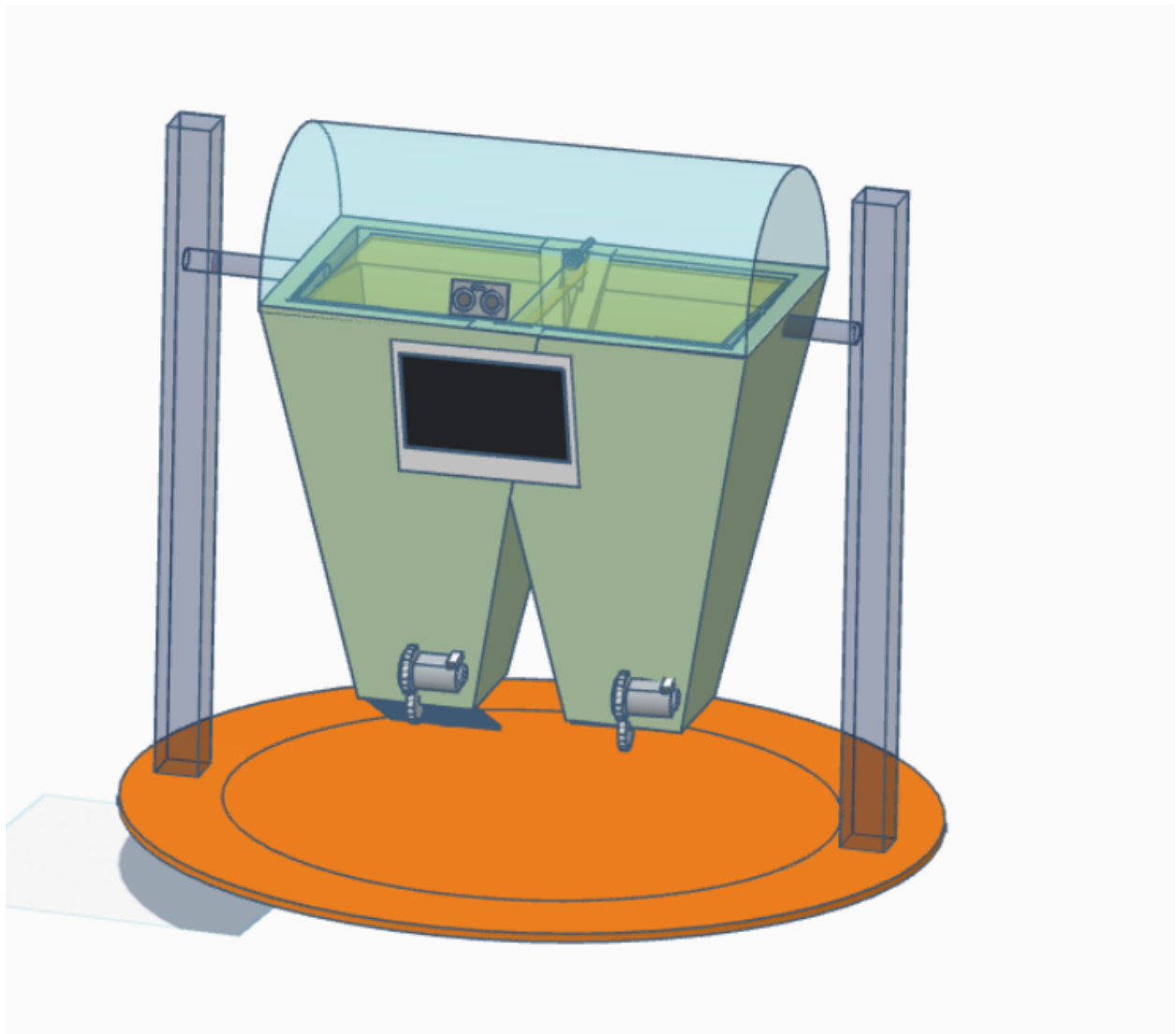# SPECULATION DOCUMENT-
WASTE DETECTING BIN

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Introduction

➢ As people are getting smarter so are the things. While the thought comes up for Smart cities there is a requirement for Smart waste management. The idea of Smart Dustbin is for the Smart buildings, Colleges and Hospitals.

