

## Article Info

Received: 17 Jan 2020 | Revised Submission: 20 May 2020 | Accepted: 28 May 2020 | Available Online: 15 Jun 2020

## Automatic Metal, Plastic and Other Dry Waste Sorter and Status Alert

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### ABSTRACT

*The nation and the world are challenging a massive issue of removal, separation and reusing of solid waste and inappropriate management of these wastes are dangerous to human well-being also natural framework to appropriately deal with the waste it must be separated, conveyed and arranged to decrease the dangers to the public life. The proposed strategy is simple and cost-effective. The separation of dry waste is proposed to categorize the trash into metallic waste and plastic waste. Since it is dry waste segregation, the technique uses a moisture sensing module to detect wet waste and if sensed thus stops working. The metal is identified by using a metal detector and the plastic by using a plastic sensing module after that they will be dumped into the allocated bins. If any other dry waste is placed which is not detected by metal, plastic and moisture sensors then the object will be dumped in other materials bin. Whenever the bins are filled the authorized persons will get notified and uploaded to cloud.*

**Keywords:** Raspberry Pi 3; Metal detector; Plastic sensing module; Moisture sensing module.

### 1.0 Introduction

In late years, the waste removal has become a tremendous reason for fear inside the world. According to 2019 article India's urban populace is around 429 million and that they produce 62 million tons of waste once every year. Out of this 5.6 million tons is plastic waste and 15 lakh tons is e-waste and along these lines the staying waste is biomedical waste and dangerous wastes. An amazing figure of forty-3,000,000 tons of Solid Waste is gathered every year, out of which just 11.9 million, which is 22-28% is dealt with, while around 31 million tons of waste is left untreated and discarded at the landfills.

Each item includes a timespan, yet tragically that is not the situation with plastics. The very truth is that our planet can't process plastic. Plastics take around 500 to 1000 years to totally corrupt gratitude to the nearness of complex polymers. Subsequently, till now what small amount bit of plastic has ever been produced or utilized by us are frequently found in some structure or the inverse on the earth. What's more, presently it's arrived at an emergency point. Researchers estimate that every zone of seas contains

around 46,000 bits of coasting plastic. According to The World Economic Forum study done on plastic contamination round the world, Oceans will have a bigger number of plastics than fish by 2050, if plastic contamination keeps on rising. India's commitment to plastic waste that is dumped into the world's seas per annum might be a vast 60%.

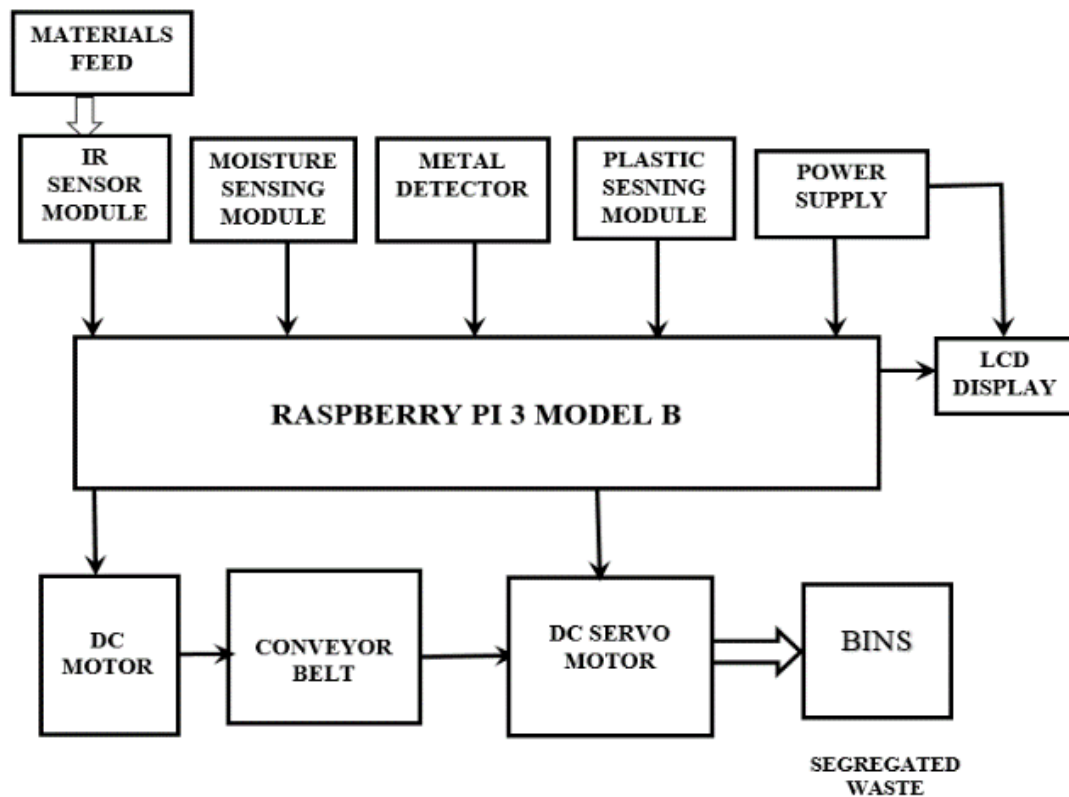
Another investigation uncovered that India has developed in light of the fact that the fifth biggest producers of e-waste inside the world. Dumping of trash with metal things into landfills will make numerous issues to individuals and to the earth by discharging lethal substances. Soil defilement from substantial metals and polycyclic fragrant hydrocarbons (PAHs) discharged metal waste processing. Since these problems can be managed by the segregation of wastes into different categories as we are concentrating only on dry waste and in that plastic and metals are there usage has been increased and so there waste production also increased.

