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PLC Based Industrial Trash Barrel

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Abstract*: The Expeditious rise in the magnitude and kind of solid trashes deposited on the earth due to increase in the economic growth, industrialization and urbanization, is becoming a burgeoning problem for national and local governments to fortify protective and tenable management of waste. The segregation, Handing, Transport and disposal of waste needs to be properly managed inorder to minimise the risk to the health and safety of the public and the environment. The recessional value of waste is well accomplished only when it is segregated. In India the government spends over 25% of their budget on solid waste management. When the waste is segregated into multiple streams such as glass, metal, paper, plastic then it becomes more easy to recycle them and reuse them. Our intention is to separate the recyclable solid waste and collecting them in individual bins which could be used accordingly as per the applications. Programmble Logical Controller helps us just doing that under hard conditions. We use IR sensor, Capacitive and Inductive proximity sensors to detect each object which is moving on a conveyor belt and is segregated and collected in various bins with the help of gates, which is controlled by Programmable Logical Controller. The dust bin employs the sensing mechanism to distinguish between the wastes.

Keywords*: Programmable Logical Controller, Infra Red sensor, Automated Waste Segregator, Central Processing Unit.

I. INTRODUCTION

One of the main anxiety with our society has been solid waste utilization and its management which interrupts the stability of environment and also has an undesirable and undeniable effect on health of the society. Effectiveness in managing the solid wase is one among the main problems in the current century. The conventional method of manually collecting and segregating the trashes utilizes more human effort, cost and time cost. This work proposes is a trash barrel which could be a solution for a segregation system at both industries as well as for commercial purpose, so that it can be directly sent for recycling. It is made to collect the refuse into metallic waste, glass waste, paper waste.

Smartbin solution empowers cleaning workers to detect cleanliness issues in real time. Thus, the system can able to help in increase the overall cleanliness and productivity[7]. This kind of segregation when implemented in industries it finds a variety of application because some industries being the major cultivator for the solid waste may pay for the consequences. So, this could be one among the best solution to avoid the environmenta issues due to solid trashes. The PLC will tends to produce a high level accuracy.

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II. PROPOSED SOLUTION

When the IR sensor placed at the edge of the conveyor detects the presence of the waste, the signal is passed to PLC, then the PLC makes the blower and the conveyor belt to start running. As a result, if the waste contains any paper waste then it will be pushed by the blower to the bin which is placed opposite to the blower. Now the rest of the waste travels through the conveyor belt by crossing the inductive sensor. when the inductive proximity sensor detects the presence of the metal, then the PLC will turn on the electromagnet placed at the top the conveyor. The rest will be the glass waste which is dropped as such in a separate bin. Finally the electromagnet is released and with the help of the hydraulic cylinder the metal waste is pushed into a separate bin. The ultimate aim of this segregation is to separate the waste at disposal level.

III. BLOCK DIAGRAM

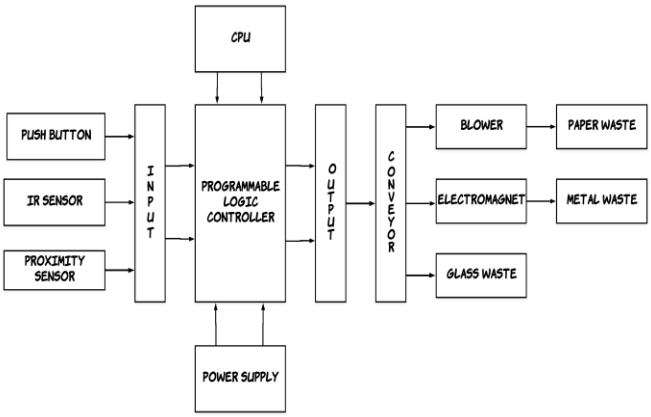

Fig.1 Block Diagram

The above block diagram explains the overall working of the proposed system where the IR sensor and Inductive sensor takes the input module of the PLC. The output of PLC is fed to the blower and conveyor belt. It is visible that the blower separates the paper whereas the metal and the glass waste is separated via conveyor belt. The PLC takes up the working source from the ladder operation fed to it with the help of CPU along with the power supply. The purpose of the push button is to turn on the motors for the conveyor.The Programmable Logic Controller being the heart of this entire process switches the output based on the inputs received by the sensors.