➢ We plan to create a Smart Dustbin which is an improvement of normal dustbin by elevating it to be smart using sensors and logics. Smart dustbins is a new idea of implementation which makes a normal dustbin smart using ultrasonic sensors for garbage level detection and updating that data on a webpage, or an app on the principle of IoT.

➢ It is a common sight to witness garbage spilled out in and around the dustbins. The area around improperly maintained dust bins can house disease spreading insects like mosquitoes, flies, bees and driver ants. The environment around a dustbin is also conducive for increasing the pollution level in air. Thus, the waste detecting bin detects trash lying around its base, and alerts the user, using an LCD monitor, prompting him/her to throw the trash inside the bin.

➢ Waste segregation at the disposal level is the most efficient as well as cheapest. Hence, the bin automatically segregates waste put into it into wet and dry, and puts them in respective components, making use of various sensors.

➢ During a global pandemic, the importance of contactless disposal of garbage has been highlighted. The bin, using an ultrasonic distance sensor, detects a person about to throw waste into the dustbin, and automatically open the lid.

➢ The Bin also, is fully automated to empty the waste out.
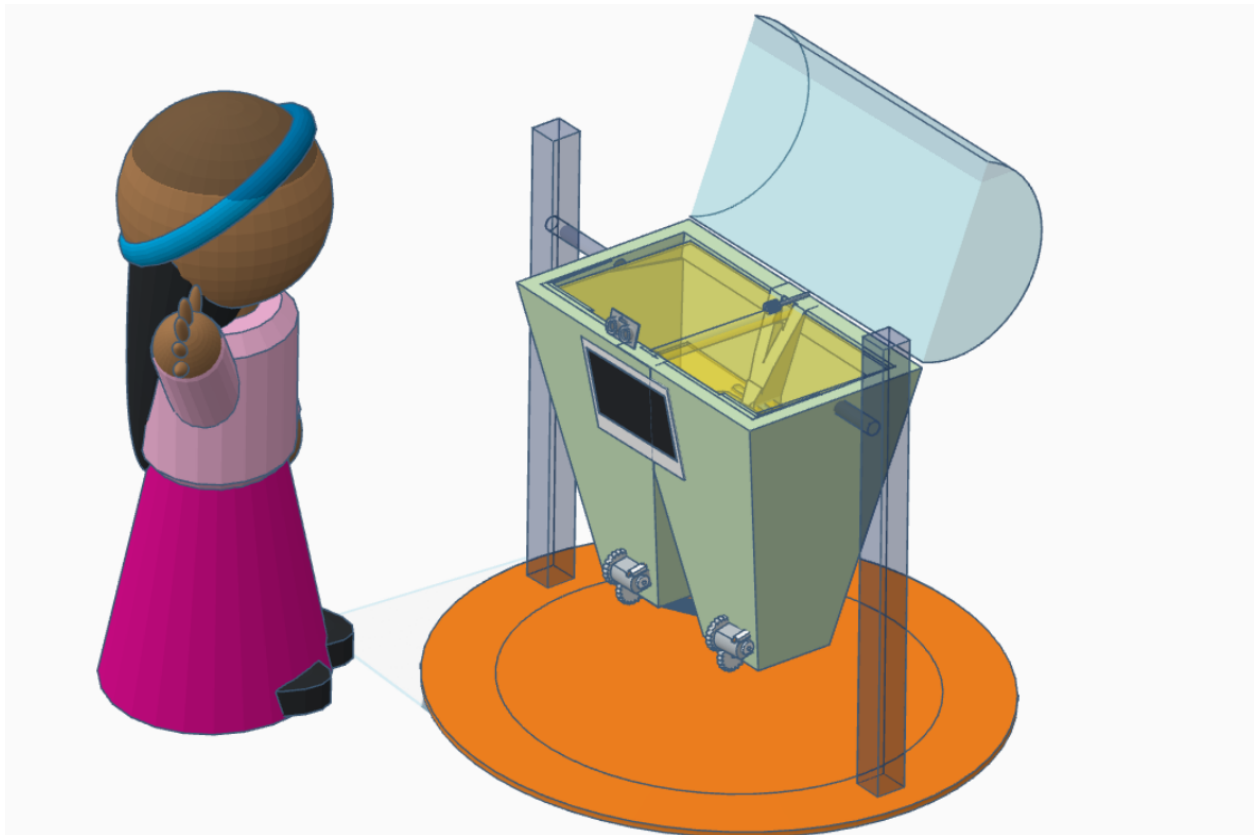
Features -

