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AUTOMATED WASTE SEGREGATOR

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ABSTRACT: The rapid growth in the population has also led to the surge in the volume of waste being generated on a daily basis. This increase in the generation of waste due to continuous growth in the urbanization and industrialization has become a severe problem for the local and the national government. It is also posing a serious problem for the local authorities to manage the wastes being dumped everywhere as landfill. To ensure the minimal risk to the environment and human health, it is necessary to take meticulous measures when segregating and transporting waste. Segregation of waste in a proper manner brings to the limelight actual economic value of the waste. The traditional method used for segregating of waste in India is through rag pickers which are time-consuming and can have adverse effects on the health of the people who are exposed to such wastes. Here we propose the use of an Auto Waste Segregator (AWS) which is cheap and also an easy to use solution for segregation of household waste. It is designed to segregate the waste into three categories viz. metallic, dry and wet waste. The system makes use of moisture sensor and IR sensor for the segregation of wet and dry waste and inductive proximity sensor for the detection of metallic waste and an LCD display for displaying the result of segregation. It is evident from experimental reports that segregation of waste using AWS has been successful.

Keywords: waste, segregation, sensor, also, metallic, problem, local, segregating, heal

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I. INTRODUCTION

With the world experiencing rapid population growth, the accompanying surge in waste generation has become a pressing concern for both local and national governments[1]. The expansion of urban areas and industries has only exacerbated this issue, making waste management a significant challenge[2]. The indiscriminate dumping of waste in landfills poses serious threats to both the environment and human health[3]. To address this problem effectively, it is crucial to adopt meticulous measures for waste segregation and transportation.[4]

Traditional methods of waste segregation, such as those involving rag pickers, are not only time-consuming but also pose health risks to those involved[5]. In light of these challenges, the introduction of an Auto Waste Segregator (AWS) presents a promising solution. The AWS offers a cost-effective and user-friendly approach to household waste segregation, with the capability to categorize waste into three main groups: metallic, dry, and wet waste.[6]

The functionality of the AWS relies on various sensors, including moisture sensors, IR sensors, and inductive proximity sensors[7]. These sensors enable the system to accurately differentiate between different types of waste, ensuring efficient segregation. Additionally, the AWS features an LCD display to provide real-time feedback on the segregation process, enhancing its usability and effectiveness.[8]

Experimental reports have shown promising results for waste segregation using the AWS, underscoring its potential to revolutionize waste management practices[9]. By embracing innovative technologies like the AWS, communities can mitigate environmental risks and promote sustainable waste management practices for the benefit of current and future generations[10].

RESEARCH OBJECTIVES

Following are the research objectives, which the researcher has framed in order to conduct the study.

- To investigate the impact of rapid population growth on waste generation and its management at local and national levels.

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- To assess the effectiveness of traditional waste segregation methods, such as rag pickers, in comparison to automated solutions like the Auto Waste Segregator (AWS).To evaluate the uses of graphene
- To explore the economic value of properly segregated waste and its potential contribution to sustainable waste management practices.Evaluating the water absorption properties of graphene.
- To evaluate the health and environmental risks associated with improper waste segregation and disposal methods.
- To examine the feasibility and scalability of implementing the AWS as a cost-effective solution for household waste segregation in urban areas.

II. RESEARCH METHODOLOGY

Our prediction model is trained to categories 5 types of waste i.e., paper, cardboard, glass, plastic and metal. Hardware components includes camera used to take picture of the waste item to be segregated, processor to predict the type and send appropriate signal to the microcontroller which moves the conveyer belt and the bins such that the waste item is segregated properly. First a picture of the waste object which needs to be categorized is taken. This image is sent to the processor where the image is sent to a CNN network which is trained to categories the input image into paper, cardboard, glass, plastic or metal. The CNN network will give predictions of the image for all these 5 categories ranging from 0-1. Whichever category get high prediction, that category is the predicted category of the input image. According to this prediction, appropriate signal is sent to a microcontroller. This will control the movement and rotation of conveyer belt and the bins. In our model we have three bins two of which are assigned to different type of waste (for example, plastic and paper) which can be changed at any time and the remaining bin will be marked as other. If the signal received by the microcontroller specifies waste type which is allotted to any bin, the bins will rotate such that the bin allotted to the predicted waste type is in front of the conveyer belt otherwise, the bin allotted for ‘other’ category will be moved in front of the conveyer belt such that the object

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is segregated into its respective bin.