IV. FLOW CHART

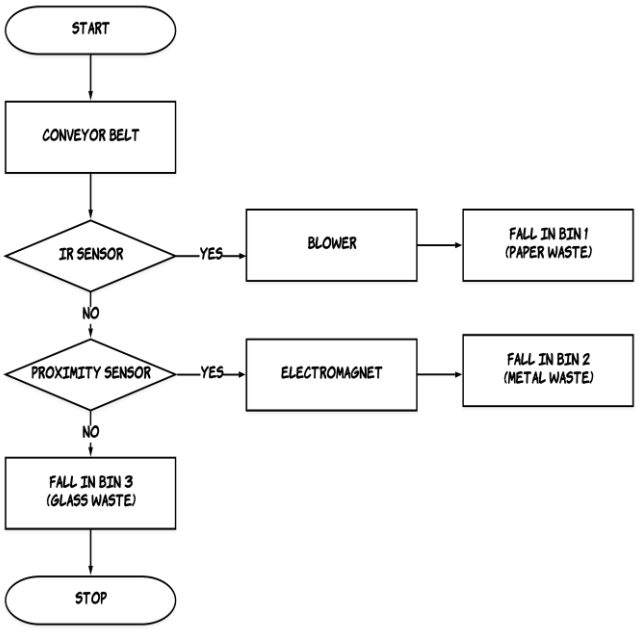

Fig.2 Flow Chart

The above flow chart will help to analye the process flow of the trash barrel. The process begins with turning ON the conveyor belt. When the IR sensor senses any kind of object that is moving through the conveyor, then the Blower is set ON which makes the paper waste to fall into the bin 1. If no object is detected by the IR sensor and if proximity sensor senses any kind of metal, then the Electromagnet is turned ON inorder to pick up the metals from the trash and makes it fall into the bin 2. The left out glass is dropped as such in bin 3.

V. LADDER DIAGRAM

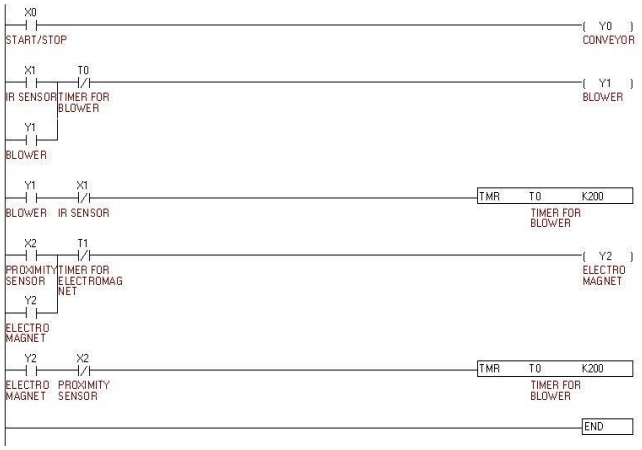

Fig.3 PLC-Ladder Diagram

The ladder diagram is one among the programming language used for programming the PLC. The software used for the simulation is WPLSoft 2.47. The X0 being the start turns ON/OFF the conveyor motor(Y0). X1 is the normally opened switch meant for IR sensor that will turn on the Blower (Y1) for 10secs with the help of Timer (T0). X2 is also a normally opened switch meant for proximity sensor that will turn on the Electromagnet (Y2) for 20secs with the help of the Timer(T1).

VI. HARDWARE DESCRIPTION

A. Programmable Logic Controller

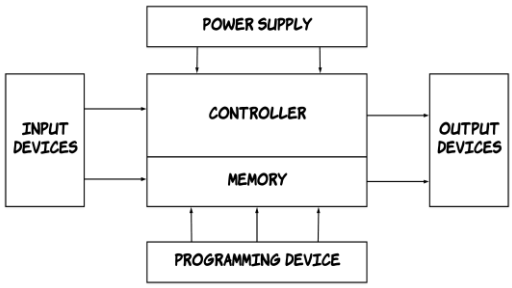

Fig.4 Block Diagram of PLC

The PLC works as the core of this project. PLC paves the way for automating the emerging world. The PLC is a replacement for the conventional relay and the hard-wired controlling concepts, they tend to help in controlling the more complex applicationsThe PLC could be programmed in five ways. The programmed PLC can be modified whenever and wherever needed. They find a wide variety of application in the industry sectors. It acquires the signals as input from the sensors and performs various operations as the output. When any of the sensors associated with the process of segregation receives any kind of signal, the PLC will switch between the outputs accordingly.

