Advanced Waste Segregator with Monitoring using Arduino

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***Abstract*- This paper proposes implementation of an advanced waste segregator with monitoring using Arduino and various sensors. The waste has to be segregated and monitored properly so as to gain the golden property of the waste by recycling. Also if the waste is handled manually then there is a chance of spread of diseases and various infections. If the waste is handled with fast working segregated machine and a data of segregated waste then it reduces the chances of various diseases by keeping it far away from workers and helps industries to make a great profit by recycling them at their required pace. It is designed in such a way that it keeps an eye on the segregated waste with the help of various sensor and microcontroller.**

Index Terms- Microcontroller, IR sensor, Rain sensor, Proximity sensor, DC motor, LCD display.

I. INTRODUCTION

In this modern era sorting and disposal of waste is a major problem to the whole world. Also the huge amount of wastes have an adverse impact on the environment. At this present time, we are totally unware of the golden value of wastes i.e. the energy required to make a product by recycling is much less as compared to the raw material. Also it impacts on the cost of the product as well as less carbon emission.

The common method of disposal of the waste is by unplanned and uncontrolled open dumping at the landfill sites. This method is injurious to human health, plant and animal life. This harmful method of waste disposal can generate liquid leachate which contaminate surface and ground waters; can harbor disease vectors which spread harmful diseases; can degrade aesthetic value of the natural environment and it is an unavailing use of land resources.

The economic value of the waste generated is not realized unless it is recycled completely. Several advancements in technology has also allowed the refuse to be processed into useful entities such as Waste to Energy, where the waste can be used to generate synthetic gas (syngas) made up of carbon monoxide and hydrogen[9]. The gas is then burnt to produce electricity and steam; Waste to Fuel, where the waste can be utilized to generate bio fuels. When the waste is segregated into basic streams such as wet, dry and metallic, the waste has a higher potential of recovery, and consequently, recycled and reused. The wet waste fraction is often converted either into compost or methane-gas or both. Compost can replace demand for chemical fertilizers, and biogas can be used as a source of energy. The metallic waste could be reused or recycled.

So for easy disposal sorting of waste on the basis of type is very important. This work proposes an Automatic Waste Segregator (AWS) which is a cheap, easy to use solution.

II. OBJECTIVE

The growth of population resulted in increase of wastes and most of these wastes are dumped at any public places, farms and other places. This results in the increase of various harmful health effects on human beings, animals and in our environment. Based on a research study by various organizations the garbage waste going to increase about 250% in next 25 years. The low cost and efficient working of our project will help out to recycle most of the waste easily and also reduces health issues as it's done whole by machines. The basic aim of our project is to segregate our wastes at primary stage so that most of wastes get recycled easily and keeps our surrounding's clean. Also at industrial level the whole sorted waste material can be monitored and is recorded which is displayed on the 'LCD display'. Which is going to help industries to keep records on segregated materials.

III. SYSTEM DESIGN

The project is designed and developed in such a way that it sorts the wastes into three categories namely dry waste, wet waste and metallic waste. The whole circuit diagram along with its description are explained below:

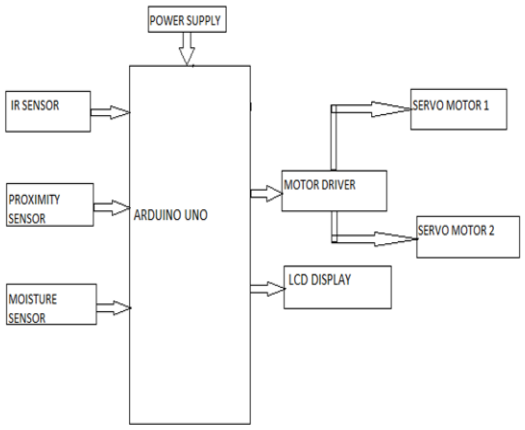


Fig 1: Block diagram of automated waste segregator.

The whole operation is controlled by the microcontroller 'AVR Atmega 328PU', the whole model is powered from a 12V battery and a 5V supply is given to microcontroller with the help of voltage regulator. Now the whole working is controlled by the microcontroller based on the inputs of various sensors. When any material gets entered it gets recognized by the IR sensor then after it moves down towards the metallic and moisture sensor, if both sensor gets output low then the material sensed as dry material and gets collected in Bin1 i.e. dry waste. If another material gets entered and is sensed by the proximity sensor i.e. a metal, then the rotating platform which is controlled by the controller and driven by the servomotor gets rotated in clockwise direction at an angle of 90 degree and the material falls into the Bin2 i.e. metal waste and the last case if any wet waste gets into the model then it is sensed by moisture sensor and the microcontroller drives the servo motor at an angle of 180 degree in clockwise direction and the waste falls into the Bin3 i.e. wet waste. Whenever any material gets deposited in any bin then the counter counts and shows it on the LCD Display about the quantity of material deposited in each box.