The proposed Automated Waste Segregator project aims to revolutionize conventional waste management practices by introducing an innovative system that automates the process of waste segregation. Leveraging advanced sensor technology and machine learning algorithms, the system will efficiently sort various types of waste materials, including plastics, glass, paper, and metals, into separate containers for recycling or proper disposal. By eliminating the need for manual sorting, the Automated Waste Segregator will significantly reduce labor costs, minimize human error, and enhance the overall efficiency of waste management operations. Moreover, by promoting recycling and proper waste disposal practices, the system will contribute to environmental sustainability efforts and support the transition towards a circular economy.

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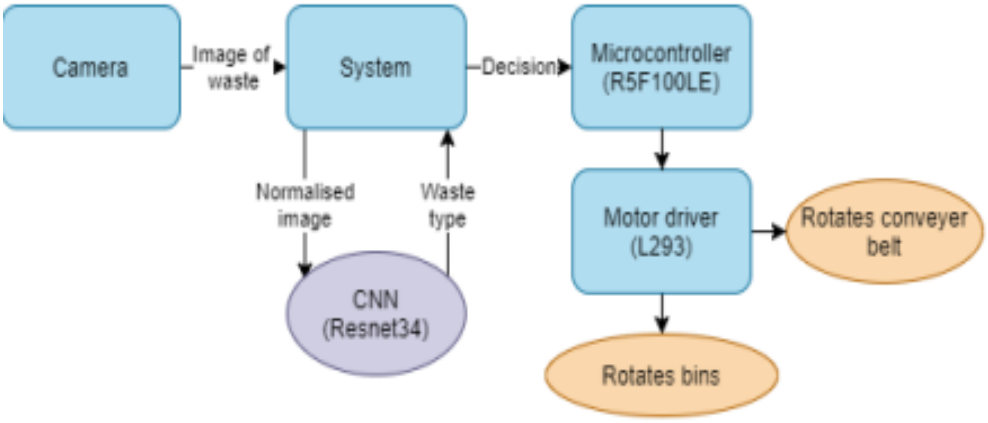

Figure 1: Flow Diagram

HARDWARE SPECIFICATIONS:

1) FOR SEGREGATION: CONVEYOR BELT

The belt is the moving object of the system. The system is a combination of at least two pulleys that ensure circular movement of the belt which pivots about them. The belt and the object placed on it move forward as the pulleys are powered. The pulley which is powered is the driver pulley and the unpowered pulley is the idler pulley.

2) DC MOTOR

It is utilized to drive the conveyor belt. It is interfaced with the Arduino UNO by means of L298 bridge IC. The direct current energy is converted into mechanical energy with the help of the rotational motor. A variable supply voltage is used to control the speed of the engine. The speed is also affected by changing the quality of current in the field windings.

3) 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,

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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.

4) MOISTURE 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.

5) PROXIMITY SENSOR

The presence of objects is detected without any physical contact with the help of proximity sensor. It detects objects by "emitting electromagnetic field or electromagnetic radiation and observes the changes in the field or return signal." The Inductive proximity sensor is used to identify the metallic waste. For the identification of paper and plastic Capacitive Proximity sensor is used. It also differentiates between them as paper and plastic have different permittivity value.

6) FOR DETECTION OF WASTE LEVEL:

- **ULTRASONIC SENSOR**

  It is used to keep check on the garbage level of the bin. The acoustic Ultrasonic sensor is divided into three categories: receivers, transceivers and transmitters. The transmitters radiate the ultrasound by 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.

- **GSM MODULE**

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Mobile telephone technology is used in GSM to provide a data link to a remote network. It is like a sim that is connected to the Arduino along with various types of data obtained from the board. The board has pins to take out +5V or other values of power and ground connections. TTL-level serial interface with the host is implemented in this technology.

