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AUTOMATIC SEGREGATION OF WASTE USING ROBOTIC ARM

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Abstract - *As the world is in the stage of upgradations, there is one stinking problem we have to deal with Garbage. Waste segregation and recycling are effective ways ofreducing dumped trash. Recycling is done manually by sorting the waste by the human interface. To reduce human interface and to make systems smarter. We implemented a system for collecting and segregating waste into dry and wet with no human interface. The system designed with inbuilt sensors to detect and segregate the waste, along with an arm to pick and place the waste into separate bins designed for dry and wet waste.*

Key Words: **Arduino, Ultrasonic Sensor, Wi-Fi Module, IR Sensor.**

1. INTRODUCTION

A rapid increase in volume and types of solid and hazardous waste as a result of 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 are to be properly managed to minimize the risks 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 for the segregation of dry and wet waste.

This paper proposes an Automated Waste Segregator (AWS) which is a cheap, easy to use solution for a segregation system at households so that it can be sent directly for processing. It is designed to sort the refuse into wet waste and dry waste. The AWS employs capacitive sensors to distinguish between wet and dry waste. Experimental results show that the segregation of waste into wet and dry waste has been successfully implemented using the AWS. This system employs an IR sensor moisture sensor and an ultrasonic sensor to perform the various operations. It consists of dc motors to drive the system. A Wi-Fi module is incorporated to get the notifications respectively when a certain action is performed.

2. LITERATURE SURVEY AND SUMMARY

In [1], the basic idea behind this project is to implement a smart way of handling the garbage which is done by using the IoT protocol for the dustbin status wirelessly, through email to notify the concerned persons that the system is filled with garbage and need to be replaced. The Espresso chip which is a NodeMCU ESP8266 platform is selected along with ultrasonic sensor and LCD interfacing for current status display. This system is based on IoT protocol. The working is based on the Arduino platform. This microcontroller controls the movement of Dustbin on a specific path defined by a line or the path can be pre-programmed in the device. The LCD, Ultrasonic Sensor, Proximity Sensor, Wi-Fi module (ESP8266), and Motor Driver (L293D) are interfaced with the Arduino UNO board. If someone wants to put the garbage in it, then the person can stop the dustbin by

Keeping a hand in front of it. Notification is displayed on LCD and also transfers the message through the Wi-Fi module– ESP8266. This module transmits and receives data on a web server. It collects information from proximity sensors, ultrasonic sensors and also controls the movement of a dustbin.

In [2], the system aims to schedule trucks by finding the shortest path for waste collection. This system sets up smart waste bins/ trash cans per society, which will be IoT enabled. It transmits information about dustbin fill status and harmful gas levels. It finds an efficient route to collect maximum waste with less cost and fuel. The system provides estimated dates for collection of waste, Real-time bin status, expected fill updates for the bins, and optimized the shortest path for waste collection. This is a bin monitoring system for waste collection. The trucks landing at our doorstep irregularly for waste collection discard their further path if they get filled at some point. Eventually delaying the collection of waste in some regions. This leads to waste accumulation in such regions. To avoid such condition this system is introduced for scheduling trucks for waste collection.

