

Microcontroller Based Separation of Metal from Garbage Waste

Prof B H Band¹ A Bhandurje² S Wath³ S Duryodhan⁴ V Ughade⁵

¹Assistant Professor ^{2,3,4,5}UG Students

^{1,2,3,4,5}Department of Electrical Engineering

^{1,2,3,4,5}PRMCEAM, Badnera, Maharashtra, India

Abstract— The advantages of garbage separation system are to improve the results in better minimize raw materials wastage and reduce manufacturing costs. These benefits also categorized as to improved garbage management system. The purpose of this paper is to segregate the metal and nonmetal waste from the garbage which is major problem observed in the industrial and in domestic use. It is very crucial to have some system to manage waste automatically which is currently not available. The Prime Minister Modi's mission of Swaccha Bharat Abhiyan can also be successfully implemented by the using this proposed system. To separate out metal and nonmetal waste into respective bins by sensing of different sensors incorporated along with the conveyor belt. The system has motors interfaced with the micro controller.

Key words: Metal Segregation, Waste Product, AC-DC Motor, Microcontroller

I. INTRODUCTION

Increase in population has led to improper waste management in cities and also in urban areas which has resulted in spreading different types of diseases. This paper proposes a simple technique for separation of metal from waste garbage which is a simple, easy to use solution for a segregation system at households, so that the wastes can be sent directly for processing. The waste categorise into three main categories namely; metallic, organic and plastic, thereby making the waste management more effective. Sensors are added for monitoring waste collection process. The sensors would be placed in all the garbage bins.

In India the population is one of the threat in the development so as to develop the garbage system which is produced by millions of people is increases in ever year. Around five million tonnes of garbage is generated in metropolitan cities. The available land in the cities to dump the garbage is not sufficient most of these cities are overflow with waste. 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. Thus, we develop a simple way to manage garbage system based on microcontroller for proper management of waste. The monitoring system overall monitor the garbage waste 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 garbage gets separated into the categories then the more chances available to recycled and reuse. Compost can use for chemical fertilizers, and biogas as 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.

However, recently municipal workers collect the waste from street to street in order to dispose the waste by proper means. Hence devise a method so as to segregate the collected waste as per its proper categories. The collected waste is sorted into dry, wet and metal waste by employing various sensors and relays with the help of embedded C. The purpose of this project is to segregate the metal and nonmetal waste for the industrial and domestic use. As per as the environment concern the waste garbage management is today's necessary condition. The advantages separation garbage waste to improve in energy savings, better environmental performance, minimize raw materials wastage and reduce manufacturing costs. The separated waste can be sent to the recycling and processing plant instead of sending it to the segregation plant then to the recycling plant.

II. LITERATURE REVIEW

Following are the literature work done on garbage separation system:-

Chatterjee and Kumar [1] represented an model where equal participation of the formal and non-formal sector is ensured to make the e-waste management. The main motivation for non-formal operators is to extract precious metals from printed circuit board (PCB) using unscientific and unhygienic methods, which are harmful to the workers and the environment. Non-formal operators will concentrate on collection, disassembly, segregation of e-waste, whereas, formal sector will concentrate on processing the PCBs to extract precious metals.

Ramahali and Mahlangu [2] studied the removal of heavy metals from platinum industry by the process of bio-sorption and the advantage of this method. This method has not only provided the removal techniques for removal of effective metals but also high post metal recovery during elution. The paper gels, prepared by chemical modification of waste paper, exhibited remarkable capacity and efficiency for the pre concentration and separation of gold, platinum and palladium from other co-existing metal ions at low to high concentration levels. Their major advantages are that they are usually of very low cost, decrease metal concentrations considerably and are especially useful in waste waters containing low concentrations of metal ions.

Yoheeswaran [3] recommended the scenario, legislation and regulation in national level, e-waste recycling formal and informal sector in national level. In India e-waste generation rate is 20% increase and to cross 805,000 tons. Major amount of e-waste is recycle and recovery by informal sector using basic methods such as open burning and acid stripping method. The both methods are harmful to the human and environmental. It has been seen in order to maintain E-waste awareness should be informal sector and public for disposal of waste. The discarded material collect, separate and transport by the informal sector and recycling, recovery

and disposal by the formal sector is the way of reduction of pollution.

