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Automatic Waste Segregation

Dr. B Doddabasavana Goud[1], Mubashira Banu[2], Afreen[3], Manjula S[4], Bhagya Lakshmi[5]
[1, 2, 3, 4, 5]*Department of Electrical Engineering, R.Y.M Engineering college Ballari, Karnataka, India*

***Abstract:** Rapid increase in volume and types of solid and hazardous waste due to continuous economic growth, urbanization and industrialization, is becoming a burgeoning problem for national and local governments to ensure effective and sustainable management of waste. It is estimated that in 2006 the total amount of municipal solid waste generated globally reached 2.02 billion tones, representing a 7% annual increase since 2003 (Global Waste Management Market Report 2007). The segregation, handling, transport, and disposal of waste needs to be properly managed to minimize the risk to the health and safety of patients, the public, and the environment. The economic value of waste is best realized when it is segregated. Currently, there is no such system of segregation of dry, wet and metallic wastes at the household level. This paper proposes an Automated Waste Segregator (AWS) which is a cheap, easy to use solution for a segregation system for household use, so that it can be sent directly for processing. It is designed to sort the refuse into metallic waste, wet waste and dry waste.*

I. INTRODUCTION

According to a sanitation survey called “Swachh Survekshan-2016” conducted by the ministry of urban development under the swatch- bharat mission, it was found that about 50% people in India face the problem of improper waste collection and management. According to center of science and environment, innovative disposal and recycling methods must be introduced instead of land fill sites. Thus, we have proposed a cost effective “Automatic waste segregator and monitoring system” for proper management of waste. Automatic waste segregator categorizes the waste as plastic, metallic or organic. The monitoring system helps to monitor the waste collection process. The common method of waste disposal is by unplanned and uncontrolled dumping at landfill areas. This method is hazardous to human health, plant and animal life. When the waste is segregated into basic streams such as plastic, metallic and organic, the waste has a higher potential of recovery, and then, recycled and reused. The abundant increase in population led to the improper waste disposal. Waste disposal is a huge cause for concern in the present world. The disposal method of a voluminous amount of generated waste has had an adverse effect on the environment. 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 can contaminate the surface and ground waters; can harbour disease vectors which spread harmful diseases; can degrade aesthetic value of the natural environment and is an unavailing use of land resources. There exists chance for missing bills, absence of consumer etc. Even though these conventional meters were replaced with more The economic value of the waste generated is not realised unless it is recycled completely. Several advancements in technology have 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. 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 into either compost or methane gas, or both. Thus, the Automated Waste Segregator has a lot of applications in the management of the waste. The system separates the waste in different bins under the category of wet, dry, metallic waste. Different sensors are used for the detection of the type of waste. The level of the garbage in the bins is monitored continuously so that the bins don’t overflow and they are emptied timely. The notification is sent to the concerned authority with the location at which the bin is placed.

II. METHODOLOGY

The Automatic Waste Segregator System is driven by the Microcontroller Arduino UNO. All the components that are connected to Arduino UNO are programmed using the Arduino IDE. The program is written in Embedded C language and it reads the input/output pins of the components. The conveyor belt system moves when it senses the garbage. The servo motors are present to deflect the wet, dry and metallic waste into the specific bins. The metallic waste is detected by Inductive Proximity sensors. The dry waste has paper and plastic which are differentiated using the Capacitive Proximity sensor. The wet waste is examined with the help of Moisture sensor.

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The measure of the dustbin level is calculated by the Ultrasonic sensor connected at the edge of the dustbin. When the dustbin is full, a message- BIN IS FULL is sent to the cleaning authorities. The message is sent using the GSM module that provides the communication between the bin and the authority. The location of the bin can also be sent. The location is known with the usage of GPS module that is connected to the system. The fig.1 shows the stepwise working of the whole system.

Fig. 1 Flow diagram of the Automatic waste segregation.