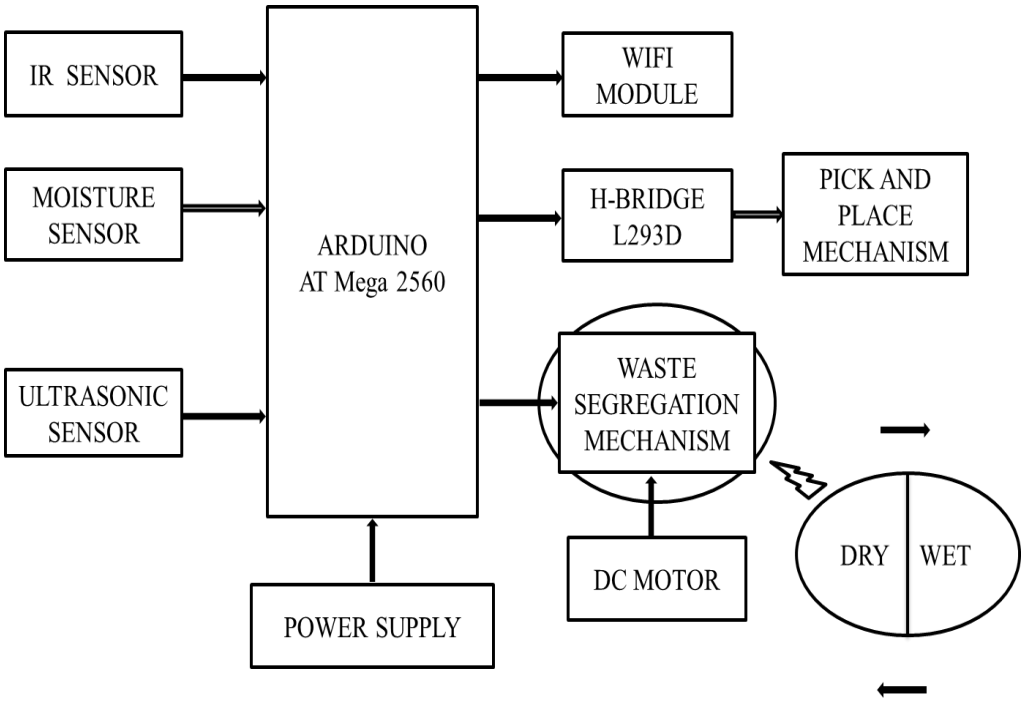
The waste which generates harmful gases needs to be collected earliest so that harmful gas levels in the atmosphere can be reduced. Bins are composed of sensors and communication technology which senses the level of waste in bins and measures toxic gases. It sends information through GSM/GPRS communication from the bin to the server, which includes GSM/GPRS connectivity to each bin causing a large increase in operating cost. The data sent are received and stored by workstation, then the shortest distance is calculated and also pick- up dates are estimated.

In [3], this paper describes the application of —Solar Smart Bin in managing the waste collection system of an entire city. A smart city is incomplete without a smart waste management system, as they play a vital role in keeping the cities/towns clean & hygienic and also provide a better public image for the tourists coming from all around the world. This Solar Smart Bins proposed to manage the waste collection system of the entire city. The module consists of two bins, one for crushing the biodegradable waste such as plastic/paper cups and glasses, and various other materials and the other bin is used for storing the bottles, tins, etc. It is being designed in such a way that, energy-efficient data aggregation from a large number of bins even under the harsh environmental conditions can operate significantly and is reliable and accurate. The principle used for measurement is locating the level of object by the reflected sound waves so-called echo sounding. GSM module consists of SIM800A. It requires 5V DC voltage and current consumption of 500mA.

In [4], the proposed model has two dustbins (named as Dustbin A and Dustbin B) which will be kept at public places mostly. Dustbin A can be used but Dustbin B cannot be used until Dustbin A is full. Dustbin B can only be used once Dustbin A is full and then Dustbin A will not open until the waste is cleared in the Dustbin A. Whenever any dustbin is filled up, a message is sent to the concerned authority. This will avoid the overflow of waste in the bin. Dustbins have automatically closed and open features depending on the presence of an obstacle. The proposed system consists of double dustbins, where second Dustbin B cannot be used until and unless Dustbin A is filled. Dustbin B can only be used once Dustbin A is full and then Dustbin A will not open until the waste is cleared in the dustbin A. Two IR sensors are placed in the front of the bins so that whenever any person comes in front of dustbin it opens and closes automatically using a servo motor. An ultrasonic sensor is used to measure the level of waste inside bins. Once the Dustbin A or B gets filled up a message is sent to the concerned authority via GSM module.