Patil et al. 2014[4] proposed an innovative strategic model for the recovery of valuable metal for the management of e-waste by employing combined technological strategies viz. chemical and biological. Chemical technology involves the leaching of silver from electronic scrap using toxic chemical like cyanide. The complex silver cyanide form is then subjected to biological technology using passive low-cost material. This fact helps to know the strategy to strengthen supply chain elements for efficient management of e-waste.

Okwu and Onyeje [5] focuses on the good site extraction of valuable substances by means of recycling. The processes involved in e-waste recycling are: collection, dismantling, pre-processing, end processing and final metal recovery collection mechanism of e-waste is very important because it is the determinant of the quantity of waste that is available for recovery through recycling and the amount that is lost in the process of storage. Dismantling is the removal of some functioning or valuable components such as copper cables, memories, drives, batteries, capacitors and so on for re-use. It has been noticed that E-waste process contains collection, dismantling, pre-processing, end processing and final metal recovery.

Willner et al. [6] gives the bacterial leaching of metals from various poly metallic wastes and the removal of metals by the process of bio hydrometallurgical method. These wastes are the carriers of valuable metals: base metals, precious and platinum group metals. It has been seen that biological leaching has been conducted in the presence of variety microorganisms and in a wide range of waste-carrying base, special and precious metals. In many cases promising results of metals extraction were obtained. Problems associated with metal toxicity towards microorganisms have been solved by their adaptation to high concentration of heavy metals. Although many problems associated with the selection of the optimum process parameters still remain to be resolved, increased efficiencies of bacterial leaching operations, make these processes more competitive in relation to conventional methods.

Sivakumar et al. [7] studied the E-waste composition, categorization, Global and Indian E-waste scenarios, prospects of recoverable, recyclable, and hazardous materials found in the E-waste, Best Available Practices, recycling, and recovery processes followed, and their environmental and occupational hazards. It is recommended that an effective take-back program providing incentives for producers to design products that are less wasteful, contain fewer toxic components, and are easier to disassemble, reuse, and recycle may help in reducing the wastes. Hence creating awareness among the e-waste generating sectors is the important task now. Technical audit and Life cycle analysis are also recommended before releasing the electronic consumer product.

B H Band and A D Ingole [8] give detailed description of dc and ac machine working for operation of the system.

III. PROPOSED SYSTEM

We developed a system for separating out metal and non-metal particles using embedded C for the domestic and industrial use. In this system the scrap materials (i.e. metal and non-metal waste) will be fed onto the conveyor belt, object sensors will detect the particles on the conveyor belt and start the rotation of the conveyor belt. Then, metal sensors which are clamped to the conveyor belt will sense the metal waste and stop the conveyor belt. A segregator attached to the system will push the metal waste into its respective bin, which will be carried for further operations and the non-metal waste are automatically fed into the waste dust bin.

A system depends on the metal partial present in the object which is moving across Sensor which is a proximity metal sensor. When sensor gets triggered it gives high input to micro controller and micro controller starts motor for actuators.

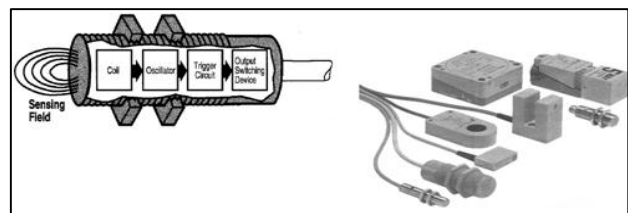


Fig. 1: Working Principle

An embedded system is a computer system with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today.

The proposed system uses metal sensor and ultrasonic sensor to separate the metal waste from the waste in the dust bin. The proposed system consists of two doors and opens depending on the wastes. It uses a metal sensor to detect the metal parts in the garbage. The metal sensor contains metal detector which works on the basis principles of electromagnetic induction. A metal detector is having one or more inductor that is generally used to interact with metallic elements on the ground. A pulsing current is applied to the coil, which then induces an electromagnetic field. When the metal passes across the magnetic field of the coil, like coin, the field induces eddy currents in the coin. When it detects the metal, the system will open the corresponding door else for the other waste it will open other door. The ultrasonic sensor will detect the presence of the object. LCD display unit displays the status of the segregation process. DC motor is responsible for motion of the objects. Conveyor belt is used for separation of waste particles. Arduino controls the whole process.