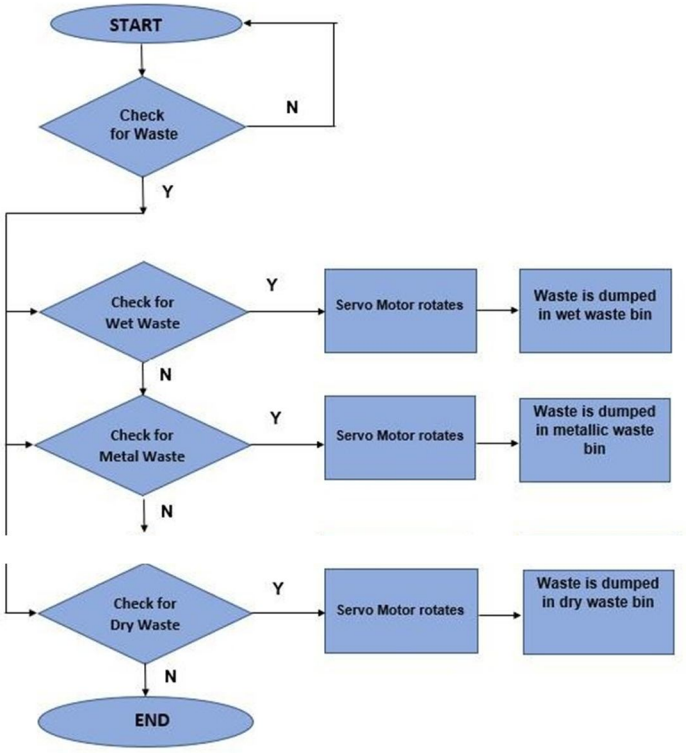


Fig .1. Flow diagram of proposed system

III. HARDWARE REQUIREMENTS

ARDUINO UNO- It is an open-source electronics platform dependent on simple to interface hardware and execute programming. The assortment of chip and controllers is done with the help of Arduino board structures. The Arduino boards are equipped with 14 digital pins for input or output, and 6 analog pins for input that are used to interface different circuits. The customization of microcontrollers is done by utilizing Embedded C and C++ programming codes. Arduino microcontroller gives an Integrated Development Environment (IDE) that supports different programming languages. Current Arduino boards are programmed by means of Universal Serial Bus (USB).

LCD Display - This lcd are very commonly used in most of embedded projects. It's cheap in price, Availability and programmer friendly we see this 16x2 lcd display in our day-to-day life such as calculators. We use 16x2 display because it has16 columns and 2 rows.

Connecting wires- Connecting wires are used to make the flow of current in the circuit These connecting wires are used in the circuits, bread board and in the internalconnections of the circuits. These wires are made up of a copper.

A. For Segregation

1) *Servo Motor*- It is used to deflect the waste to the respective bins. A servomotor is defined by a rotary actuator or linear actuator that takes into account exact control of angular or linear position, velocity and acceleration. A suitable motor is coupled to a sensor for obtaining position feedback. The digital or analog input control signal represents the position directed for the output shaft.
2) *Wet Sensor*- It is used to identify if the garbage is wet or dry. The content of moisture in the waste is tested and accordingly it is dropped in the appropriate dustbin.

3) *Metal Sensor*- The presence of objects is detected without any physical contact with the help of metal sensor. It detects objects by emitting electromagnetic field or electromagnetic radiation and observes the changes in the field or return signal. The Inductive metal sensor is used to identify the metallic waste. For the identification of paper and plastic Capacitive metal sensor is used. It also differentiates between them as paper and plastic have different permittivity value. converting electrical signals into ultrasound. It is then reflected by the obstacle and received by the receiver that converts the ultrasound into electrical signal. The reflected signals are used to interpret the position of the garbage in the bin.

4) *IR Sensor*- This module consists mainly of the IR Transmitter and Receiver, Op- amp, Variable Resistor (Trimmer pot), output LED along with few resistors. The 5 VDC supply input is given to the VCC pin and the supply negative is connected to the GND terminal of the module. When no object is detected within the range of the IR receiver, the output LED remains off.

Fig. 2 Block diagram of the proposed system and Fig . 3 Output model of proposed system.

