

Automatic Waste Segregator Using Plc

Atul Pandhare¹, Harshpal², Vaibhav Kakade³, Prof. Archana Ubale⁴

^{1,2,3,4} Dept of Electronics and Telecommunication

^{1,2,3,4} AISSMS IOIT, PUNE

Abstract- World's population is growing with a high rate of 1.09% and the waste produced with it gives rise to problem for the municipal corporation for the waste management as the landfills are filling up. A large part of waste management is done with the help of rag pickers and this increases the chances for diseases among the rag pickers. So there should be a system which can work efficiently to minimize the issue as possible. The proposed work will include the segregation of different wastes. Out of the different segregated wastes, wastes like plastic, glass, metal and metal will be recycled. Recycling will reduce the landfills filling up problem and will largely help the nature as well. The proposed work will be using PLC because of its reliability in harsh environment. This system is economically feasible because of the acute use of devices used for interfacing with PLC. Today, there is no proper management of wastes. So there is need for the system that not only provides the waste management but also improves the quality of life. This system consists of Programmable logic controller, different sensors that include photo sensor, moisture sensor, inductive sensor and conveyer belt.

Keywords- Waste segregation, PLC, conveyer belt, Moisture sensor, Photo sensor, Inductive sensor.

I. INTRODUCTION

As we know in present scenario population is growing day by day, due to which the amount of waste being produced is also increasing at a very faster rate. It is also propagating a very critical problem at the municipal level to manage the wastes being dumped everywhere as landfill waste. So, it is very important to have some required system to manage waste automatically which is currently not there. In present time there are some existing systems, which involve the basic traditional method of rag pickers who collect and dispose most of the urban solid waste. It is very time consuming and segregating waste using their bare hands might cause deep cuts and bruises due to glassy or sharp objects. These cuts can lead to infections which may lead to severe illnesses. Even with a high prevalence of bites of rodents, dogs and other vermin [1], this system is still operational at a large scale in many parts of India. Segregation can also be performed using RFID where the RFID is attached to each different type of materials during manufacturing only to avoid the problems during sorting at the disposal stage of the

product [2]. The problem arises when RFID scanners are used in harsh and non-suitable environment, also companies must be ready to bear the costs so that tags are attached to each manufactured product. One other method is using micro-controller for segregation. But it poses some problems like time consumption, not suitable for all types of environment and unable to segregate sanitary waste, medical waste and e-waste properly hence failing to obey certain rules and regulations imposed by the government in segregation. So in order to overcome the limitations from all these methods PLC based system is proposed due to the advantages like modular design, make required short-term adjustments without a large impact on the whole system, flexibility, low cost, less wiring etc. The proposed work includes automatic system using PLC where IR, moisture, photo-electric, inductive and capacitive sensors are connected with PLC so that they function in a proper order to detect different materials moving continuously on the conveyer belt. A flap will be used to segregate the materials to different conveyer belt which will ultimately lead the material to its desired bin.

II. AUTOMATIC WASTE SEGREGATOR SYSTEM

In this context, we are going to describe the block diagram. Fig.1 explains the working of various inputs/outputs in the system work done using PLC.

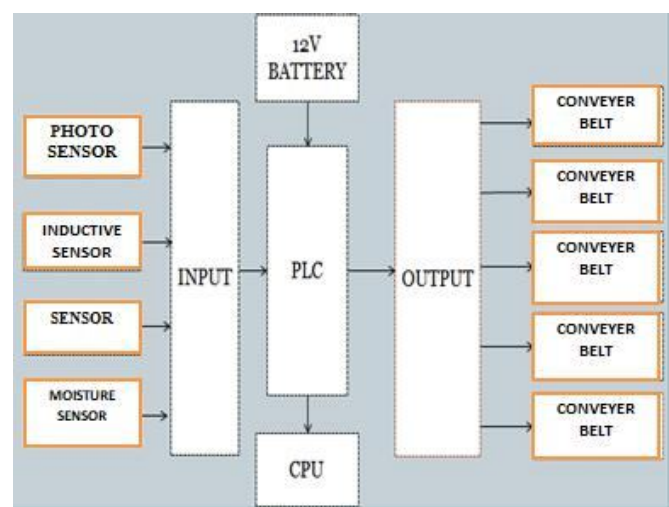


Fig.1

This system explains the interfacing between different modules that includes the input, output and various detecting sensors along with three conveyor belts. The three conveyor belts are main conveyor belt, left conveyor belt and the right conveyor belt. Firstly, at the input side photo sensor will detect the presence of the upcoming waste at the start of the main conveyor belt. As soon as the photo sensor will detect the main conveyor will start moving. The other two sensors used are the moisture and inductive sensor which will detect the following waste materials are interfaced. A flapper is used to separate out the required waste to move whether in left or right conveyor.

III. COMPONENTS USED

The main components used in the proposed system are discussed below:

A. Photo Sensor:

The main work of this sensor is to detect the presence of any object on the conveyor belt. The principle on which this sensor works is the infrared radiation emitted by the sensor

.Whenever a object comes in its path of the emitted radiation , the sensor send the signal to the PLC controller which will start the conveyor in forward direction.