3. METHODOLOGY

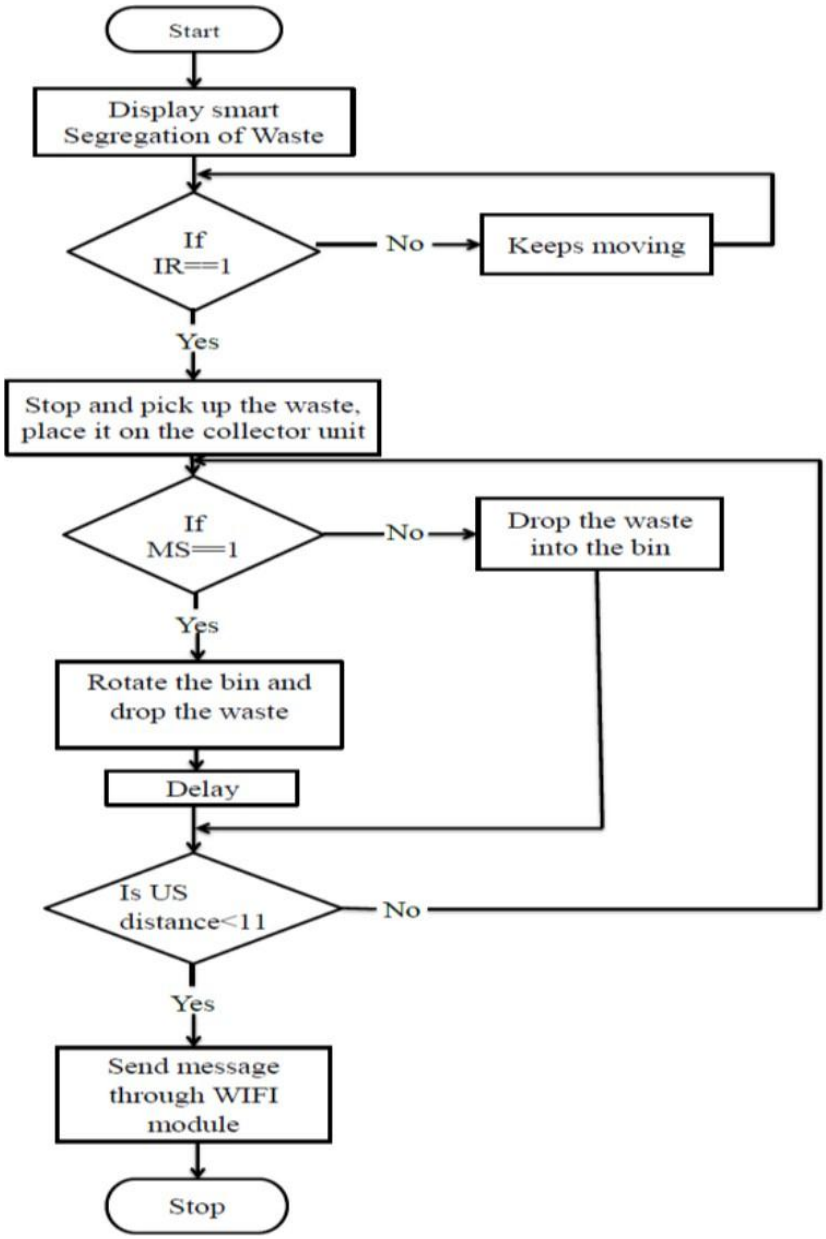
3.1. Proposed Block Diagram



In this project, the ROBOT is designed using DC Motors and Motor Drivers. The ROBOT will sense the presence of waste on a conveyor using IR Sensors. After that, the gripper will pick the waste and at the gripper, there are two types of sensors. The sensors are Moisture, metal proximity, and limit switch. The metal proximity sensors are used to sense the metal type waste and the limit switch is used to sense the other waste except for the metal. Soil Moisture sensors are used to sense agriculture or wet waste. As the sensors sense the waste the bin placed at the vehicle will move accordingly. ARM will drop the waste in the proper section of the bin. WI-FI module used here to send the intimation to concerned authority once the separation is over and even when the bin is full. The Block diagram shows the different components used in the Smart Dust bin System is Power Supply, IR Sensor, Metal Sensor, and Moisture Sensor ARM. The sensor is connected in dustbin it is used to detect the level of dustbin where dustbin is full or empty.

With the help of sensors, the system can segregate the waste collected in collection Point. In turn, the Controller initiates Robotic arm to collect the waste and segregate accordingly. Three Separate storage based dustbin is designed for automatic waste collection and segregation. As soon as the ultrasonic sensor senses that the garbage container reached its maximum capacity.

3.2. Flow Chart



4. RESULTS

This system provides a Robotic solution for Garbage segregation. A pick and Place mechanism is used for separation. Use of Sensors like Moisture for Waste separation such as wet and dry. Planning for enabling the collection of garbage generation data. This checks the waste level over the dustbins by using the Sensor. Once it detected immediately this system alert to concern authority through the WIFI module. The below figures shows the snapshots of the results obtained.