1) **Automatic lid opening using ultrasonic sensors:-**
   Ultrasonic Sensor is an instrument which measures the distance of a person/hand using ultrasonic sound waves. It has a transducer that helps to send and receive ultrasonic pulses based on the object's proximity. It detects the waste materials or objects.
Then, the servo motor helps in opening the lid of the dustbin. The arduino is programmed in such a way that after detecting the person/hand using an ultrasonic sensor, the lid will open automatically and this is done using the servo motor.
distance=(speed of sound)*(time taken by pulse)
The time taken by pulse to reach the ultrasonic sensor back is found out using a pulseIn function, which would measure the time from the start, till a HIGH value is read, by the receiver pin.
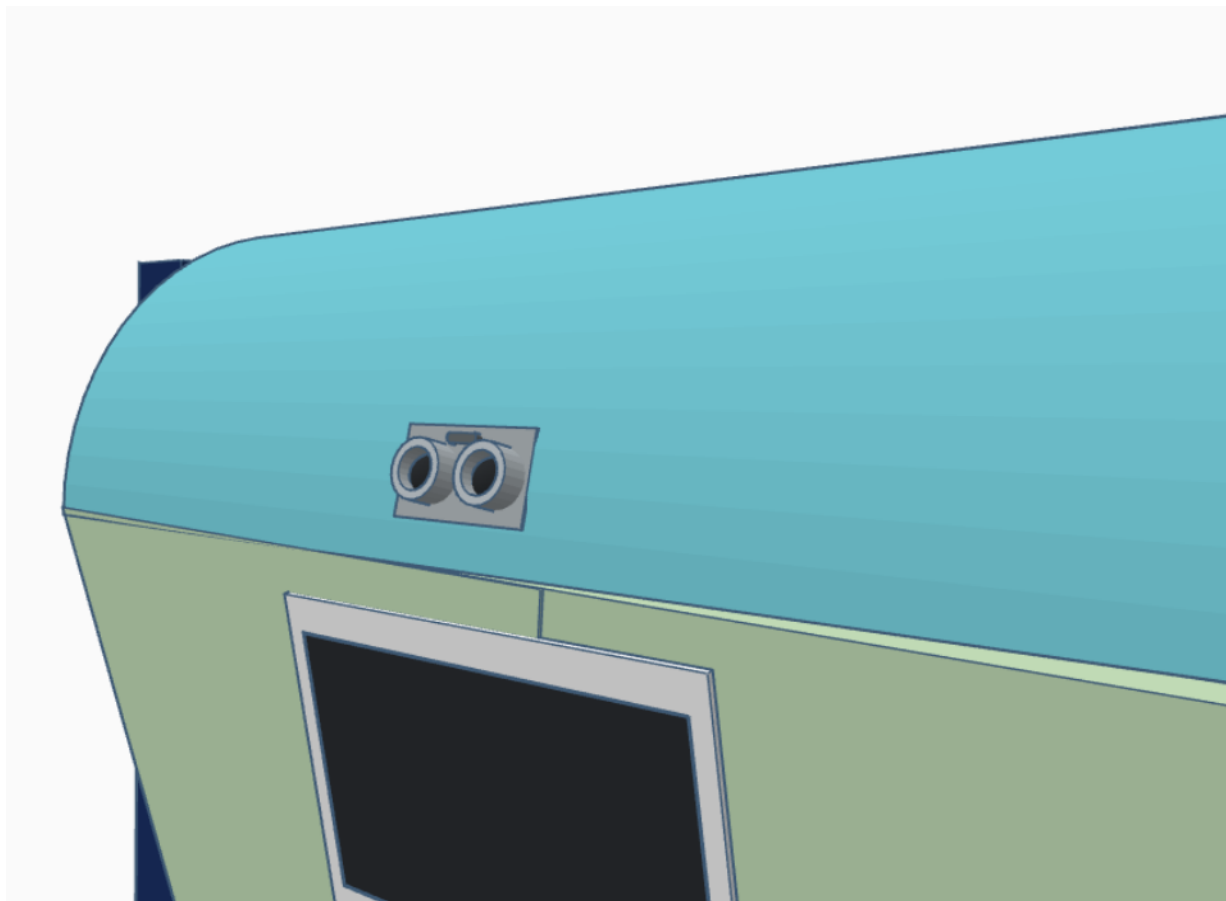
2) Waste Segregation:-

a) Detection of metallic objects before segregation of waste into wet and dry using inductive proximity sensors:-

