



# AUTOMATIC SEGREGATION OF WASTE USING ROBOTIC ARM

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*Abstract:* As the world is in a stage of upgradation, there is one stinking problem we have to deal with and that is Garbage! In our daily life, we see the pictures of garbage bins being overfull and all the garbage spills out. This leads to the number of diseases as large number of insects and mosquitoes breed on it. A big challenge in the urban cities is solid waste management not only in India but for most of the countries in the world. Hence, such a system has to be build which can eradicate this problem or at least reduce it to the minimum level. Our project provides one of the most efficient ways to keep our environment clean and green here our aim is to build a waste segregation robot which has the ability to detect, pick and separate different kind of waste and dump them into the respective dustbins which will be very easy for to be recycled and keep our surroundings clean.

*Index Terms* – Waste segregation, Robot.

## I. INTRODUCTION

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 so as to minimize the risks to the health and safety of patients, the public, and the environment.

Waste segregation and recycling are effective ways of reducing dumped trash. Unfortunately, these practices are not widely implemented in the country. People have been negligent when it comes to proper waste disposal, ignoring labels and throwing recyclables that can still be reused. Most of the people are unaware or ignore the fact the waste segregation and recycling can reduce cost, reduce drain in our resources, and lessen the waste being produced. Typical composition of garbage people throw in are 5.8% metals, 3.5% glass, 1.6% plastic, 12.9% papers, 1.8% textiles and 53.7% biodegradables which means only the remaining 20.7% of the wastes should really be going to our landfills. In our country, recycling centers do manual process of sorting wastes so it increases human interface. For this we implement a system which minimizes human interference in the waste collecting and segregation process.

## II. OBJECTIVE

The main purpose of this project is to contribute to the society by reducing the human intervention. The overall Objective is to categorise waste materials into different partitions for the disposal consideration, to take proper measures for waste handling and to promote prevention, preparing for reuse, recycling, other recovery and disposal. It mainly focuses on various options available for the disposal of waste for a brighter and more sustainable future.

## III. MOTIVATION

Cleanliness is next to Godliness is a widespread proverb which means maintenance of cleanliness lead a person toward goodness and humanity. Seven years since the launch of SWACHH BHARAT ABHIYAN, we have seen it's major impact on various sectors like community and public toilets, solid waste management etc. This is what has motivated us to work on this SMART BIN project.

#### IV. LITERATURE SURVEY

In Paper[1] they have tried to upgrade trivial and vital component of the urban waste management system, i.e. dustbin. The basic Idea behind project is to implement a smart way of handling the garbage in a smart way which is done by using the IOT protocol for transmitting the dustbin status wirelessly, which can generate e-mail to notify to the concerned person that system is filled with garbage and need to be replaced We have selected the Espresso chip which is a node MCU ESP8266 platform. The ultrasonic sensor will show the level of garbage filled in dustbin, whereas the proximity sensors will detect the obstacle present in front of dustbin to avoid collision. LCD interfacing has been done to show the current situation of dustbin.

Paper[2] aims to schedule trucks by finding shortest path between the almost filled waste bins and bins which have produced harmful gases and gives a route for collection. The system will consist of setting up smart waste bins/ trash cans per society, which will be IoT enabled. These smart bins will transmit information about its fill status and harmful gas levels. Proposed system provides efficient and optimized routes to collect maximum waste with less cost and fuel. The system provides estimated dates for collection of waste, real time bin status, expected fill up dates for the bins, and optimized shortest path for waste collection. The system will summarize the collected information and generate reports.

Paper[3], In past few decades there is a rapid growth in the rate of urbanization and thus there is a need of sustainable urban development plans all around the world. By using modern technology and strategic approach, the concept of smart cities is coming up all around the world. 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 paper describes the application of "Solar Smart Bin" in managing the waste collection system of an entire city.

Paper[4] focuses to develop a model of smart dustbin which can be effectively used at public places in smart cities. The 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 overflow of waste in the bin. Dustbins have automatically close and open feature depending on the presence of an obstacle. In our system, the garbage level in the dustbins is detected with the help of Ultrasonic sensor and presence of the obstacle is detected by IR Sensors and communication to the authorized control room by GSM system.

Paper[5], The increased level of environmental pollution due to different kinds of waste, unauthorized landfills and the lack of counting and monitoring of the territories ecological conditions are problems faced by all mega-cities around the world. Nowadays, in the Russian Federation there is no system of preparing specialists in the field of waste management, which indicates the need for creating requalification program for specialists in this field. The article describes an additional professional requalification program developed at Peter the Great St. Petersburg Polytechnic University - "Environmental economics and waste management".

#### V. BLOCK DIAGRAM

The proposed block diagram(**Fig.1**) consists of a IR sensor to detect the waste material, a robotic arm to pick and place the waste into the conveyor, moisture sensor to detect the wet waste and inductive proximity sensor to detect metallic waste and a Ultrasonic sensor to detect the level dustbin. Dustbin has three parts i.e., one for dry waste, wet waste and metallic waste. DC motors and motor drive for the movement of robot and robotic arm. A Wi-Fi module(ESP8266) to send information and a microcontroller(ARM7 LPC2148).

#### VI. METHODOLOGY

In this project ROBOT is designed using DC Motors and Motor Drivers. The ROBOT will sense the presence of waste using IR Sensors. When the waste is detected using IR sensor, then the gripper will pick the waste. Once the gripper picks the waste detected, the robotic arm rotates and places the waste detected into the conveyor. Two types of sensors are attached to the conveyor. The sensors are Moisture sensor and metal proximity sensor. The metal proximity sensor is used to sense the metallic waste. The Moisture sensor is used to sense the agriculture or wet waste. As the sensors sense the waste the bin placed at vehicle will move accordingly. ARM will drop the waste in proper section of bin. Wi-Fi module is used here to send the intimation to concerned authority when the bin is completely full.

