# Automatic Bin Bot- Garbage Collecting System in Residential Areas and Enlightening Disposal Mechanism

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**Abstract -** *The world today faces major garbage crisis-the product of rapid economic growth, poor urban planning, overcrowding, corrosive corruption and political dysfunction. The present tried and tested methods of garbage collection in residential areas have so far been done with Municipal solid waste workers (MSWWs) where they expose too many work related health hazards and safety risks, notably allergic and other diseases of the respiratory system. Hence to overcome this major problem of waste collection, BinBot (Automatic Garbage collecting robot) is developed. It facilitates the smarter way for garbage collection automatically from houses in the Residential areas and intimates the municipality about the BinBot status through IoT to collect the garbage when it is filled. This would be helpful for the "Swachh Bharat" (clean India) by 2019, India's real garbage challenge.*

**Keywords:** *Arduino UNO, IoT Module, RFID, Ultrasonic Sensor, IR Sensor*

## 1. INTRODUCTION

Garbage is the major problem not only in cities but also in rural areas of India. The ultimate need of the hour for a developing nation is the key for "Smart City". Even though there are many existing systems that solve cleaning and monitoring common dustbin but there is no proper method for the disposal of garbage at every house daily. When the human is not at home it is very difficult to dispose the household waste while the MSWW'S come to collect the waste. So this proposed system would facilitate disposal of waste at every house in the absence of human. This System consists of two bins that are home dustbin and the moving dustbin (BinBot). This smarter way of garbage collection facilitates the automatic garbage collection from house by the BinBot (Moving dustbin) by moving in the predefined path and facilitate disposal using IoT

### 1.1 Methodology Home Dustbin:

Home dustbin is for the people to throw their household wastes. Dustbin is interfaced with RFID and door opening mechanism. It is kept placed in a stand at certain height from the ground in front of every house. RFID enable interaction between home dustbin and moving dustbin. Ultra sonic sensor would indicate when waste in it reaches the maximum level. Door opening mechanism disposes the waste when it is interfaced with BinBot. The major advantage of using microcontroller is to control the devices which are connected with it according to the signal from the IR Sensors. In future depending upon the applications sensors can be used. Both Analog and digital sensors can be used.

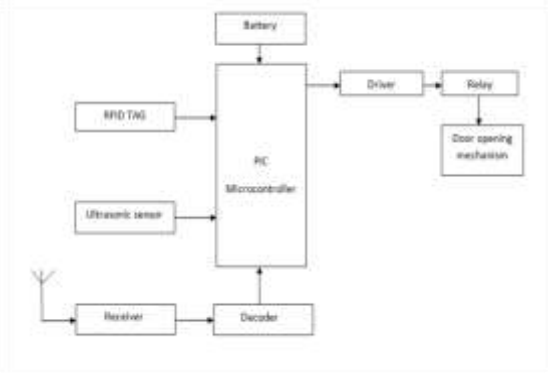


**Figure 1: Block Diagram of Home Dustbin**

### 1.2 Moving Dustbin (BinBot)

Moving dustbin contain Ultra sonic sensor, IR sensor, RFID reader, transmitter also interfaced with IoT.

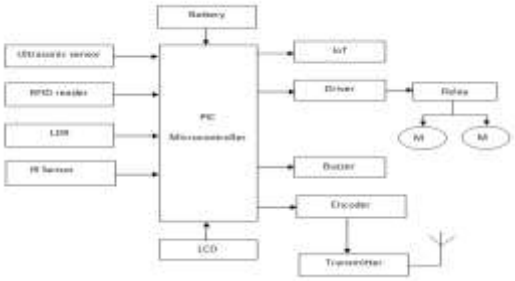


**Figure 2: Block Diagram of Moving Dustbin (Bin Bot)**

## 2. WORKING PRINCIPLE

Moving dustbin (BinBot) move along the defined path at the corner of the street (by line following mechanism). When BinBot comes closer to the home dustbin RFID reader reads the data from the RFID and stop moving then BinBot transmit data to home dustbin through the transmitter. After receiving the data about the arrival of BinBot it enable the door opening mechanism to dispose the waste to Bin Bot. After waiting for some time BinBot starts moving and continue this process at every house.

When BinBot comes in contact with any obstacle it detects it with IR sensor it stops moving and wait until the path is cleared. Garbage level in the BinBot is sensed by Ultrasonic sensor. If the garbage in BinBot attains the maximum level it stop moving and intimate municipality to

collect the garbage. Also the BinBot status is sent through IoT for collecting garbage by municipality workers.

### 3. HARDWARE USED MICROCONTROLLER:

PICs are popular with both industrial developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in PIC 16877 is flash technology, so that data is retained even when the power is switched off. Easy programming and erasing are other features of PIC 16F877. PIC16F877A microcontroller is used in the project.