Metal objects would fail the wet and dry test, as they are conductive, and will complete the moisture/wetness detecting circuit. Hence, they need to be segregated first.

Inductive proximity sensors can detect metal targets approaching the sensor, without physical contact with the target. Now talking about the working principle of the sensor; this operates when a metal target enters the magnetic field created by the coil generating eddy currents which circulates within the target and as the proximity of the target to the sensor increases then the oscillation amplitude simultaneously decreases and in this way the sensor detects that whether the target is metallic or not.

The PNP NO 3 wire sensor can be used for this purpose. Two wires go into ground and 5V respectively, while the third wire can be connected to an analog pin. This voltage value can be read on the serial monitor, and a threshold can be determined to decide if a metallic object is present or not.
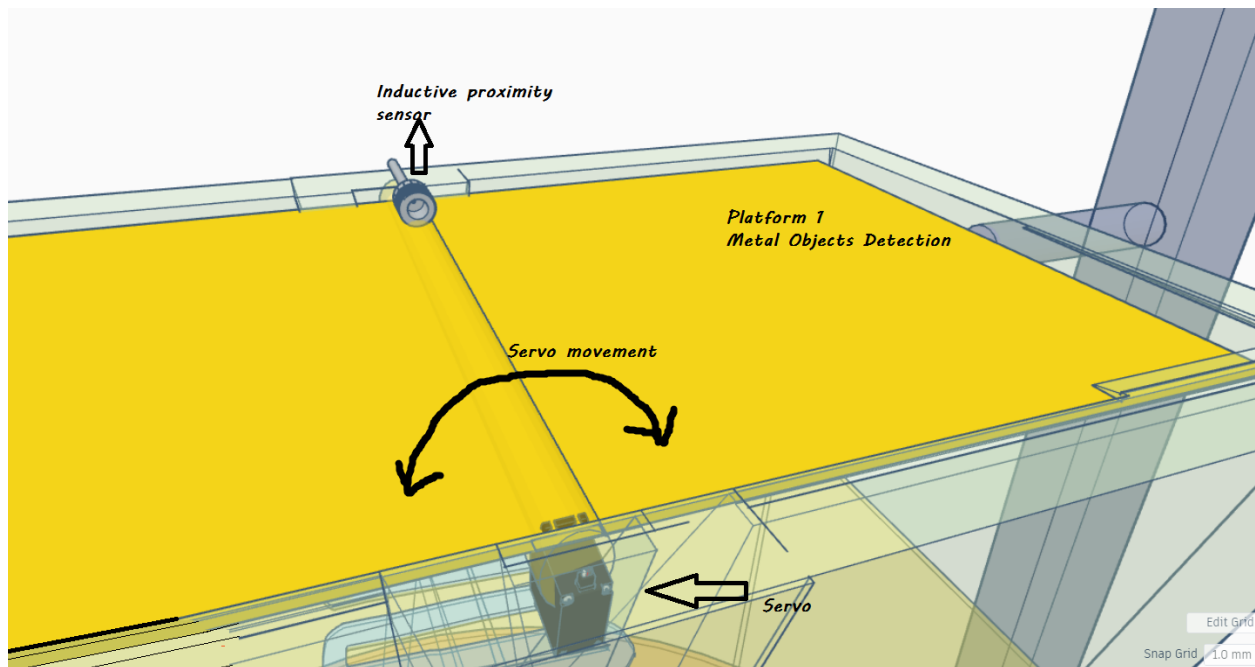
b) Differentiating between Dry and wet waste:-

