

SEGREGATION OF WASTE USING PLC

Lakshmi P¹, Dimple V², Srinidhi J³, Arunkumar G V⁴

¹⁻⁴Student, Dept. of Electrical and Electronics Engineering, Acharya institute of technology, Bangalore, Karnataka, India

Abstract - India generates about 62 million tonnes of waste every year. Piling up of these waste can cause a lot of pollution in the city and with improper waste management it is a threat to our health and environment. Hence we need to implement proper waste management where we can segregate the waste and recycle or reuse them which can reduce the land filling and also be utilised effectively. In this paper our prime focus is on segregation of waste into metal, wet and dry. By this method we classify the waste and is moved to their respective bin which reduces the time and labour requirement. And it also helps in maintaining the clean environment, hands free segregation and also increase the value of waste.

Key Words: PLC, Conveyor belt, Moisture sensor, Inductive sensor, Capacitive sensor, Segregator.

1. INTRODUCTION

Segregation of waste is a very important step in the process of waste management. Though we dispose the waste cautiously, without segregation it will end up being the pollution. By segregation we can save a lot of time and energy as the useful materials can be recycled and reused. And it also helps in maintaining the hygiene around the city and decrease the labour work for separation of waste.

We can describe the waste segregation as the process of separating the metallic, dry and wet waste into distinct bins and leading to effective utilisation of waste. If the waste is segregated at the source it benefits the further process of recycling.

After the segregation of waste into distinct category we need to take an effective and efficient way utilizing them where wet waste can be used to produce methane gas and as compost which can reduce the demand of fertilizers and biogas can be produced. Plastic, wood and metallic waste can be recycled and reused which decreases the effort of finding the new raw materials for manufacturing.

2. LITERATURE SURVEY

By the use capacitive sensing module wet and dry waste is distinguished [9]. Here three pairs of copper plates are placed along the circular walls with an inclination to each other at an angle of 45°. The property used for segregation is

the relative dielectric constant which is high for wet waste compared to dry waste.

The segregation of waste can be considered as twostep process- identification and separation [5]. The process of identification can be made easier with the help of recent technologies like machine learning and image processing algorithms where the waste is classified according to predetermined classes.

Incineration of the organic waste material can also be one of the effective way where we use the process of combustion of organic materials in the waste and obtain the useful by-products [10]. These by-products are heat, flue gases and ash. They can be used for the generation of electricity, growth in the production of crops, producing Liquefied Petroleum Gas. Nitrogen produced can be used for manufacturing of fertilizers. And by this process the solid mass of organic waste can also be reduced.

3. COMPONENTS USED

A. PLC – Programmable Logic Controller

We are using the H1U series PLC (0806MT-XP). It has 8 input and 6 output and it's an NPN type. It's main function is to get the signal from the input and perform certain actions with respect to the program. The software used for programming is Autoshop.V3.02.

B. Moisture sensor

We are using FC-28 moisture sensor. It is used to identify the organic waste (wet waste) by sensing the presence of moisture in the waste material.

C. IR sensor

This sensor helps us to detect the presence of object on the conveyor belt by the help of infrared radiations.

D. Inductive sensors

It uses the principle of electromagnetic induction to detect the object. It helps in identifying the metal objects without contact.

E. Capacitive sensor

It can detect the presence both magnetic and nonmagnetic object. With the change in capacitance between the plates the objects presence is determined.

F. Conveyor belt

A conveyor belt is continuously moving with the sensors attached to it at distinct places from each other to segregate the waste to respective bins. We considered a conveyor belt of length 500 mm.