### 2.0 Related Work

Syeda Madiha Samreen [2] this paper proposes a way for the separation of metal, glass and plastic

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**Figure 1: Block Diagram**

wastes using an Arduino Uno with ATmega328 acts as a microcontroller. The tactic uses conveyor belt which runs with a DC motor. It uses Inductive Proximity Sensor and Capacitive Proximity Sensor to sense metal, plastic and glass. When the thing is placed on the belt supported the output of the 2 sensors the objects are going to be collected into the respective bins. Kesthara.

V[3]this paper proposes a sensible bin which segregates metal waste, dry waste and wet waste using ARM processor. The inlet section is given open and shut mechanism. The metal waste is identified using detector then wet waste by using moisture sensor alongside IR Sensor. The dry waste is separated using blower mechanism since dry waste weight is a smaller amount than wet and metal wastes.

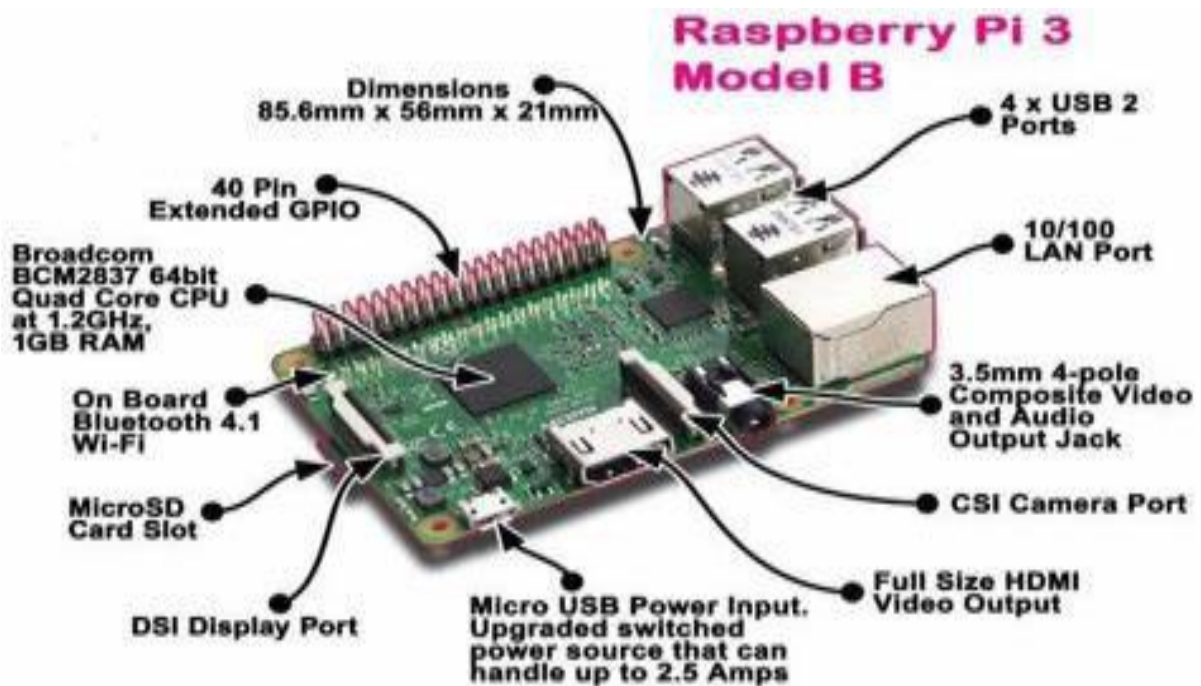
Minal Patil [4] this paper proposes Waste Segregator at Household Level uses a PIC microcontroller. The IR sensor for the thing detection, a detector for metal objects and a moisture sensor for wet waste. The inlet section contains a flap mechanism. When the thing is identified by IR Sensor then it will allow the thing to sensing module using flap mechanism. After sensing supported the

output they will be dumped into the bins they allocated for.

