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Metal and non-metal sorting

Akash Kumar[1], Vikas Kumar Singh[2], Himanshu Gautam[3], Sumanth Kumar[4], Rakesh Kumar[5], Snigdha Chaturvedi[6]

[1,2,3,4,]Student, IMS Engineering College, Ghaziabad, Uttar Pradesh

[6]Assistant Professor, IMS Engineering College, Ghaziabad, Uttar Pradesh

ABSTRACT

Nowadays solid waste management is a major concern. Solid waste has to be crushed, classified and sorted. Sorting is an important step for recycling and reuse of materials. Conventionally sorting techniques like magnetic sorting and eddy current sorting is only able to process some special kinds of ingredients of waste mixture roughly. This project comes with an idea of the sorting of metals & non-metals. It will be a revolution for industries in which proper management of materials is required for delivering quality assured products at cheaper prices. Sorting is done to separate out metal and non-metal materials differently. The whole setup is fully automated which is useful as well as eco-friendly.

Keywords—*Metal, Non-Metal, Sorting, Metal Detector, Motor*

1. INTRODUCTION

In recent years, sorting of scrap material using various automated techniques has gained a lot of focus. One of the multiple steps in the recycling of non-ferrous metals is the separation of shredded material into different groups.

In our project, we propose the concept of "Metal & Non-metal Sorting Using Metal Detector". This system of sorting products is optimized to differentiate between metal & non-metals product, which is done with the help of a metal detector. A continuous conveyor belt carries the different products, and with the help of a control motor it separates metal from non-metal.

In a nutshell, this system consists of a metal sensor. When the conveyor belt carries the products, it goes through a metal detector, if it's a metal product the control motor separates it with the help of a bar and the skipped product goes further to another container for non-metal. GSM technique is also introduced for mobiles messaging. The counter displays the metal count.

This project is useful in automobile industries, steel plants and industry for separation of metal and non-metal element in the industry on a large basis. It can also be used for waste management so also beneficial for the environment.

2. SYSTEM OVERVIEW

The system consists of a metal sensor. When the conveyor belt carries the products, it goes through a metal detector, if it's a metal product the control motor separates it with the help of a bar and the skipped product goes further to another container for non-metal. GSM technique is also introduced for mobile messaging. The counter displays the total metal count.

The various components of the project are as follows:

- Metal Detector
- Transformer
- Rectifier Bridge
- L293D Motor Driver
- DC Motor
- Arduino Uno

2.1 Metal detector

A metal detector is used for detecting the presence of a metal. Metal detectors are useful for finding metal inclusions hidden within objects, or metal objects buried underground. The basically consist handle with a sensor probe inbuilt within it which can be swept over the ground or other objects. The detection of metal is done using the concept that the presence of metal varies the inductance. Generally, a metal detector has an oscillator that produces alternating current. This current produces an alternating

magnetic field. Now, when a piece of metal comes near the coil, eddy currents get induced in the metal. This change in magnetic properties can be measured. The basic properties of metal detector used are:

- Type: Electronic Components
- Power Source: DC
- RoHS Compliant
- Material: Epoxy
- Weight: 0.1

Fig. 1: Metal detector

2.2 Transformer

The transformer is a static device that transfers electrical energy from one circuit to another without an electrical connection. This transfer of energy is based on electromagnetic law of induction. The ideal transformer assumes that all the flux generated by the primary winding links with the secondary and there are no losses but practically, some flux takes path outside winding and does not link with the secondery such type of flux is called leakage flux. This Leakage flux results in energy being alternately stored in and discharged from the magnetic fields with each cycle of the power supply. It causes poor voltage regulation, causing the secondary voltage not to be directly proportional to the primary voltage, particularly under heavy load. Transformers are therefore normally designed to have very low leakage inductance.

Fig. 2: Transformer

2.3 Bridge rectifier

A bridge rectifier is basically a connection of four or more diodes in a bridge circuit. It is generally used for converting alternating current to direct current. A bridge rectifier gives full wave rectified waveform which is cheaper as compared to a 3 wire input from a transformer with center tapping. The fundamental characteristic of a diode is that current can flow only one way through it, which is defined as the forward direction. A diode bridge uses diodes as series components to allow current to pass in the forward direction during the positive part of the AC cycle and as shunt components to redirect current flowing in the reverse direction during the negative part of the AC cycle to the opposite rails.

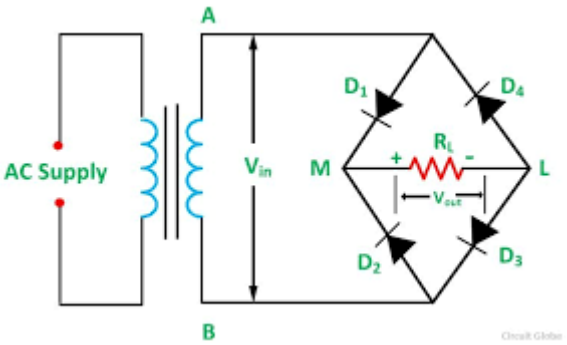

Fig. 3: Bridge Rectifier

2.4 L293D Motor Driver

IC L293D is a basically a dual H bridge motor driver. These ICs act as current amplifiers as they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

L293D has Two H Bridge driver circuits. For the common mode of operation two DC motors are driven simultaneously. They can be operated in forward as well as reverse direction. Logic inputs 2&7 and 10&15 are used for controlling motor operations. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively. Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state. a single L293D chip there is two h-Bridge circuits inside the IC which can rotate two dc motors independently. Due to its size it is very much used in a robotic application for controlling DC motors. Given below is the pin diagram of an L293D motor controller. There are two Enable pins on l293d. Pin 1 and pin 9, for being able to drive the motor, the pin 1 and 9 need to be high. For driving the motor with left H-bridge you need to enable pin 1 to high. And for right H-Bridge you need to make the pin 9 to high. If anyone of either pin1 or pin9 goes low then the motor in the corresponding section will suspend working. It's like a switch.

