Arduino Based Waste Segregation System Using Robotic Arm

Priyanka V[1], Hemavathi R[2]
[1] PG scholar (C & I), Dept of Electrical Engineering
[2]Assistant Professor, Dept of Electrical Engineering
[1, 2] University Visvesvarayya college of Engineering Bangalore, Karnataka, India

Abstract- *Robotic arm for waste segregation is proposed for segregating the wastes as metal and other wastes. People are throwing about 79.3 % of waste which can be recycled. Solution to this is to use an automatic waste segregation system. This paper proposes such a system which is cheap and easy to use. The whole process is done in two steps. Firstly, the waste is detected by IR sensor and picked up by the robot arm. Secondly, the waste picked is sensed on the waste segregation system to segregate the wastes as metal and other wastes by means of induction proximity sensor. The waste is then dumped into the bin. The proposed system utilizes Arduino mega 2560 microcontroller programmed in embedded C using Arduino IDE software.*

Keywords- Arduino mega 2560 microcontroller, IR sensor, Metal sensor.

I. INTRODUCTION

The effective way of reducing dumped waste is segregation and recycling of the waste. People are not implementing the guidelines given by the government in disposing the waste properly and they are throwing 79.3% of waste which can be recycled and remaining 20.7% only has to be dumped into landfills.

A solution to this is to use an automated waste segregation system. This project consists of an automatic waste segregation system which is cheap and easy to use. It can be used for segregation of households so that the segregated waste can be directly sent for processing. This system segregates metal and other wastes by using inductive proximity sensor and the experimental results shows a successful segregation of the wastes using automated waste segregation system. The system consists of IR sensor to detect the waste. Once it is detected the robotic arm picks the waste and places it on the plate.

The waste placed segregated by automated waste segregator as metal waste if it is sensed by the inductive proximity sensor otherwise considered as other waste. Then the waste is dumped into the appropriate bin.

II. LITERATURE SURVEY

The aim of literature survey is to set up the importance of the overall area of Study.

[1] The proposed dustbin model consists of two dustbins named as dustbin A and dustbin B kept in public place mostly. Dustbin B cannot be used until dustbin A is full. GSM module is used to send message to the concerned authority when any of the dustbin is full in order to avoid overflow of waste in the bin. IR sensors are placed in the front to detect any person comes in front of the bin based on which there will be an automatic open or close mechanism of the bin by means of servomotor. Ultrasonic sensors are used to measure the level of waste inside the bins. Arduino UNO controller is used.

[2] The prototype is able to automatically separate the wastes into residual and recyclable wastes by employing a moisture sensor. This system uses the concept of conveyor belt to move the particular waste into the respective bin and is operated with the help of 12V DC motor. Ultrasonic sensors are used to detect the presence of waste then the moisture sensor is ready to measure the value of resistance to current of the waste. If moisture percentage is $\geq$ 10 it is wet waste otherwise dry waste. Servomotor rotates by 0 degree for wet waste and by 180 degree for dry waste.

[3] The proposed system segregates metal and non metal wastes. The robot used is mechanically able to pick up the waste and put it into the appropriate bin. It consists of two motors one for gripping movement and the other one for arm movement. It employs PIC microcontroller. Inductive proximity sensor is used to detect metal waste. Takeover is taken by the limit switch to remove other wastes.

III. BLOCK DIAGRAM

The block diagram of the proposed work is shown in the figure 1. The whole process is carried out in two steps. One is picking and placing of the waste by means of robotic arm, this requires IR sensor for detection of waste, motors for the working of the robotic arm, H-bridge to achieve the

required direction of the motor. The second step of the process is segregating mechanism. It requires induction proximity sensor. The whole process is controlled by Arduino mega 2560 microcontroller.

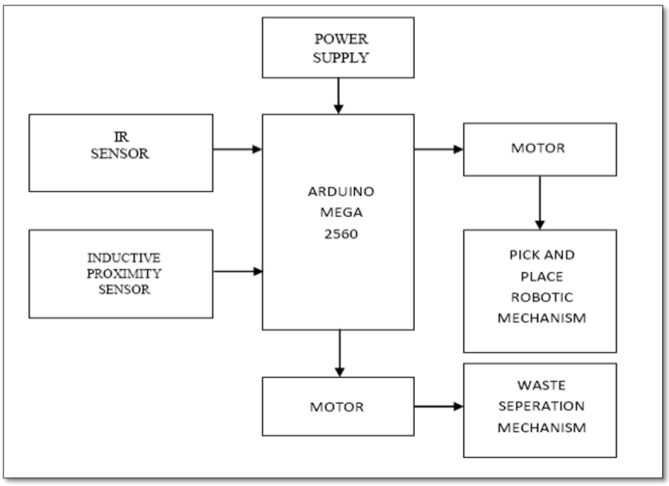

Fig. 1: Block Diagram

IV. COMPONENTS USED

4.1 Infrared sensor

Infrared sensor as shown in figure 2 is used to detect the presence of waste. It consists of transmitter which transmits infrared rays and receiver receives some of these radiations when it hits any waste. IR sensor placed in front of the system detects the waste for each movement of the robot 20 times. Accuracy is about ±0.5cm.