GPS MODULE- It is a routing device that is connected with the Arduino UNO that uses the Global Positioning System (GPS) to determine the location of the bin. The recorded location is sent to the authorities using the GSM module embedded in the unit. Fig. 2. Block diagram of the proposed system

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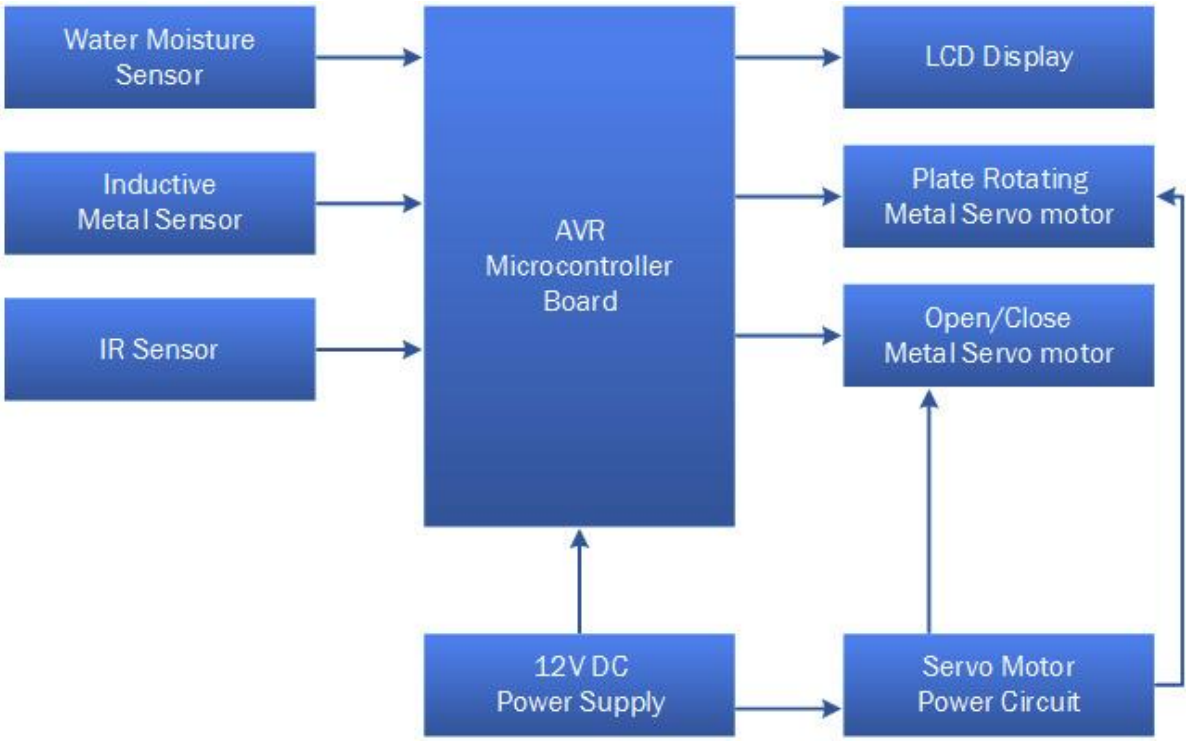

Figure 2:Block Diagram

EXPERIMENTAL SECTION:

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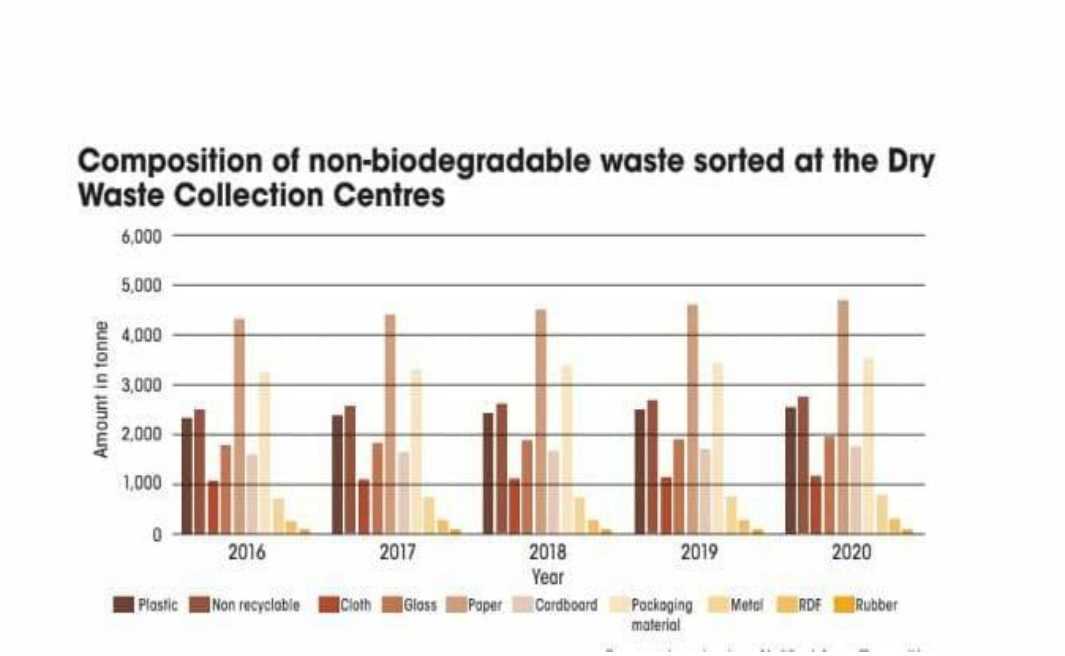

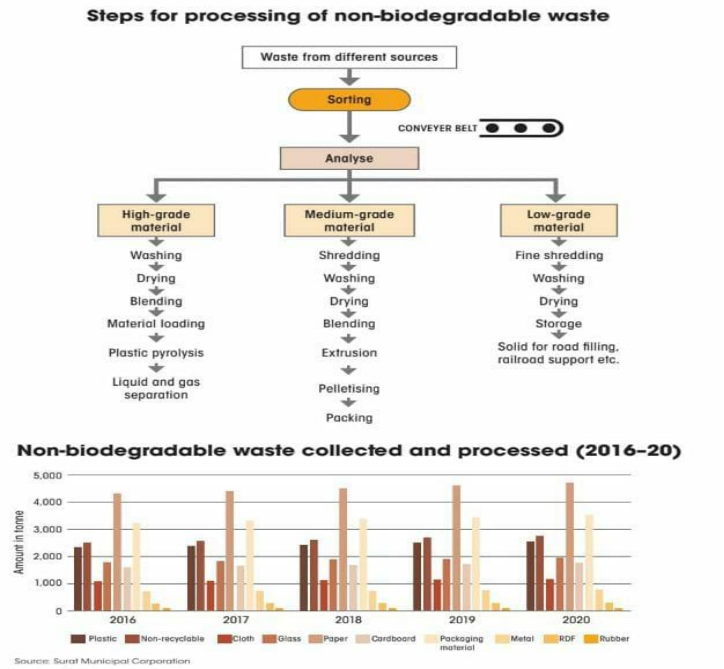

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FUTURE SCOPE:

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. Using a robotic arm along with a conveyor belt will make the process of segregation easier. Also, more sensors can be used to segregate bio-degradable and non-bio-degradable waste, plastics, recyclable waste, e-waste, and medical waste.

CONCLUSION:

Implementation of this system at a local level like societies, educational institutes, etc. can reduce the burden on the local authorities. The automatic waste segregator is one small step towards building an efficient and economic waste collection system with a minimum amount of human intervention and also no hazard to human life. makes the system far-effective and also easier to install and use at a domestic level. Segregating all these wastes at a domestic level will also be time-saving. While implementing our system we came across many problems like the sensing range of inductive proximity sensor, the accuracy of the moisture sensor, adjusting the range of IR sensors .AUTOMATED WASTE SEGREGATOR

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