The whole design of the system along with the components used is as follows:

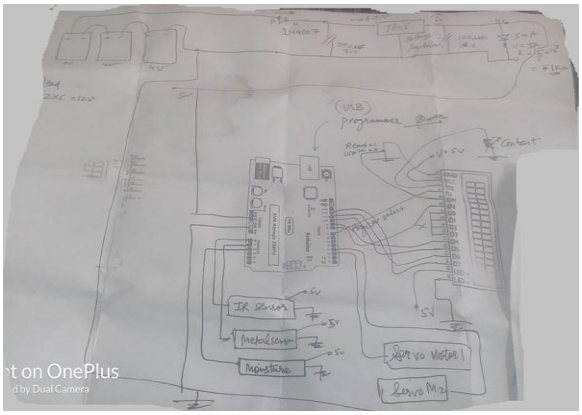


Fig 2: Circuit diagram of proposed model.

IV.DESIGN REQIREMENTS

A. Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital Input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic Resonator [6], 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 an AC-to-DC adapter or battery to get started.

Fig 3: Arduino Uno panel view.

B. Motor Driver

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction.

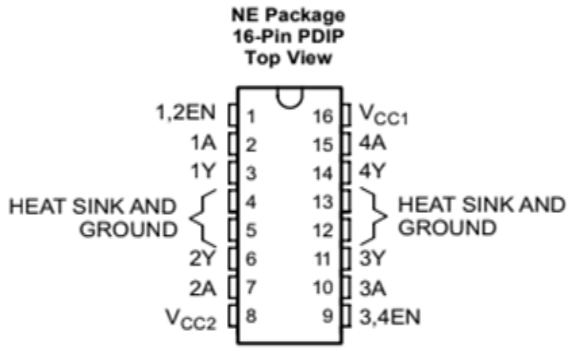


Fig 4: Pin diagram of L293D H-Bridge motor.

C. IR Sensor

The IR Sensor-Single is a general purpose proximity sensor. Here we use it for collision detection. The module consist of an IR emitter and IR receiver pair. The high precision IR receiver always detects an IR signal.

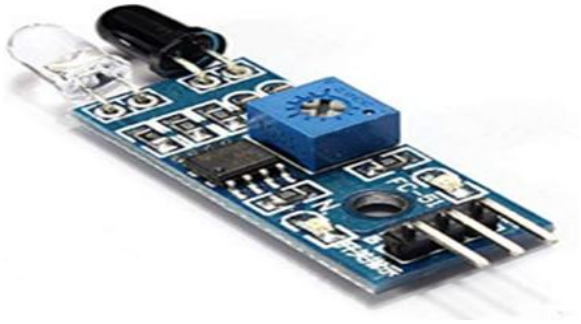


Fig 5: IR sensor

D. Inductive Proximity Sensor

Detects metal objects up to 7 cm giving active low output with LED indication & buzzer on detecting metal. The heart of this sensor is the inductive oscillator circuit which monitors high frequency current loss in coil. The circuit is designed for any metallic body detection by detecting the variations in the high frequency Eddy current losses. With an external tuned circuit they act as oscillators. Output signal level is altered by an approaching metallic object.

Fig 6: Inductive Proximity Sensor

E. Servo Motor

A servo motor is a closed-loop system that uses position feedback to control its motion and final position. In industrial type servo motors the position feedback sensor is usually a high precision encoder, while in the smaller RC or hobby servos the position sensor is usually a simple potentiometer.

Fig 7: Servo Motor.

F. Rain Sensor

The rain sensor module is an easy tool for moisture detection of wet waste materials. It can be used as a switch when wet wastes falls through the raining board and also for measuring moisture intensity [1]. The module features, a rain board and the control board that is separate for more convenience, power indicator LED and an adjustable sensitivity though a potentiometer.

Fig 8: Rain Sensor Module with control board.

