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Smart Waste Segregation with Crusher Using Arduino

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ABSTRACT: Pollution increases in our day to day life to reduce that An efficient method is required to dispose the waste material. More over waste is not separated in an proper way in which they are deposited in many places,, due to this all the materials are mixed and stored in same place in which both the decaying products and non decaying products are stored in same place. So that decaying products are also not getting decay due to this disorders are caused including global warming etc. In this project material will be separated based on their type then crushed and stored in respective storage box. It would also help in reducing the volume of the material and will thus help in effective waste management.

KEYWORDS: Waste Segregation, Arduino, Sensors, Conveyor Belt.

I. INTRODUCTION

Throwing of waste material in bin is good manner, but it's not the place where the waste management ends It is the place of process begin. Segregation is the process of finding the type of material belongs to and then they are separated by their type of material based in metal, glass, or plastic for proper disposal and recycling and is the first step of waste management. It is often recommended to have separate dustbins in the house or at public places to keep metal, plastic and glass separate storage box. Improper segregation may cause mixing in land, in turn leading to toxic release in the ground and eventual contamination of ground water. Most of the waste can be reused and recycled. Several laws, regulations and other actions at the government level for waste management. Literature survey says that the basic method followed usually involves rag pickers. It seems to be time consuming and also segregating waste with their bare hands might cause cuts and also bruises due to glassy products. Infections may also lead to severe illnesses. In addition to a high prevalence of bites of rodents, dogs and other animals.

By this type waste materials are separated and deposited based on their type of material and gets stores and at the same time the object crushed into smaller quantity of size so that larger quantity can be stored in smaller place, as well as the cost for the product which is being deposited will be provided by the machine. By this process the material will get stored on particular area and also environment will be as pollution free environment. This type of Machines can be used in places like railway stations, bus stop and other type of publics places. By use of this machine surrounding will be clean and the product that are deposited can be easily recycle into another material for further use and can be made as an material.

II. SYSTEM MODEL AND ASSUMPTIONS

The main consumption of the work is done with the help of arduino and fully operated automatically; several types of sensors are used in this project to detect the type of material like flex sensor, inductive type proximity sensor, capacitive type proximity sensor, ultrasonic sensor and IR sensor. At first when the object us placed inside the machine passes into the first stage when the object is placed on flex sensor due to the weight of the object the flex sensor gets bed at that time the object directly gets stored in the storage box, If the object is less weight it gets into the conveyor belt an ultra sonic sensor is placed above the conveyor belt detects the type of material and the belt is

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made to move for a particular period of time. Two types of sensors are used above the conveyor belt in which the type of material is detected either metal or plastic, and the respected storage box gets open. If both Capacitive proximity sensor Inductive proximity Sensor gets detected the storage box for plastic gets open and if only Inductive proximity sensor gets detected storage for metal items gets open.

next stage of the machine is to crush the material, the object moved from the conveyor belt and falls in to the crusher stage, An ultrasonic sensor is placed in the box so that when the object is placed ultrasonic sensor gets detect the object and makes the machine to crush, crusher sets start and the object gets crush.

This crushing process is done with the help of DC Motor and the plate on the both side gets pressed and the object gets pressed. The crushed material gets out of the stage by a small gap present in the bottom side and movers to the stage three, IR sensor are placed inside the storage box, when the sensor detects the passing of the material respective coin for the material gets out from the machine.