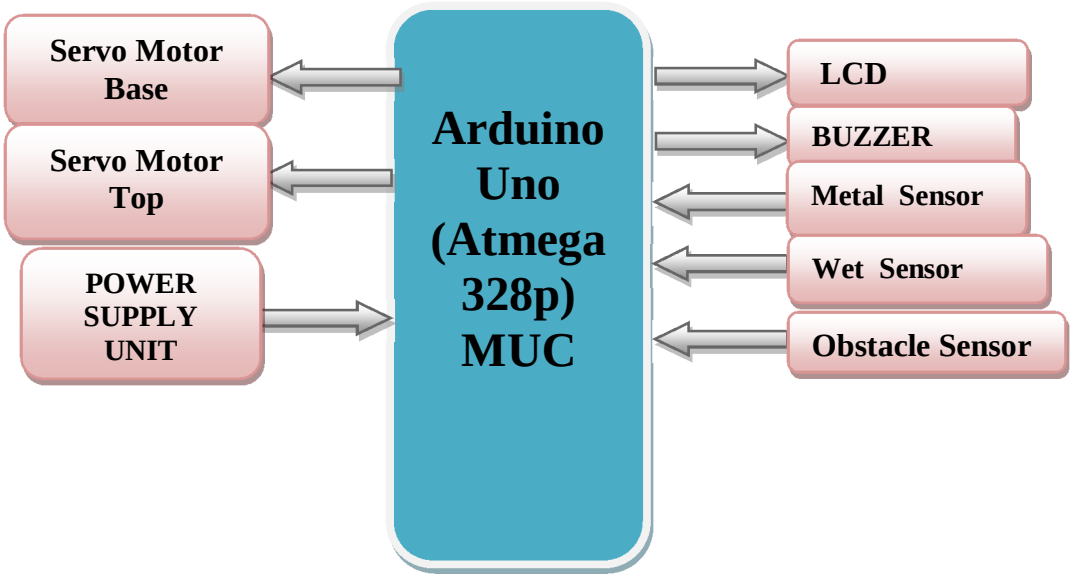


Fig 2 : Block Diagram of Automatic waste segregation

IV. WORKING PRINCIPAL

When waste is thrown in pipe, IR sensor will sense the waste. Waste is divided into three categories namely Wet, Dry and Metallic. Another sensor will sense the garbage category. As per the algorithm used, if the waste is metallic then the mechanism will bring the metal collecting bin below the pipe and with the help of servo motor the waste will fall into the metal bin. Similarly, the process will repeat if wet waste is sensed. If the sensor doesn't activated both the sensor category then waste will be considered to be a dry waste.

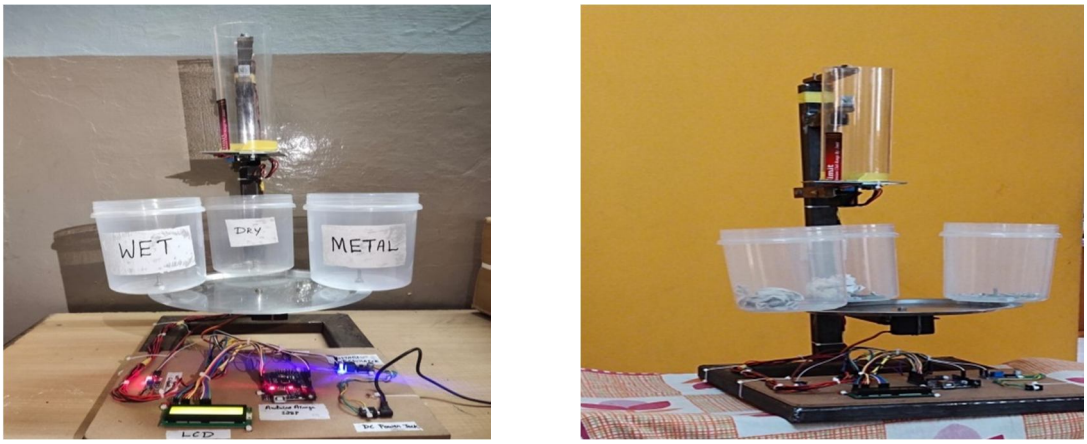


Fig 3 : Output Module

V. SOFTWARE REQUIREMENTS

ARDUINO IDE- A cross platform application comprising functions that are coded in Embedded C and C++. The programs are written and uploaded to Arduino boards using the IDE. In this system, the program is written in Embedded C for the working of the hardware components. The program consisted of separate methods for the detection of metallic, dry and wet waste. One method was written for sending the message to the authorities along with the location of the bin. The location of the bin was determined by another method that programmed the GPS module. The program code written on Arduino IDE was then fed to the Arduino for the working of the whole system.

VI. ADVANTAGES

1) Keep the environment clean and fresh.
2) Reduces environment pollution.
3) The automatic segregation process reduces manpower.
4) System is automated, efficient, time savings and easy to control.

VII. FUTURE SCOPE

1) This type of product can be used in housing societies, offices etc. Since it is cost effective, it can be implemented on a large scale as well, with some modifications.
2) Using a robotic arm along with a conveyor belt will make the process of segregation easier.
3) Also more sensors can be used to segregate bio-degradable and non-bio-degradable waste, plastics, recyclable waste, e-waste and medical waste.
4) The project can further be implemented in industries on a larger scale in order to make the correct choices for disposal of hazardous wastes.