If the target is metallic then the two platforms (one with metal detector and the other with moisture sensor) are programmed in such a way that both rotate simultaneously towards the compartment containing dry waste and if the target waste is non metallic then only the plate with metal detector will rotate, dropping the waste onto the second plate to segregate the target waste into wet and dry using the IR sensor and the moisture sensor.
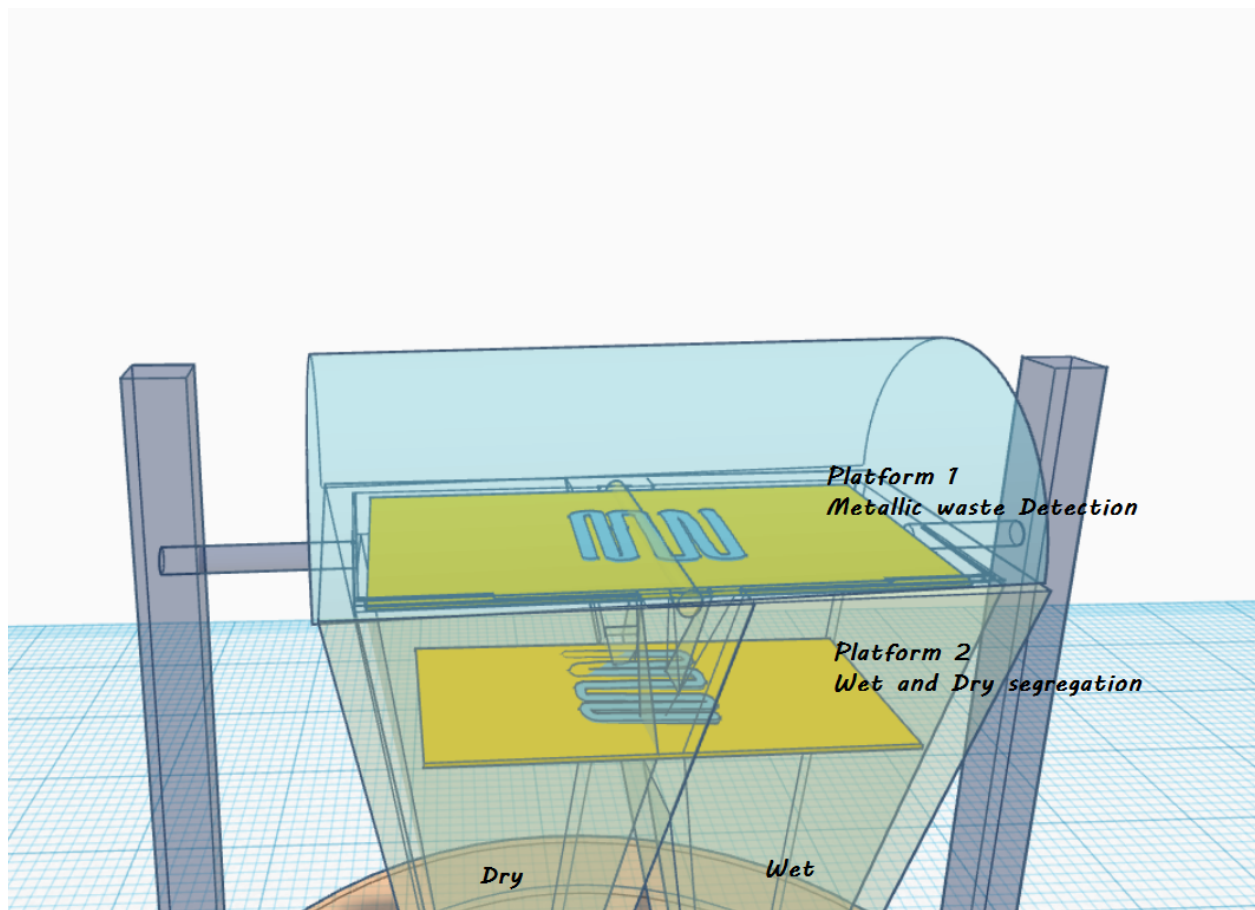

Working of the Moisture and IR sensors -

IR sensor basically detects the infrared radiations radiated by any body as well as the movement of the body in its proximity; hence when the target gets over the second lid IR sensor basically detects that the target waste is over the lid and then the moisture sensor starts its working.