Fig.5 Programmable Logic Controller

B. IR Sensor

Infrared Obstacle Sensor contains a on board IR transmitter and a receiver that sends the IR energy out and search for the reflected IR energy to identify the presence of any object passing through the sensor module. The purpose of the Infrared sensor in trash barrel is to initiate the process flow. When the IR receives any signal in the receives which means that there is some object entering in to the bin and turns on the fan inorder to secregate the paper form the refuse.

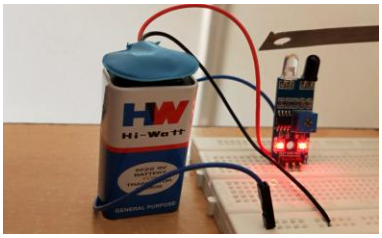

Fig.6 Working of IR Sensor

C. Blower

Blowers which are meant to provide some forced air. In our trash barrel, the blower will be turned ON only when the IR Sensor receives and transmit any kind of signal.

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The purpose of the blower is to throw out the paper from the trash.

Fig.7 Blower

D. Inductive Proximity Sensor

Inductive proximity switch which works under the principle of inductance. This Inductive proximity switch has an electromagnetic coil which is capable of identifying the metal objects. The sensor will not react if the object is not a metal. In our dustbin the proximity sensor is employed to identify the metal from the trash. When the proximity sensor receives any signal then the PLC is programmed in such a way to turn on the electromagnet.

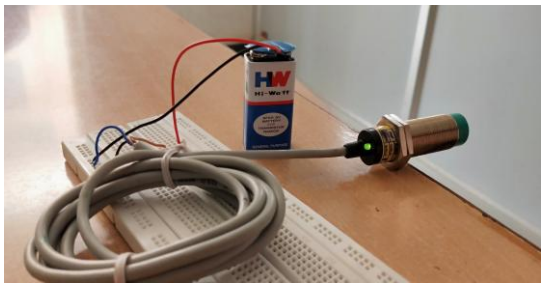

Fig.8 Inductive Proximity Sensor

An inductive sensor is an proximity sensor that works on the principle where the field line produced by the sensor is cut by an metallic object, then the sensor tends to react beacause the metals being more efficient inductors, other than any materials will thereby increase the flow of electric current.

E. Electromagnet

Electromagnets has the tendency of acquiring the magnetising property only when there is electrical supply. The associated function the electromagnet in our PLC is to pick up metal from the trashes. The electromagnet will be set free after certain time period according to our application.

Fig.9 Electromagnet

F. DC Motor

The DC motor is employed in segregating process inorder to run the conveyor. The speed of the conveyor can be adjusted by choosing the desired motor. The trash will travel through the conveyor where there is way to provide the sensor to sense. The sensors, blower and electromagnet are mounted on to the walls of the conveyor built.

Fig.10 DC Motor

VII. RESULT AND DISCUSSION

Fig.11 Snapshot of Hardware

The work descibed in the paper meets the expectation of its results. It could be one among the project that can contribute Swachh Bharat program of the central government. The features of the trash barrel are garbage sensing modules, dynamic stability which will reduce the human intervention marginally.

VIII. FUTURE SCOPE

The growing world deserves an effective management of waste inorder to overcome the hazardous pollutant effects for the betterment of humans. The problems of foul odour and manual controlled mobility calls for the future scope which includes the odour control mechanism to get rid of foul smell of organic garbage. Also, realising the requirement of an autonomous dustbin, GPS module can be implemented for path planning combined with ultrasonic sensor for obstacle avoidance. The enhancement of these kind of project will definitely lead the world to another level of growth.

IX. CONCLUSION

The proposed project paves the way for the effective management of waste at disposal level. The major advantage of our project is that implementing it to be a dustbin. The outcome propose a suitable option for an innovative dustbin. One such advantage is that the cost for the waste management could be reduced as compared to cost spent for the solid waste management at present.

This system proposes not only the solution for segregating paper, metal, and glass waste whereas our future work proposes the solution for segregating the plastic also by introducing a capacitive sensor in future. In addition to that we will focus towards the extension of various wastes.

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