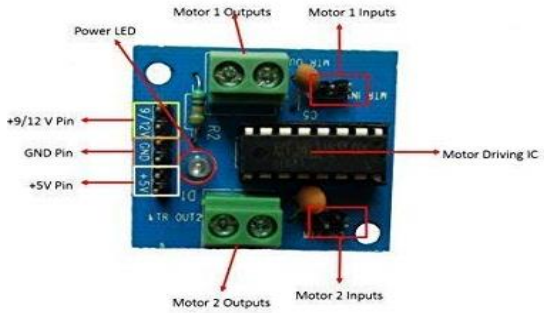

Fig. 4: L293D Motor Driver

2.5 DC Motor

A DC motor is a motor which converts direct current electrical energy to mechanical energy. It is based on the principle that when a current carrying wire is placed in a magnetic field it experiences a force. The direction of the force is determined by Fleming's left-hand rule. It consists of a stator having magnets and an armature having a winding of coils. The ends of the wires are connected to a commutator. The commutator allows each armature coil to be energized in turn and connects the rotating coils with the external power supply through brushes. (Brushless DC motors have electronics that switch the DC current to each coil on and off and have no brushes.)

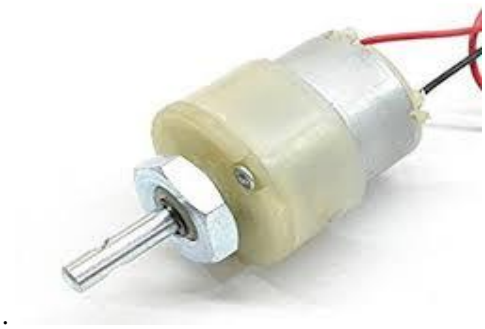

Fig. 5: DC motor

2.6 Arduino-UNO

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analogue input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards and the reference model for the Arduino platform. The ATmega328 on the Arduino Uno comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol. The Uno also differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

The software used for Arduino devices is called IDE (Integrated Development Environment) which is free to use and required some basic skills to learn it. It can be programmed using C and C++ language.

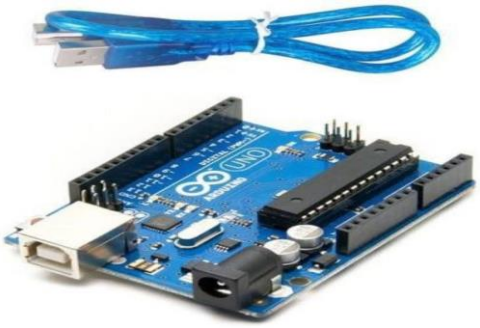

Fig. 6: Arduino-UNO

3. MECHANISM (FLOW START CHART)

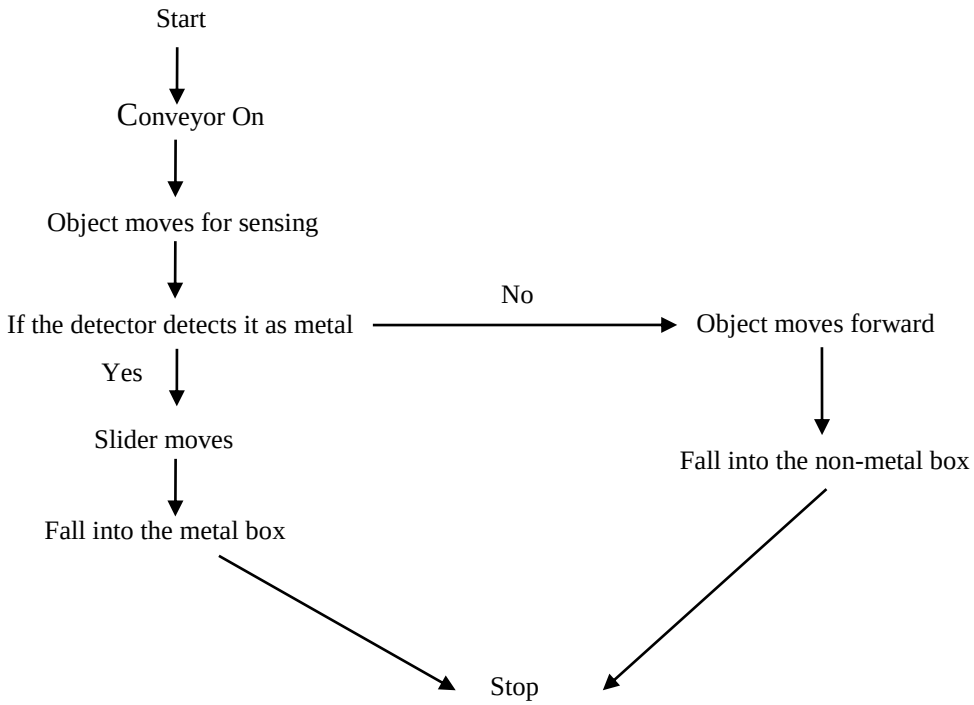

Fig. 7: Flow chart of the mechanism

4. PROJECT MODEL

Fig.8: Project model

5. CONCLUSION

The proposed method is a solution to the current waste management problem which will effectively segregate metal, glass and plastic. This system can be effectively deployed in industries for material segregation, scrap shops and urban households.The waste separated material can be used to produce the desired products thus helps in saving economy and resources.

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