Ultrasonic sensor is attached at the top of dustbin, which is used to detect the level of dustbin i.e., dustbin is full or empty. With the help of sensors the system can segregate the collected waste. In turn 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 garbage container reached its maximum capacity. The Wi-Fi module sends the message to the trash management personnel that trash box is filled completely, so that they schedule their trash collection based on this information. The sensor senses the content of the dustbin and sends the signals or the data to the microcontroller, reads the data from the sensor and process the data received from sensor, and the same data will send to Dashboard section and this section will send message to respective Municipal / Government authority person or collection vehicle.

#### VII. HARDWARE IMPLEMENTATION

**Fig 2** shows the final model of the waste segregation robot. The robot moves and when the waste is detected with help of IR sensor, the movement of robot stops. Then the robotic arm picks the waste and places the robot into the conveyor. Sensors are used to detect what kind of waste it is. The bin rotates based on what kind of waste is detected. ESP 8266 is used to send the message about the status of the bin i.e., the level of the bin. **Fig 3** and **Fig 4** shows the information displayed on the LCD Display.

#### VIII. ADVANTAGES

- Sorting of waste at the primary stage will make the waste management more effective and useful.
- Giving way to cleaner environment.
- Eco friendly.
- Lower initial investments.

## IX. LIMITATIONS

- When the bin is filled completely, it should be emptied manually.
- It considers all metals as metallic waste i.e., it can't differentiate different kinds of metals.

## X. FUTURE SCOPE

- In this current project waste is detected with the help of sensors and it can be made more efficient by using a camera (i.e., Utilization of Artificial intelligence and Image processing for detecting the type of waste makes the system more efficient).
- It can be made compact and more efficient by adding a crusher to increase the volume of waste that can be accumulated inside the bin.

## XI. CONCLUSION

Automatic Waste Segregator Bin using Robotic Arm performs the segregation into metal, dry and wet waste. The waste around the bin is detected and 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 system 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. As "SWACHH BHARAT" concentrates of keeping the country clean, this bin could help us get a better statistics value for the country's waste management.

## XII. FIGURES

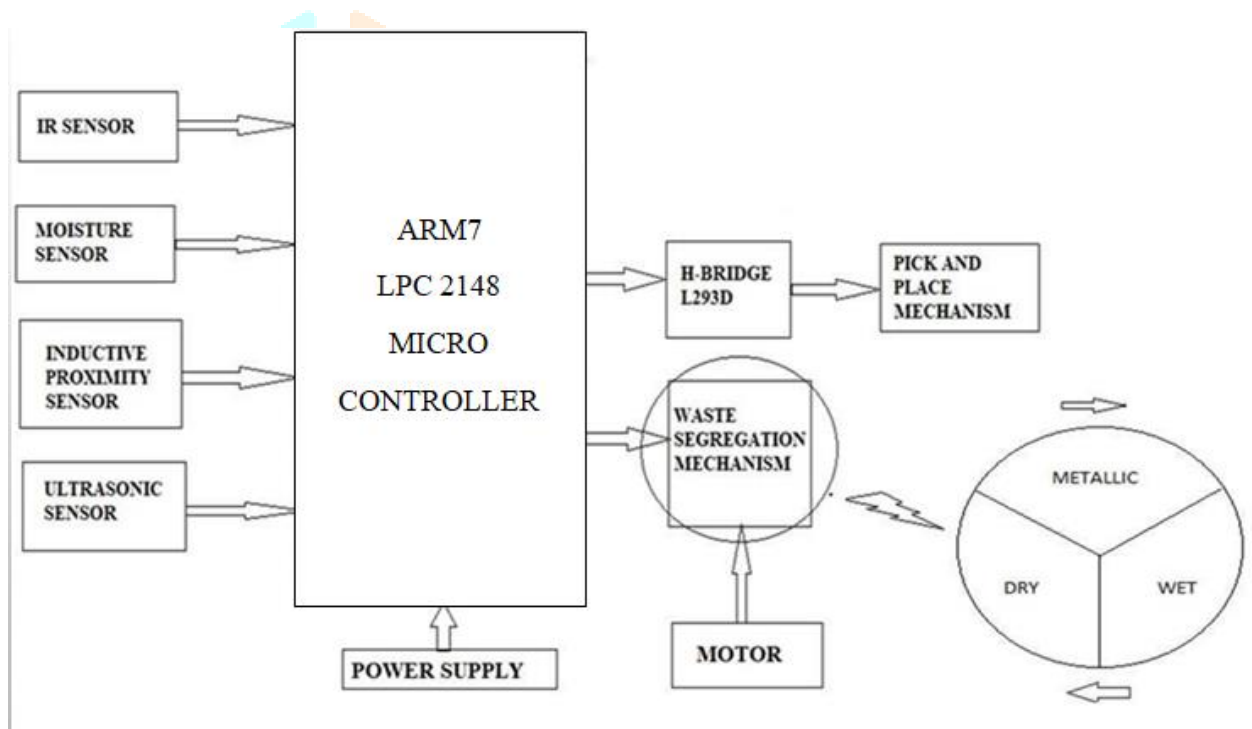


Figure1. Block diagram of the proposed project.



Figure2. Waste Segregation Robot



Figure3.



Figure4.

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