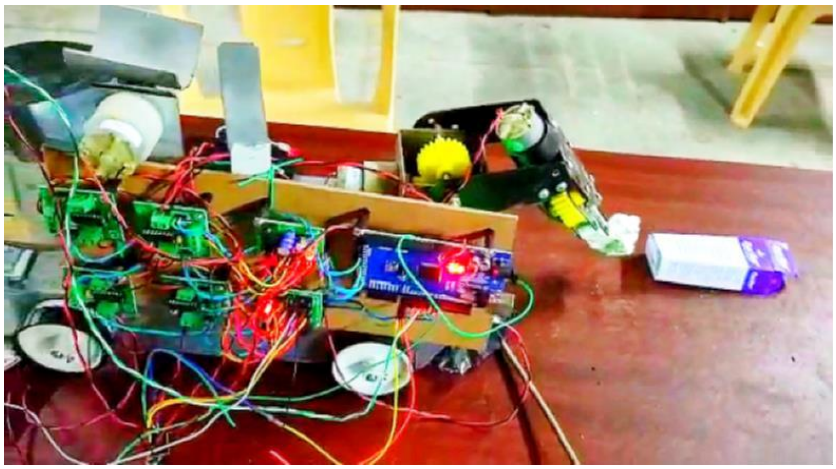


Fig-1: Once the sensor detects the waste, robot stops and arm picks the waste.

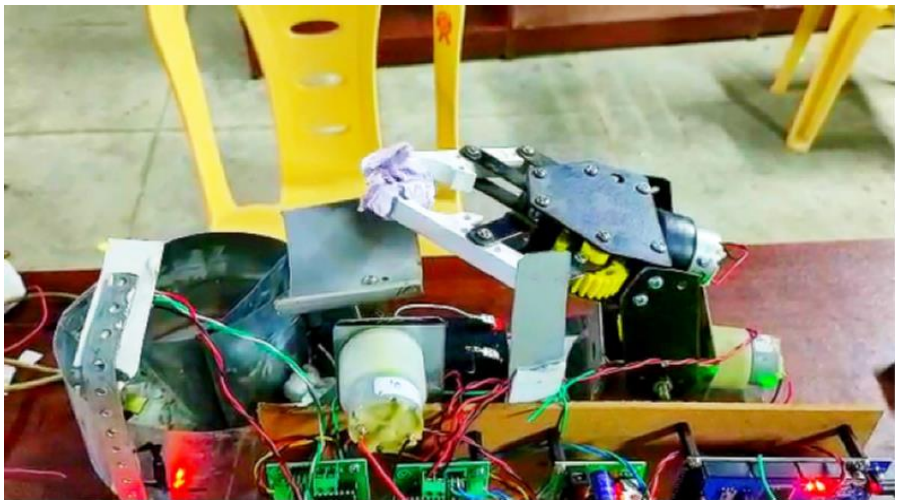


Fig-2: After picking the waste the arm place it on the collector unit.

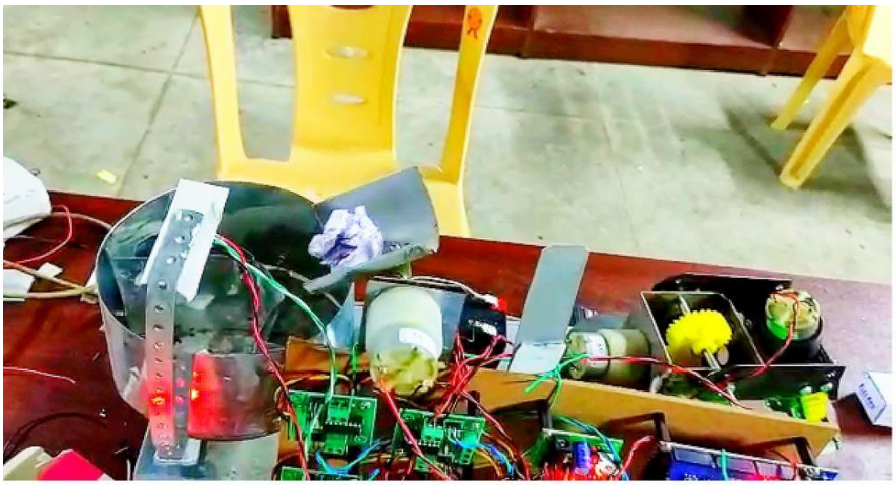


Fig-3: The collector unit detects the waste as wet and dry, and then drops it into the bin accordingly.

5. CONCLUSION AND FUTURE SCOPE

Automatic Waste Segregator Bin using the Robotic Arm performs the segregation into dry and wet waste. The waste around the bin is detected and the robotic arm is used to place the waste in the bin. This system is more innovative as it includes an automated system and a robotic arm, making it a more effective and efficient system. This research takes a step forward in contributing towards the cleanliness of our society, thereby supporting the idea "SWACHH BHARAT ABHIYAN" proposed by our humble Prime Minister. This system can be made more advanced and efficient by using a crusher and artificial intelligence in the future.

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