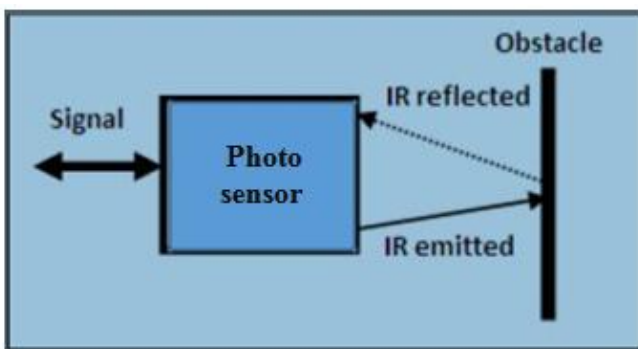


Fig.2

B. Moisture sensor:

This sensor detects the organic waste which contains the water contents in it. It will separate out wet waste from dry waste. When a particular object is detected there occurs the change in electrical impedance. The water vapors is absorbed, it will disassociate particular functional group and it will increase the electrical conductivity. This will signal the PLC controller to take necessary step in respect to conveyor belt.



FIG 3

C. Inductive Sensor

This sensor will used to detect the metallic objects from other types of wastes. This sensor works on the principle that whenever the metallic object comes in the path, the inductance of the coil and losses in the coil will be varied. This will distinguish the metallic waste from the non-metallic waste.

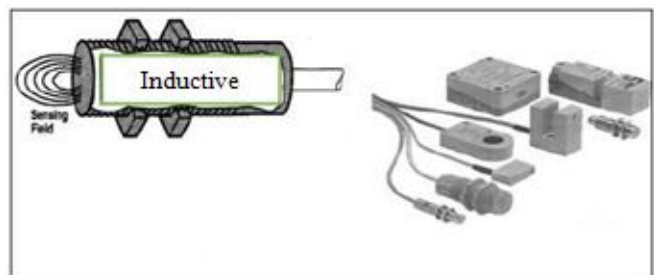


Fig.4

D. PLC: Programmable logic controller

PLC is a popular controller. It is used for various control applications for controlling process in industries and small scale applications. It is a discrete controller which uses logical and Boolean processor. PLC is used as alternative to micro-controller because of its robust performance and also troubleshooting is also feasible. In this project we used Siemens PLC which have a required numbers of inputs and outputs to interface with input and output devices respectively which is very feasible for implementing the required design.



Fig.5

E. Conveyor belt:

Conveyor belt is the very important part in terms of hardware design. It is used to carry and move the different waste materials to the respective bins. Here in this project we used three conveyor belts i.e. The main conveyor, left conveyor and right conveyor. The process starts with wastes on the main conveyor, which will carry and move the waste in forward direction till the desired distance then the other two conveyor i.e. left and right conveyor will force into work depending upon the respective sensors sensing the type of waste, which will activate either a left or right conveyor to move and carry the waste material in respective bins.

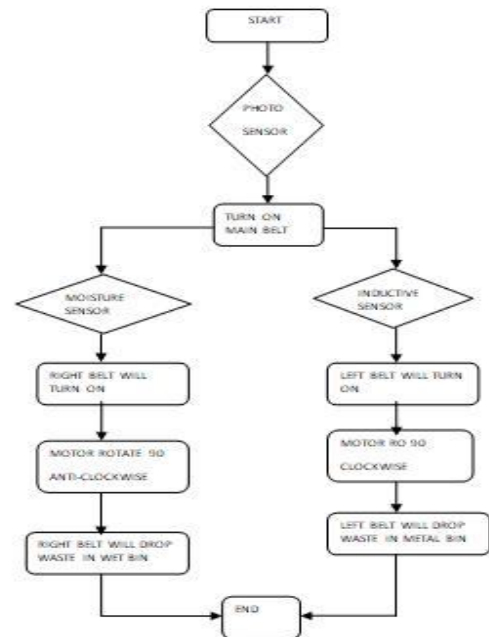


Fig. 6

IV. METHODOLOGY

Different wastes will be dropped at one end of the conveyor belt. A Photo sensor mounted at this end will detect the presence of the waste and the main conveyor belt will turn on. The main conveyer will move the waste to the middle of the conveyor where a motor is mounted with a rotating separator. The Inductive sensor and Moisture sensors separate out metal and moist waste. If the waste is metal then the separator will move the waste to the right bin but If the waste is a wet waste then the separator will move the waste to the left conveyor which will move the waste to the wet waste bin. All the other

wastes besides wet and metallic will be carried forward to the end of the main conveyor belt and will finally be dropped to the common waste bin.



V. WORKING MODEL



VI. CONCLUSIONS

1. The diseases which are spreading widely and causing a severe danger to the society due to lack of awareness in waste Management should be minimized as early as possible.

2. For growing issues in the management of waste we implemented a system to segregate the waste using PLC in order to improve the current conditions in waste management.
3. There is lot of scope for recycling when it comes to waste but due to lack of knowledge it's not widespread. So recycling of waste should be considered for saving future environmental and health issues.

After the completion of this project we will be able to have a system that is successful in for managing the wastes, in an efficient way in order to reduce the improper utilization of valuable resources like human effort, time and a system to help save the environment and to promote role of recycling in waste management.

The system separates out the wet and dry waste along with few dry components detection and separation. This system can be implemented at the municipal level or in some small scale industries to segregate out the metallic, plastic, glass and paper wastes more efficiently at an affordable cost.

VII. FUTURE SCOPE

- 1) Various different sensors can be added to this system to segregate various wastes.
- 2) A robotic arm can be added to the system to pick and drop the wastes on the conveyor belt and to re-position the waste in the middle of the belt.
- 3) A high level of Object recognition system can be implemented to segregate different different wastes using a high resolution camera.
- 4) The segregated wastes like plastic and metal can be sold to various manufacturing companies for recycling.
- 5) We can implement additional sensors to detect more objects and segregate them depending upon the input output module of the PLC.
- 6) Camera sensors instead of analog sensors can be used where the camera will detect and object based on object defined in its program.

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