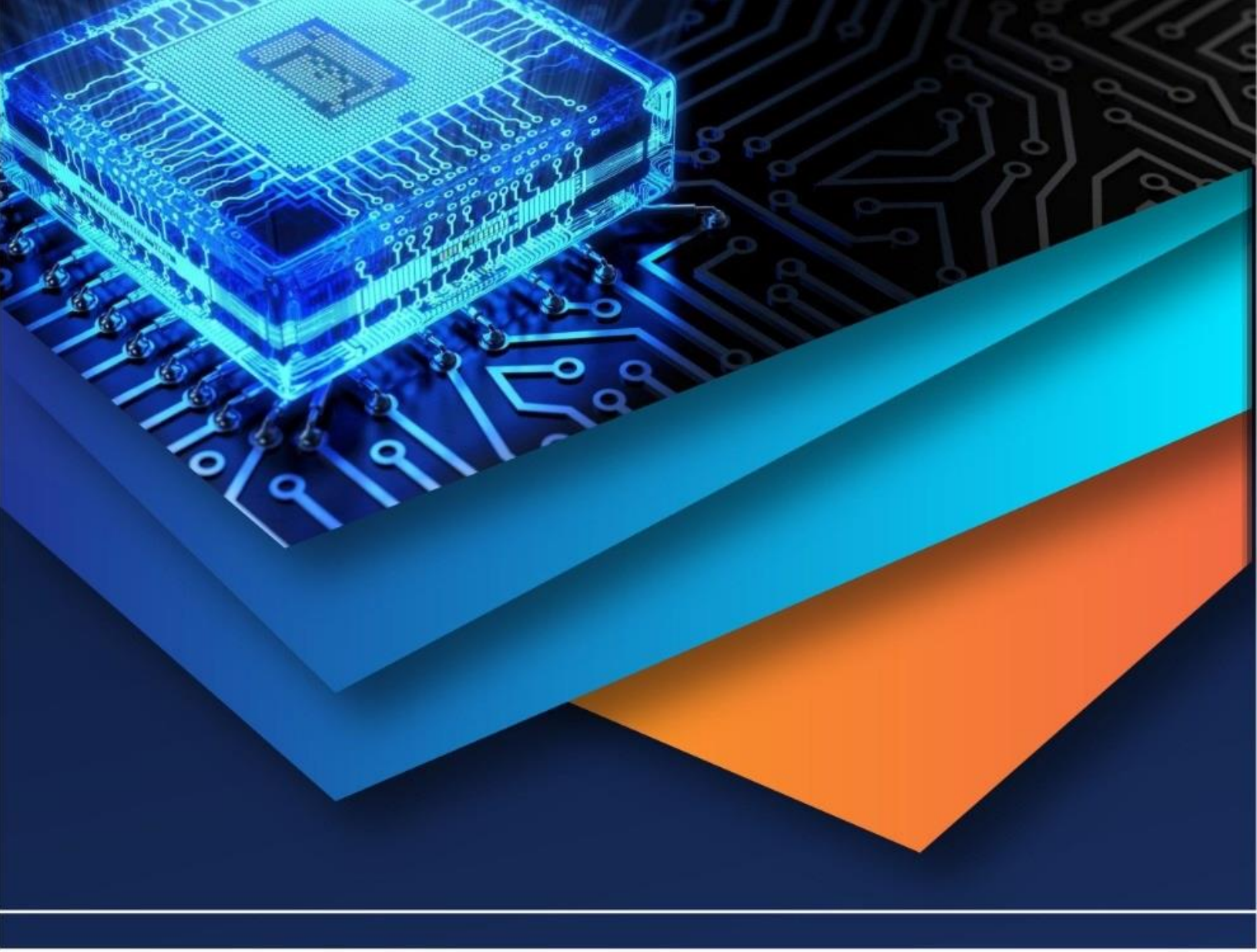
VIII. CONCLUSION

This project proposes an Automated Waste Segregation (AWS) which is a cheap, easy to use solution for a segregation system for household, so that it can be sent directly for results show that the segregation of waste into metallic, wet and dry waste has been successfully processing. Experimental implemented using the AWS. With the future scope the bins can be made solar powered with better segregation techniques like digital image processing and the waste collected in the bins can be made compact to increase the storage capacity. We analyzed the solutions currently available for the implementation of IoT and segregate the wet, dry and metallic waste. The model developed in this paper is efficient and durable since it requires less power and equipment for its operation. The model segregates wet, dry and metallic waste. This efficiently reduces man power, wastage of time and is very convenient to use.With the future scope the bins can be made solar powered with better segregation techniques like digital image processing and the waste collected in the bins can be made compact to increase the storage capacity.

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