4. METHODOLOGY

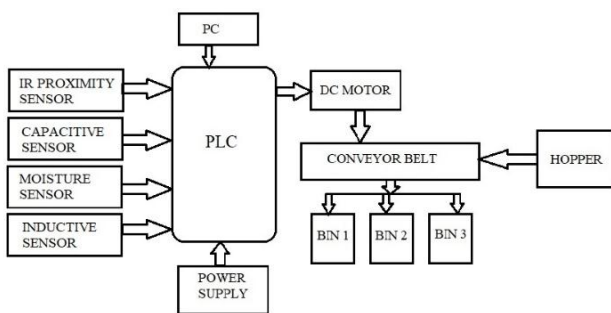


Fig -1: Block diagram of segregator

In this section, we will describe the block diagram of the segregator Fig-1. The waste material is collected from different source and is dumped on the hopper which leads to conveyor belt. Sensors are attached to the conveyor belt, as the conveyor belt carries the waste material forward with the help of sensors we can identify the wet, metallic and dry (plastic, wood) materials. As the waste materials are identified they are moved to distinct bins directly from the conveyor belt as shown in Fig-1.

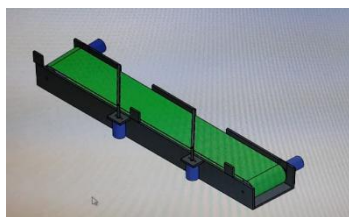


Fig -2: Conveyor belt

IR sensor is used to detect the presence of object on the conveyor belt to start the conveyor belt rotation. Then capacitive sensor will be placed first which is followed by moisture sensor and inductive sensor.

5. WORKING AND SIMULATION

In this section the working of the system is explained with the help of ladder diagram and flow chart. Fig.-3. Shows the flow chart of the proposed method.

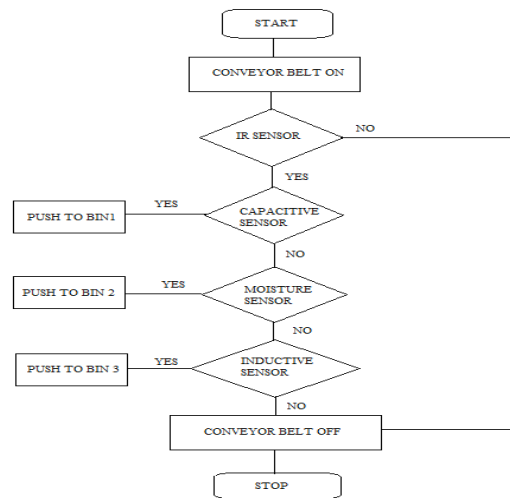


Fig -3: Flow Chart of the waste segregator

The process begins with the waste collection and dumping it on the hopper and it is moved to conveyor belt where as soon as IR sensor detects the presence of object it initiates the movement of conveyor belt forward. As the waste is moved on the conveyor the capacitive sensor senses the presence of plastic, wood other raw materials in the waste and then it pushes it to bin 1. Then the remaining waste on conveyor belt moves towards the moisture sensor which detects the presence of wet materials and moves that to bin 2 which collects wet waste material. Then finally the inductive sensor identifies the metallic present and is sent to bin 3.

The ladder diagram written for the execution of above process is as shown in Fig.-4.

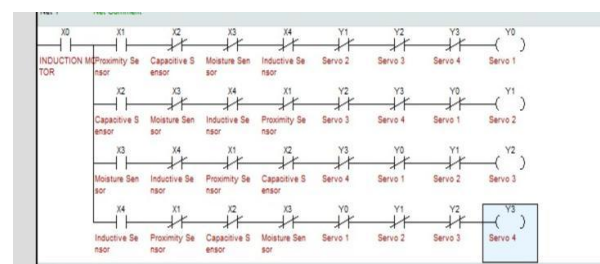


Fig -4: Ladder diagram

6. CONCLUSIONS AND FUTURE SCOPE

Segregation of waste into dry, wet and metallic at the domestic level helps us in maintaining harmony between the waste and environment as the useful waste is segregated from the pile of waste materials. By our method of waste segregation, we can easily classify waste without any human contact. Though this has limitations of classification into multiple section, by including the advanced techniques like CNN or Deep learning we can increase the efficiency of the segregator. While this method serves as the simple domestic

segregator which can be used in domestic level with better results and low cost.

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