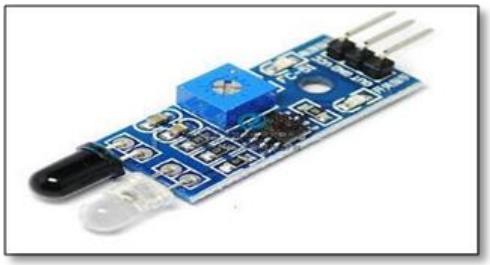

Fig. 2: IR sensor

4.2 Inductive proximity sensor

Inductive proximity sensor as shown in figure 3 works on the principle of inductance. It has four components coil, oscillator, trigger circuit and output circuit. The oscillator generates the magnetic field around the coil. When the metal waste is present in this field, eddy circuit is generated in the metallic waste. As a result it reduces the oscillator strength and triggers an output.

Fig. 3: Inductive proximity sensor

4.3 Arduino mega 2560 Microcontroller

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input or output pins among which 14 can be used as PWM outputs and has16 analog input pins. Power to the board can be given using USB connection or with an external power supply. It has a built-in LED connected to digital pin 13(When the pin is HIGH). The Arduino Mega can be programmed with the Arduino IDE software. The controller can be reset by means of software running in the computer. It has four 4 UART's. It has a 16MHz crystal oscillator. It has 16 analog inputs and each pin provides 10 bit resolution.

4.4 DC Motor

DC Motor works on the principle that when a current carrying conductor is placed in a magnetic field it experiences a mechanical force and the force is determined using Fleming's left hand rule. To change the direction of rotation of the motor H-Bridge is used.

4.5 Motor driver

L293D motor driver is an H-bridge which enables the motor rotation in both the directions. One L293D driver can drive two motors. Figure 4 shows the motor driver used in our proposed system

Fig. 4: Motor driver

4.6 Software used

Arduino IDE is open source software used here and the program is written in embedded C language.

V. EXPERIMENTAL SETUP

Fig. 5: Experimental set up of the waste segregation system

The experimental set up of the proposed work is shown in the figure 5. It consists of robotic arm and the waste segregation system. Robotic arm is used to pick and place the waste. IR sensor is used to detect the waste. IR sensor is placed in front of the base of the robotic system. It detects the waste present within a distance of 30cm. Waste segregation system is provided with inductive proximity sensor placed at the plate where the waste is placed by the robot arm. A total of seven DC motors are used. One motor is used for gripper open and close function. One motor is used for arm up and down function. One motor is used for arm rotation function. A total of three motors are used for functioning of the robotic arm.
Two motors are used for wheel movements which are provided for front wheels. One motor is used for plate movement. One motor is used for dustbin movement.

VI. CONCLUSION

The proposed prototype aims at segregating metal and other wastes using sensors and was successfully implemented using Infrared sensor, and inductive proximity sensor.

The heart of the project is Arduino mega 2560 microcontroller which is programmed using Arduino IDE software. According to the state of waste, it is segregated and dumped into the respective bin successfully. Manual collection of the waste is avoided and is made automated so that human interference can be reduced. It results in time saving also.

VII. FUTURE SCOPE

In our proposed system implementation is done for a single dustbin. Many bins can be integrated and internet of things can be used. Automatic dumping mechanism can be provided if the bin is full.

REFERRENCES

[1] G Sai Rohit, M Bharat Chandra, Shaurabh Saha, Debanjan Das-"Smart dual dustbin model for waste management in smart cities"-*2018 3rd International conference for convergence in technology (I2CT).*

[2] Nurul Nazihah Ahamad, Sarah Yasmin Mohamad, Nur Shahida Midi, Siti Hajar Yusuff, Faridah Abd Rahman-"Discrimination of residual and recyclable household waste for automatic waste separation system"-*2018 7th International conference on computer and communication Engineering(ICCCE).*

[3] V V Joshi, Rohan Ghugikar, Bhagavat Bhise, Pradip Bhawar, Shivam Kakade-"Waste segregation using smart robotic arm"-*2017 International research journal of engineering and technology (IRJET).*