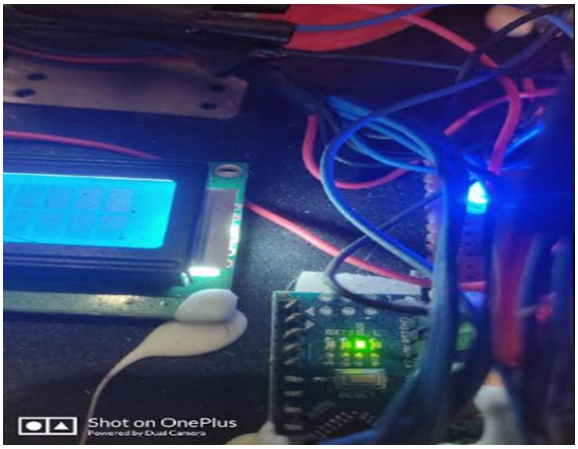
G. LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

Fig 9: LCD display of 16*2.

V. RESULTS

The Advanced automatic waste segregator when assembled properly there after we uploaded the program to Arduino Uno board. Then we try with all three types of waste material i.e. Dry, Metallic and Wet waste, it completely sorted all the wastes into proper bin box. Also the implemented working model of the whole design is as follows:



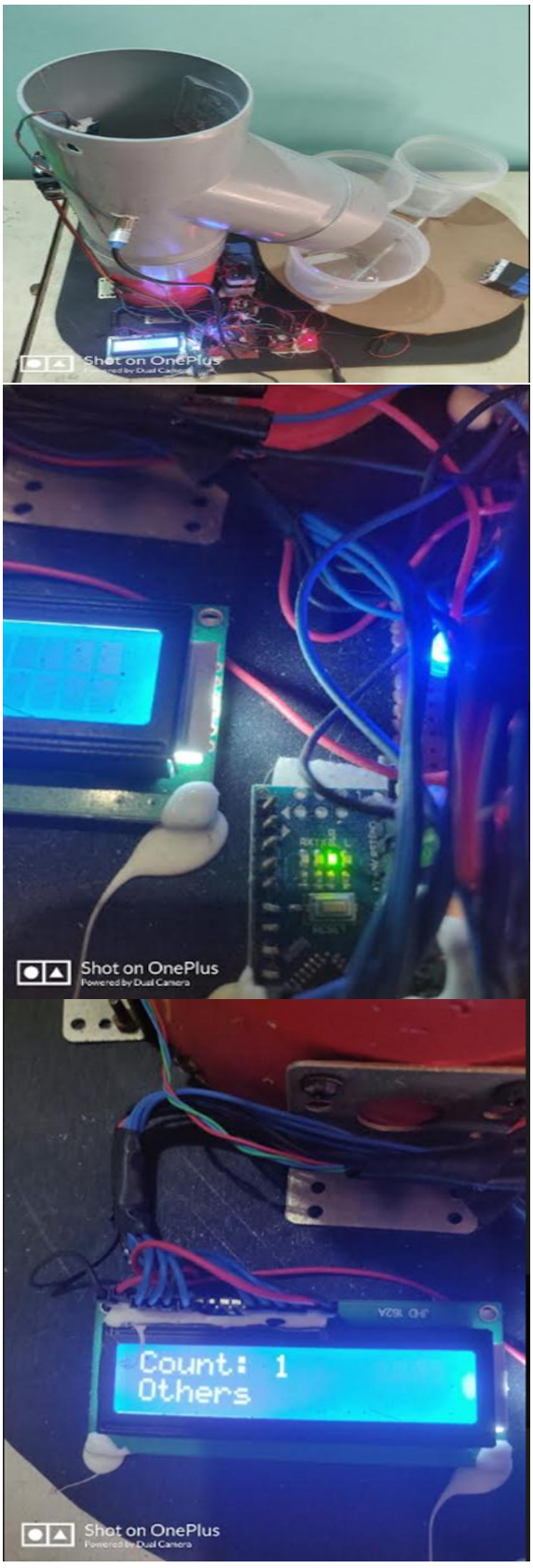


Fig 10: Proposed Implemented hardware model.

VI.CONCLUSION

This model is totally reliable and effective at both household and industrial level. All the employed sensors are working properly and also the movement and controlling of motors are smooth. It easily segregates the waste material into corresponding wet, dry and metallic waste along with its monitoring i.e. displaying information about the collection of various waste materials at different bin boxes after every entry of waste into the model. So in industries it can keeps the whole record of different materials segregated from wastes.

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