III. BLOCK DIAGRAM

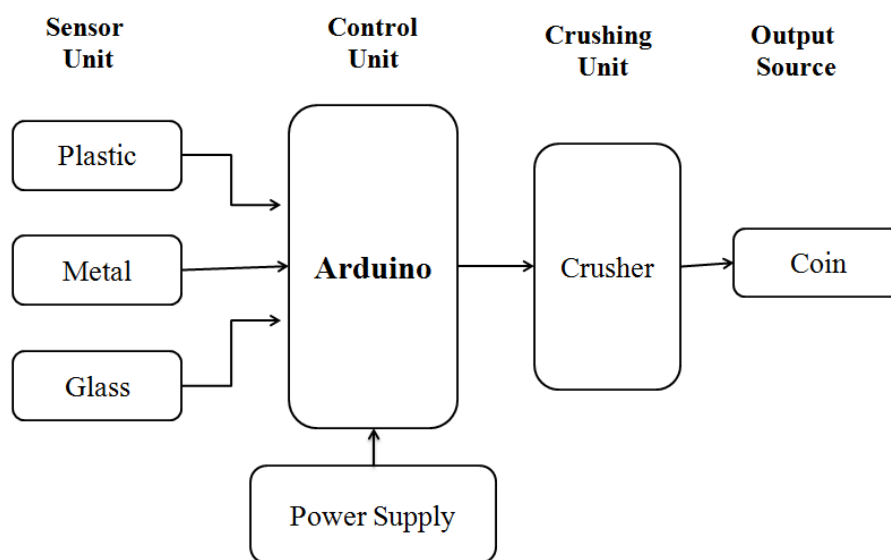


Fig. 1 Functional Block Diagram

IV. COMPONENTS USED

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

- A. Arduino
- B. Flex sensor
- C. Inductive proximity sensor
- D. Capacitive proximity sensor
- E. Ultrasonic sensor
- F. IR sensor
- G. conveyor belt
- H. Crusher

A. ARDUINO

1) Arduino Mega 2560

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins

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(of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.



Fig. 2 Arduino Circuit board

2) Power

The Arduino Mega2560 can be powered via the USB connection or with an external power supply. The power source is selected automatically. The power pins are as follows:

- VIN: The input voltage to the Arduino board when it's using an external power source.
- 5V: The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- 3.3V: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50mA.
- GND: Ground pins.

3) Memory

The ATmega2560 has 256 KB of flash memory for storing code (of which 8 KB is used for the boot loader), 8 KB of SRAM and 4 KB of EEPROM (which can be read and written with the EEPROM library).

4) Input and Output

There are 54 digital pins on the Mega that can be used as an input as well as output, using pin Mode, digital Write, and digital Read functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms.

B. FLEX SENSOR

Flex sensor is a type of sensor which works like variable resistor whose terminal resistance increases when the sensor is bent. So this sensor resistance increases depends on surface linearity. So it is usually used to sense the changes in linearity.

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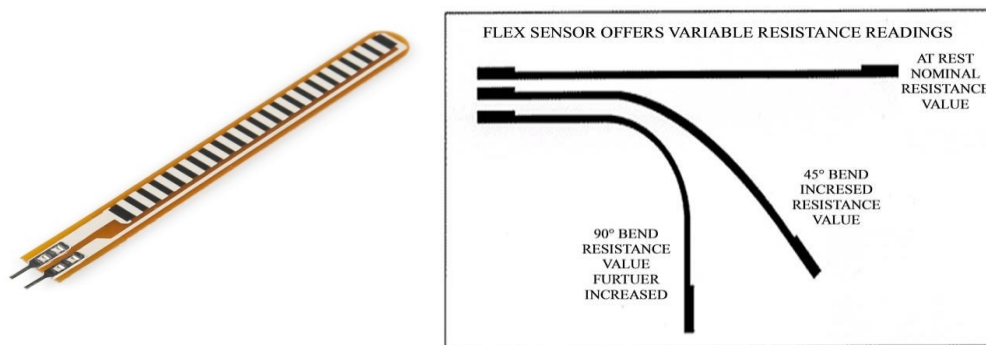


Fig. 3 Flex Sensor & its Functional block

when the surface of FLEX SENSOR is completely linear it will be having its nominal resistance. While is bent 45° angle the FLEX SENSOR resistance increases twice as before. And when the bent 90° the resistance could go as high as four times the nominal or more than the resistance.

C. INDUCTIVE PROXIMITY SENSOR

Inductive proximity sensor works based on magnetic field when a metal item is placed in front of the sensor it triggers the circuit and sends the output as analog signal. Required voltage for this sensor ranges between 12v - 24v.