The software implementation of Arduino is done through embedded C. Embedded C is preferred over other software languages for the following reasons:

- It is easy to understand and learn
- C Compilers are available with all embedded devices
- Unlike assembly, C has advantage of processor-independence and is not specific to any particular microprocessor/ microcontroller or any system.

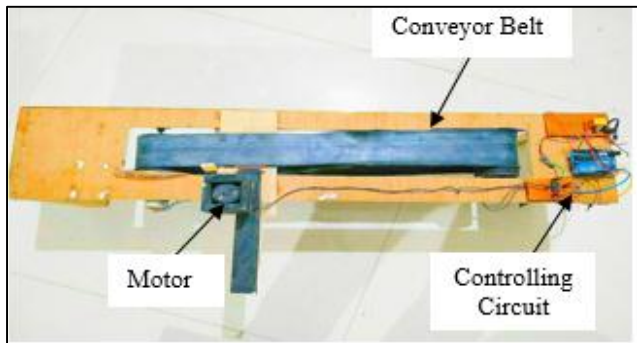


Fig. 2: Microcontroller Based Separation of Metal from Garbage Waste

IV. RESULT

The waste segregator as the name suggests segregates the waste into three major classes: plastic, organic, metallic. The proposed system would be able to monitor the solid waste collection process and management of the overall collection process.

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

V. ADVANTAGES & DISADVANTAGES

A. Advantages:

- 1) The process is fast
- 2) Its efficient for separation of metal and non-metal
- 3) It detect metal easily with more accuracy
- 4) The separated metal can be recycled again.
- 5) Increases in production capacity and quality.
- 6) Decreases in total manufacturing cost.
- 7) It minimizes manual work.
- 8) Its time saving and efficient

B. Disadvantage:

- 1) The Cost is more for small scale industries.
- 2) The Segregation system is time based hence it require frequent monitoring.

VI. CONCLUSION

Automated Waste Segregator has been successfully implemented for the segregation of waste into metallic waste at a domestic level. However, it cannot segregate ceramic into dry waste because of its higher relative dielectric constant when compared to other dry wastes. Noise can be eliminated in the sensing module to increase accuracy and overall efficiency. The system can segregate only one type of waste at a time with an assigned priority for metal waste. Thus, improvements can be made to segregate mixed type of waste by the use of buffer spaces. 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 results.

The given method gives the solution for waste management problem which effectively separate metal, glass and plastic. The Automated Material Segregation system (AMS) effectively employs inductive proximity sensor to identify metallic items, and capacitive proximity sensors to differentiate between plastic and glass waste. This system can be use in industries for material separation, and urban households.

VII. FUTURE SCOPE

For further convenience transmitters could be placed at garbage dumping places to convey a message whenever the accumulation of garbage crosses its threshold limit along with its location.

REFERENCES

- [1] Borthakur Anwasha, Singh Pradeep. Electronic waste in India: Problems and policies Review article, international journal of environmental sciences. 2012; 3:353-362.
- [2] Debaraj Mishra, Young-Ha Rhee. Current Research Trends of Microbiological Leaching for Metal Recovery from Industrial Wastes, 2010.
- [3] Yoheeswaran E. E-Waste Management in India: Global research analysis. ISSN No 2277-8160 2013; 2:4.
- [4] Willner J, Kadukova J, Fornalczyk A, Saternus M. Biohydrometallurgical process for metal recovery from electronic waste. ISSN 0543-5846 METABK 2015; 54(1)255-259.
- [5] 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
- [6] Claudine Capel, "Innovations in Waste", Waste management-world, Volume 11, Issue 2, Mar 2010.
- [7] Management Indore city," IJEP, Vol. 22(8), pp. 841-846, 2002
- [8] B H Band and A D Ingole, "Transfer of Power by Using Two Induction Machines" IJCESR, VOLUME-4, ISSUE-8, pp.36-40, August-2017
- [9] Yamazaki S, Nakane GH, Tanaka A. Basic Analysis of a Metal Detector. IEEE Instr Meas. Aug 2002; 51(4): 810-814p.
- [10] <https://en.m.wikipedia.org>