Rishabh Jain [5] this paper proposes Smart Garbage bin with real time monitoring using IoT. It uses an open source IoT platform based microcontroller called Node-MCU with a Wi-Fi module. An IR sensor to detect the presence of the thing. The temperature sensor, detector, moisture sensor are interfaced to Node-MCU to spot any fire, metal objects and wet waste respectively. The status of the bins is continuously monitored and shown through graphical representations using ThingSpeak. Whenever the bins are filled the authorized person are going to be intimated using E-mails and albeit any fire accidents are occurred they're going to be told using E-mails.

### 3.0 Proposed Method

The block diagram shown in figure represents the automated waste material segregator where two types of materials are segregated namely metals and in non-metals again plastic is separated. The controller used is Raspberry Pi 3. The method consists of a conveyor belt. The belts starts moving

**Figure 2: Raspberry Pi 3 Model B**

only when the object is identified and it must be dry object. If the object is identified as metal by the metal detector then the servo motor rotates with an angle of 180 degrees dumps in metal bin, else if the object is plastic then the servo motor rotates with an angle of 135 degrees dumps in plastic bin and if the object is not identified by both then the servo motor rotates with an angle of 90 degrees and throws in other bin.

### 3.1 Raspberry Pi 3 Model B

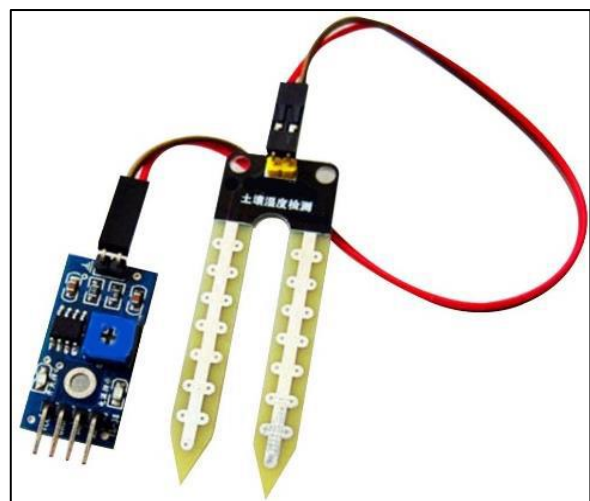
Raspberry Pi 3 Model B contains a Broadcom BCM2387 Chipset. It has 64Bit Quad-Core ARM Cortex-A53 timed at 1.2GHz. The RAM capacity is 1GB LPDDR2 SDRAM same as of Pi 2 and the GPU is Video core IV. The Raspberry Pi 3 supports on board 802.11 Wi-Fi and Bluetooth 4.1. The Pi 3 has 40 GPIO pins and 4 USB ports along with an Ethernet port. The Micro USB power input is upgraded switched power source up to 2.5Amps. The total performance of Pi 3 is 50-60% faster than Pi 2.

### 3.2 Moisture sensing module

The moisture sensing module contains a moisture sensor and it is used to detect the presence of wet content in the object.

The moisture works on the principle of capacitance to measure the dielectric permittivity of

the surrounding medium. Then the sensor produces voltage proportional to the dielectric permittivity of the water content in the object. Mostly, the moisture sensor is used for the moisture content in the soil but this can be used in different disciplines not only in agriculture.

**Figure 3: Moisture Sensor**

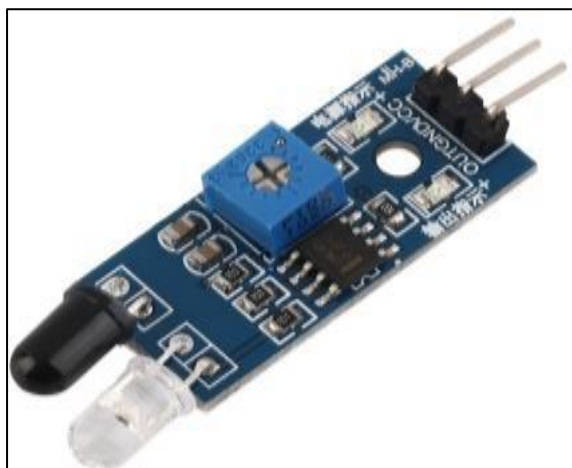
### 3.3 IR sensor module

An IR proximity sensor works by applying a voltage to a pair of IR light emitting diodes which in turn emit infrared light. The light travels in the air

and then it comes in contact with an object, it is reflected back towards the detector .when the IR sensing unit becomes active, it sends a corresponding to controller which in turn activates the other sensors.

