiates the push mechanism to discard the metallic waste.
- A blower mechanism is used to segregate dry and wet waste.
- The timing and movement of the conveyor belt is controlled by 8051 microcontroller. Continuous and unnecessary operation of any particular section is thus avoided.

A. Limitations

- 1. Segregation of the waste consumes time.
- 2. Size of the waste must be less than or equal to the dimension of the funnel i.e. 20cm X 20cm
- 3. E-waste, Sanitary waste and medical waste cannot be segregated by the proposed system as there are certain rules and regulations specified by government to be followed for their segregation.

The magnetic metals attached to the permanent magnets must be scraped out manually from the metallic bin.

B. Future Scope

- 1. Inlet section can be incorporated with a crusher mechanism to reduce the size of the incoming waste.
- 2.Inlet section can also be integrated with a blower mechanism to dehumidify the waste input in the system.
- 3. Range for the inductive proximity sensor can be increased.
- 4. Provisions can be made for on spot decomposition of wet waste.
- 5. GSM contraption to intimate to the nearest industry to use the metals collected.
- 6. Plastics can be segregated from the collected dry waste and also be processed based on their types, grades and colors. Thus further separation of dry waste can also be done.

ACKNOWLEDGMENT

We would like to express our profound gratitude to the Karnataka State Council for Science and Technology (KSCST), Indian Institute Of Science Campus, Bengaluru for funding our project, Id no-38S0128, 2015.

REFERENCES

[1]. Shuchi Gupta, Krishna Mohan, Raj Kumar Prasad, sujataGupta, ArunKansal, 'Solid Waste Management In India: Options and Opportunities 'in Resource, Conservation and Opportunities : Volume 24,Issue 2 ,Novemeber 1996,Page :137

[2]. S.Sakai, S.E.Sawell, A.J.Chandler, 'World Trends in Municipal Solid Waste Management', Environmental Preservation Centre, Vol 16, Page 341, 1996,Kyoto University, Japan

[3]. S. Yamazaki, H. NakaneG and A. Tanaka, "Basic Analysis of a Metal Detector," IEEE Instr. and Meas., vol.51, no. 4, pp. 810–814, August 2002

[4]. Carullo.A,ParvisM,'An Ultrasonic Sensor for Distance Measurement in Automotive applications, in: IEEE sensors journal,vol1 n 2,Page143