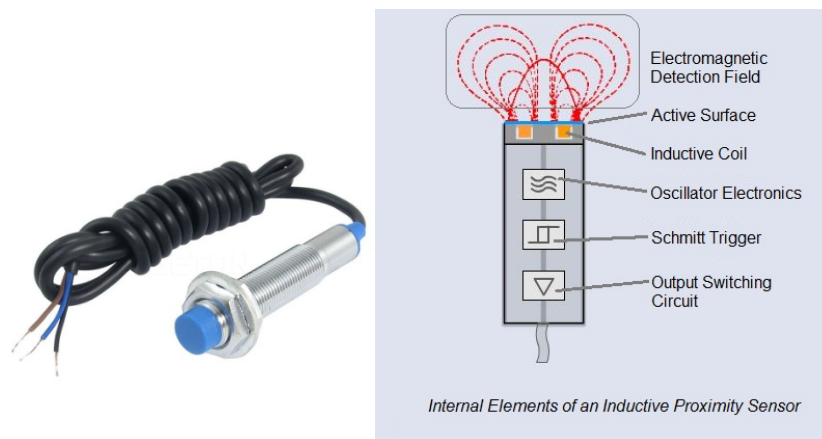


Fig. 4 Inductive Proximity Sensor & its & its Functional block

An inductive proximity sensor has four components: The coil, oscillator, detection circuit and output circuit. The oscillator generates a fluctuating magnetic field the shape of a doughnut around the winding of the coil that locates in the device's sensing face. When a metal object moves into the inductive proximity sensor's field of detection, Eddy currents build up in the metallic object, magnetically push back, and finally reduce the Inductive sensor's own oscillation field. The sensor's detection circuit monitors the oscillator's strength and triggers an output from the output circuitry when the oscillator becomes reduced to a sufficient level.

D. CAPACITIVE PROXIMITY SENSOR

Capacitive proximity sensor works based on electrical field, they detect both metallic and non metallic substances when

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placed in front of the object, they work based on object detection. Required voltage for this sensor to work ranges from 12v to 36v and the output is in the form of analog signal. And that signal is sent to the controlling unit.

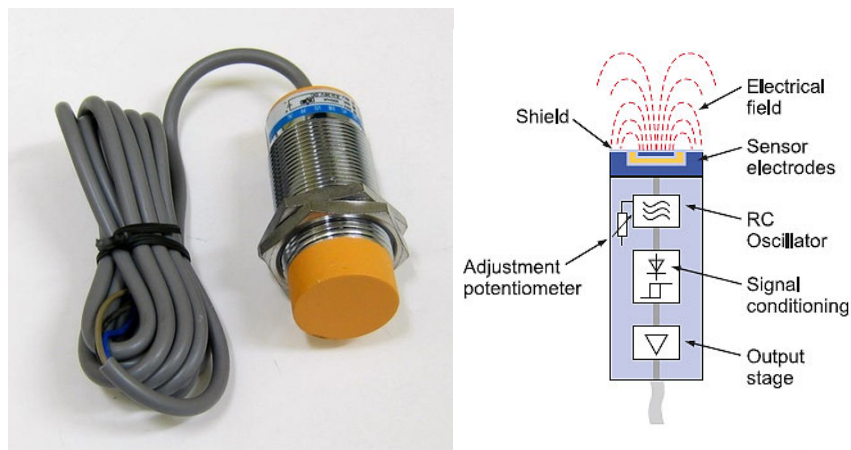


Fig. 5 Capacitive proximity sensor & its Functional block

In capacitive sensors, the two conduction plates (at different potentials) are housed in the sensing head and positioned to operate like an open capacitor. Air acts as an insulator; at rest there is little capacitance between the two plates. Like inductive sensors, these plates are linked to an oscillator, a Schmitt trigger, and an output amplifier. As a target enters the sensing zone the capacitance of the two plates increases, causing oscillator amplitude change, in turn changing the Schmitt trigger state, and creating an output signal.

E. ULTRASONIC SENSOR

This is a type of sensor works based on optic field in which they produce a type of sound wave called as ultrasonic sound these type of sound cannot be heard by human ears. there are two sensors by which one sends the other receives the signal.

$$\text{formula: Distance } L = 1/2 \times t \times c$$

where L is the distance, T is the time between the emission and reception, and C is the sonic speed.

There are four pins in this sensor in which 1st pin is VCC 2nd pin trigger 3rd pin echo and 4th pin is ground. Power the Sensor using a regulated +5V through the Vcc and Ground pins of the sensor. The current consumed by the sensor is less than 15mA and hence can be directly powered by the on board 5V pins (If available). The Trigger and the Echo pins are both I/O pins and hence they can be connected to I/O pins of the microcontroller.