IR Sensors work by using a specific light sensor to detect a select light wavelength in the Infra-Red spectrum. By using an LED which produces light at the same wavelength as what the sensor is looking for, you can look at the intensity of received light. When an object is close to the sensor, the light from the LED bounces off the object and into the light sensor.

**Figure 4: IR Sensor**



### 3.4 Metal detector

Metal detector work by transmitting an electromagnetic field from search coil into the ground.

**Figure 5: Metal Detector**



Any metal objects within the electromagnetic field will become energized and retransmit an electromagnetic field of their own. Here we are using LC metal detector non-contact metal induction detection module as a metal detector. When it approaches any metal, it makes a sound. This is a module specifically designed to detect metal. The module operates by including currents in metal objects and responding when it occurs. A nice onboard buzzer signals when it detects something and an onboard potentiometer allow adjustment of sensitivity. It is working with an operating voltage of 5V DC and its sensing range of detection is 1cm.

### 3.5 Plastic sensing module

The plastic sensing module contains Transmitter and ReceiverSections. This module contains IR sensors. As we know the IR sensors contains in built IR transmitter and IR receiver. Along the sides of conveyor two IR sensors are placed. Among them one side has IR transmitter and the other side has IR receiver. The IR transmitter has LED and IR receiver has photodiode. When the rays travel from transmitter to receiver section then it is identified as plastic. This is considered based on the transparency property.

### 3.6 DC servo motor

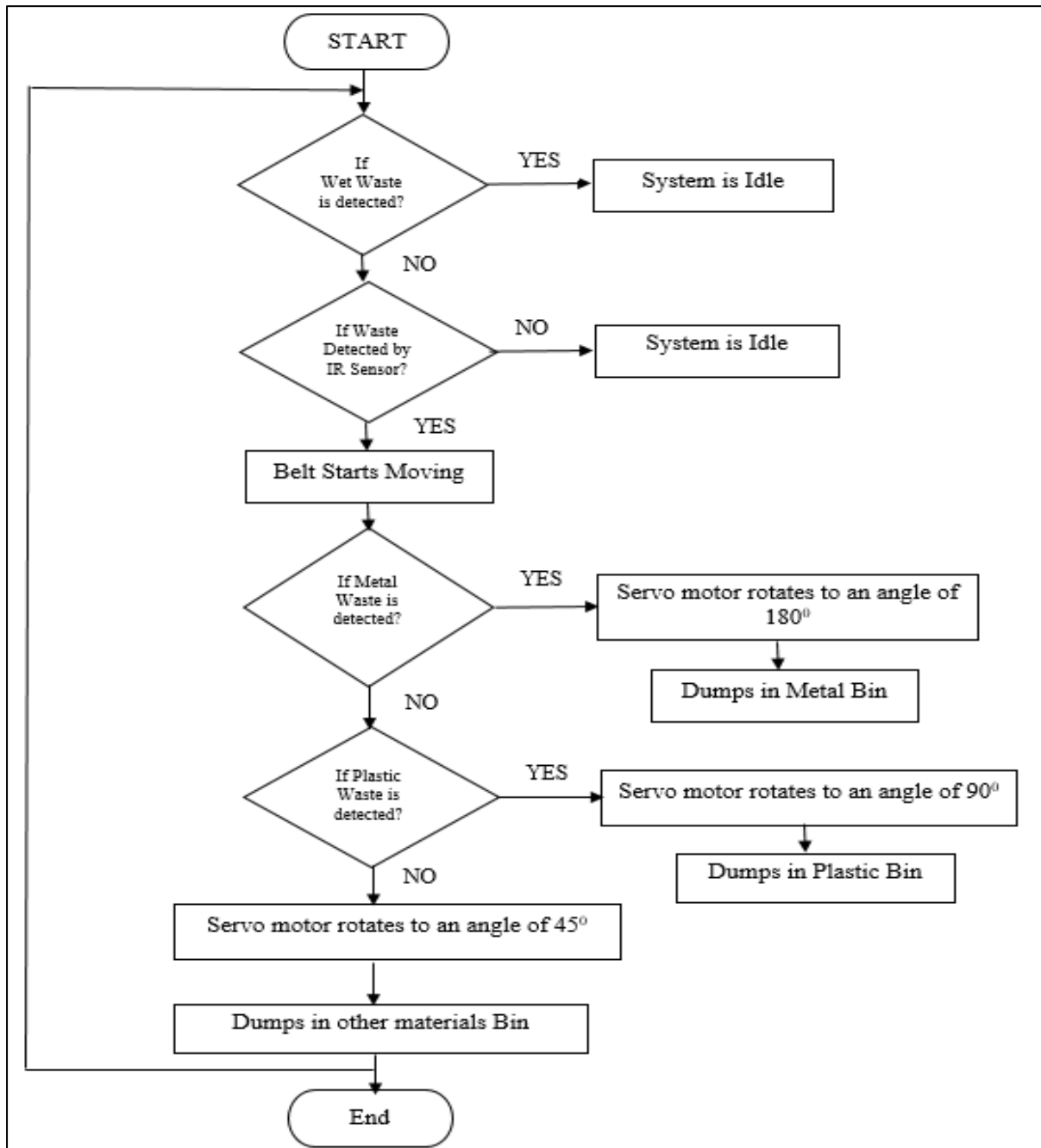
A servo motor is a linear actuator or rotor actuator that allows for precise control of linear or angular position, acceleration, and velocity. It consists of a motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed especially for use with servo motors.