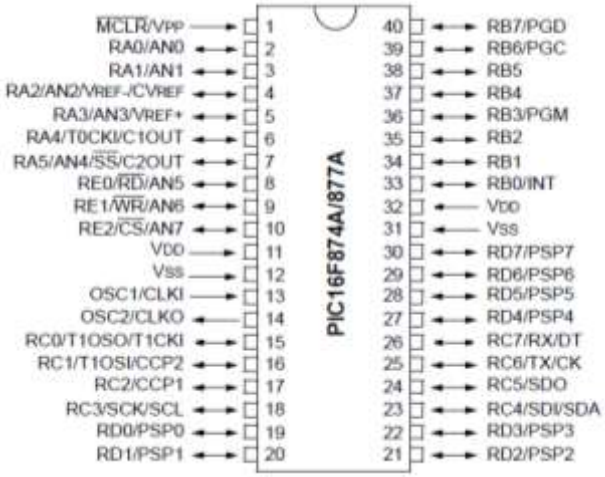


**Figure 3: Pin Diagram of PIC16F874A**

### 4. IR SENSOR:

**4.1 IR TRANSMITTER:** an IR led is also known as IR transmitter, is a special purpose LED that transmits infrared ray in the range of 760nm wavelength. An IR LED' also known as IR transmitter, is a special purpose LED that transmits infrared ray in the range of 760nm wavelength. Such LEDs are usually made of gallium arsenide. The appearance is same as a common LED. Since the human eye cannot see the infrared radiations, it is not possible for a person to identify whether the IR LED is working or not, unlike a common LED.

**4.2 IR RECEVIER:** An IR led is operated in forward bias just like any ordinary led. When it is in reversed biased condition if there is no light falling on the diode it will decreased and TX. When the sensor is placed in front of a white surface the light emitted from led gets reflected on to diode so the photodiode act as a short circuit. So the voltage at the output will be almost equal to 0v in case of black body or space then no light falls on the diode so it will act like an open circuit. So voltage at output will be almost equal to 5v.

### 5. ARDUINO UNO:

The Arduino Uno is a microcontroller board grounded on the ATmega328 (datasheet). It comprises of 14 digital input/output pins (out of which 6 can be utilized as PWM outputs),6 analog inputs, a 16MHz ceramic resonator, a facilitation for USB connectivity, a power jack, an ICSP header, and a reset button. Its designs comprises of assistances that supports the microcontroller in every possible way. In order to get to work with it one has to simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery. It is accessible in two different versions namely Arduino Uno and Genuino Uno which could be visualized. The variations are observed with reference to the region. The Uno is unique from all its former boards in the way that it does not make use of the FTDI USB-to-serial driver chip. The word "Uno" refers to one in Italian and it is named so to mark the forthcoming release of Arduino 1.0. The Uno and version 1.0 are the reference versions of Arduino in the forward journey.

### 6. ULTRASONIC SENSOR:

Ultrasonic ranging module offers a 2cm - 400cm non-contact measurement function, the ranging accuracy could reach up to 3mm. The building modules includes ultrasonic transmitters, receiver and control circuit. Here electrical energy is transformed into sound to send the pulse. The sound that is received back is converted into electricity. Thus the time lag between the sent and received sound signal is used to estimate the distance to the object. Spacing between sensors is dogged by their beam angles. The sensors must be spaced so that they do not interfere with each other. This interference is sometimes referred to as "crosstalk". The target should be mounted perpendicular to the axis of the sensor.

### 7. RADIO FREQUENCY IDENTIFICATION:

#### 7.1 RFID TAG

RFID tag is a tiny device that stores and forwards the data to RFID reader. They are characterized in two types – active tag and passive tag. Active tags are contains an inherent internal battery and do not demands power from the reader. Stereotypically active tags have a longer distance range than passive tags. Passive tags are slighter and lighter in dimensions than that of the active tags. They do not contain an inbuilt battery and thus they look upon RFID reader for its operating power and undoubtedly have a lower range limited up to few meters.

#### 7.2 RFID READER

The radio frequency gets transmitted by the reader when powered ON. When the tag is positioned close to the reader, the RFID tag will collect the radio frequency via the antenna placed inside the tag exclusively. The radio

frequency received will be converted into electrical power that is enough for the tag to transmit the data back to the RFID reader. In addition to this, the reader will transmit the tag ID to the external device by a serial communication. A wide range of reader modules are readily available now. The most communal and easy way to use reader is EM-18.This module read the RFID passive tag and shifts the tag ID to the Arduino microcontroller.

## 8. WORKING PROCEDURE

1. Home dustbin is placed in front of every house
2. BinBot moves along the line on the street corner
3. If BinBot comes closer to home dustbin, RFID reader read RFID and start communicating with the help of transmitter and receiver
4. Then home dustbin open the door at the bottom to put the waste into the BinBot
5. After collecting waste BinBot moves along the line and collect from all the house
6. When met with any obstacle, it stop moving and proceed after the removal of obstacle
7. Ultrasonic sensor monitor the level of garbage in BinBot and intimate municipality after reaching maximum level through IoT

## CONCLUSION

This paper gives basic idea about efficient garbage collecting in every house by reducing the workload of municipality workers and enhanced the monitoring system by using IoT technology. The Garbage pickup work is physically demanding and when delayed it exposes workers too many occupational hazards. In addition to this it also aids to diminish the need for high human intervention in garbage maintenance of the municipality and pollution monitoring system. Thus this system comes in handy as an admirable solution in environmental maintenance.

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