Fig 6. Ultrasonic Sensor

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To start the measurement, the trigger pin has to be made high for 10uS and then turned off. This action will trigger an ultrasonic wave at frequency of 40Hz from the transmitter and the receiver will wait for the wave to return. Once the wave is returned after it getting reflected by any object the Echo pin goes high for a particular amount of time which will be equal to the time taken for the wave to return back to the sensor.

F. IR SENSOR

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, The resistances and these output voltages, change in proportion to the magnitude of the IR light received.



Fig. 7 IR Sensor

G. CONVEYOR BELT

First stage of this project is to find the type of material to find that sensors are placed up on the conveyor belt to find. This conveyor moves with the help of two 12V DC Motor and makes the object to move from one place to another, this belt gets to move with the help of ultrasonic sensor and makes the conveyor to move with the object and next that object gets into the crusher for the next process.

H. CRUSHER

Main part of my project is the crushing unit in which the object is being crushed from larger size to that of the smaller size. the object is crushed and compressed to a smaller quantity of the material. This process is done with the help of mechanical work and crushed. when the DC Motor works on clock wise direction the plate moves in forward direction and when it rotates in counter clock wise the plate moves in back direction by this means of work the material gets crushed and the object is deposited in their respective place in which it has to be stored.



Fig. 8 Crusher Setup

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V. RESULT AND DISCUSSION

SOFTWARE & HARDWARE RESULT

As shown in the fig. 9 below the output of this program will be as show in the diagram and the resultant will be as in the following way. The hardware output for the program will be as the follow way.

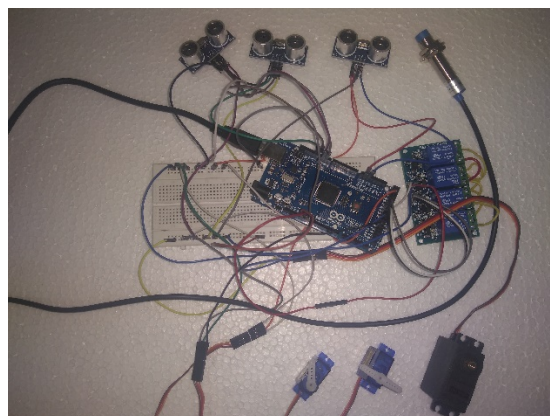
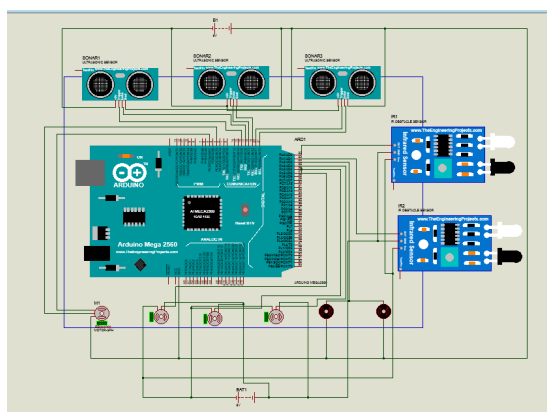


Fig. 9 software & Hardware output for the program

DISCUSSION

BY this Process, the environment will be in a clean way and safe way, and the waste material will be stored in particular place only. By this way This project will be in an helpful way and make as pollution free environment.

VI. FUTURE ENHANCEMENT

In Future this project will be in a helpful way by the separation of the material both renewable and non-renewable material are separated and sorted. In future, this can be used in places like malls, all public places that will be in a help full manner. By adding additional futures like charger to mobile phones, Laptop, and other electronic devices. By replacing that material as another material as a toy or any other product, by giving a cup of water, chocolate for children based on their age. Cost for the product could be directly send to their bank account.

In future this product can be used to separate not only as bottles but also all waste material and can be stored separately so that the product will be in an helpful manner and also in an useful asset.

VII. CONCLUSION

Waste management is one of the most important matter in our day-to-day life. This project deals with the field of pollution free environment. In which the material are separated and stored in particular field of place and that product can be used further process or that can be used to make an another object in an use full manner by concluding of all assets this project will be an help full and also will be as an environment friendly in all the way.

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