### 3.7 Conveyor belt

A 12v DC servo motor is used to move the belt. This high torque motor drives the necessary 12v and 2A current from an AC to DC converter. The start and stop of the belt is controlled using a relay. The relay makes and breaks the circuit between the converter and motor to start and stop it respectively.

The belt is looped around each of the rollers and when one of the rollers is powered the belting slides across the solid metal frame bed, moving the product. In heavy use applications the beds which the belting is pulled over are replaced with rollers.

Figure 6: Flow Chart



### 3.8 LCD display

Liquid crystal display has the ability to display numbers, characters. The display is in multiplexed mode that is only one display remains on at a time. Within 1/10th of a second the next display switches on. LCDs have materials, which combine the properties of both liquid and crystals. Rather than having a melting point, an LCD consists of two glass panels, with the liquid crystal material sandwiched in between them.

Since LCD screens do not use phosphors, they rarely suffer image burn –in when a static image display on screen for a long time, the LCD screen is more energy-efficient and can be disposed of more safely than CRT can. Its low electrical power consumption enables it to be used in battery power electronic equipment efficiently than CRT.

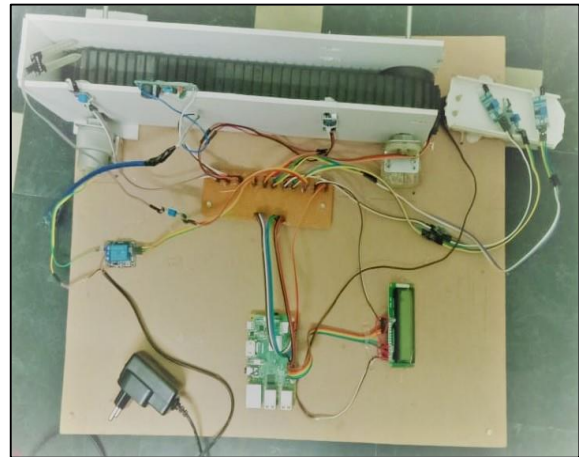


#### 4.0 Results

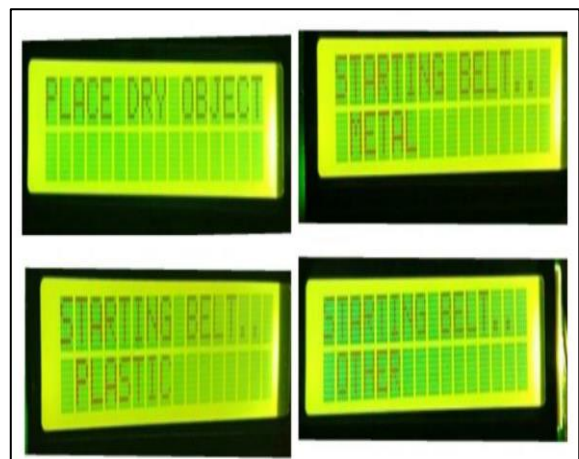
**Figure 7: Results of Automatic Waste**



**Figure 8: Results Displayed on LCD**



**Figure 9: Results in LCD Display**



#### 5.0 Conclusions

The proposed system provides simple solution for the separation of metals, plastics and other dry waste items. Since these items pollute the environment in a hazardous way. So we thought of placing this prototype at the streets which helps the municipality people in collecting waste and they can visit the place only when the bin is filled which reduces the wastage of fuel.

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