Moisture sensors detect the amount of moisture/water content present in the material, by keeping it over two electrodes. The electrical resistance through the sensor is measured. The higher the water content of the material, the lower the electrical resistance.

3) Measures the depth of dustbin upto which it is filled using IoT :-

We will use ultrasonic sensors which measure the depth by ultrasonic waves.The sensor head emits an ultrasonic wave and receives the wave reflected back from the waste at the base. It measures the distance to the target by measuring the time between the emission and reception. The output or the result which it gives can be extracted by making a website or by making an app which regularly displays the depth of the dustbin upto which it is filled. It will prevent overfilling of the bin. These sensors are placed just below the second platform which distinguishes waste into wet or dry. There will be two different arrangements each for dry and wet, controlled by a single app or website.

A wifi module is used which is a Serial WiFi transmitter and receiver which can give Microcontroller access to WiFi network.

ultrasonic distance sensors

trash level detection
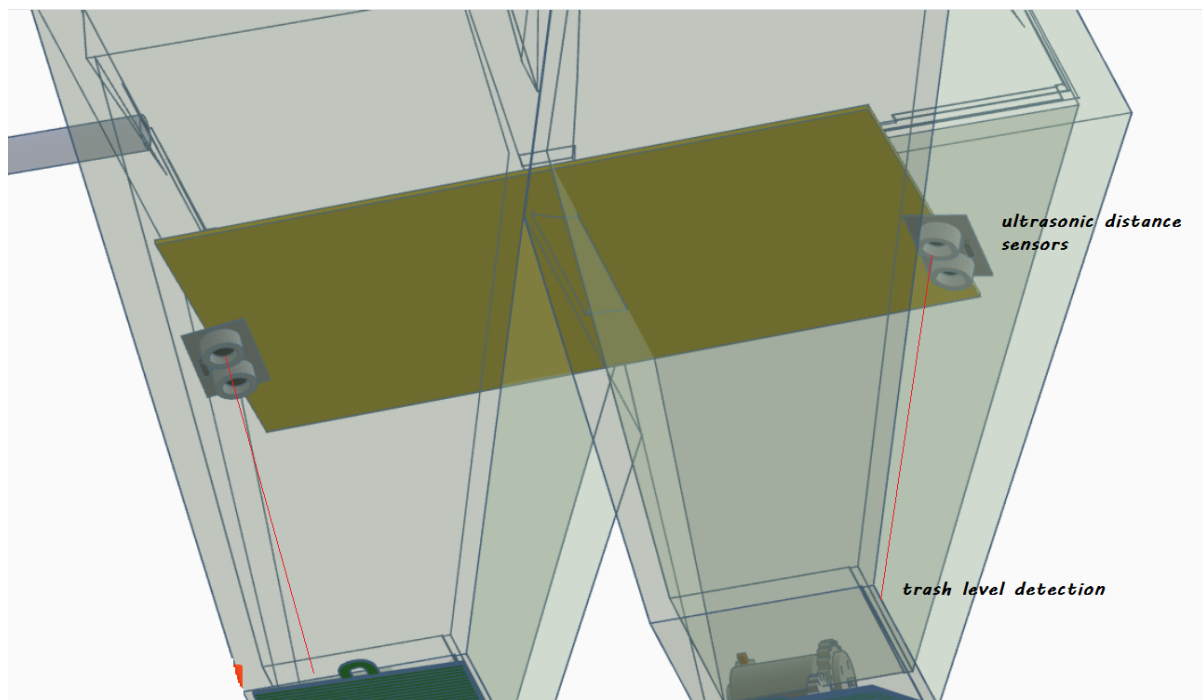
## 4) Detection of waste fallen outside the dustbin:-

This feature will prompt the user to put the waste thrown into the dustbin if it falls outside the dustbin. A base is present below the dustbin in circular shape which holds capacitive sensors. It will detect the waste fallen onto it and gives signal by displaying the same on a LCD display with a short beep(use of active buzzer). Capacitive sensors detect a voltage drop due to the change in capacitance of the target in front of it. As dielectric of every material is different, it detects most of the objects in its proximity.

Capacitive sensors on base
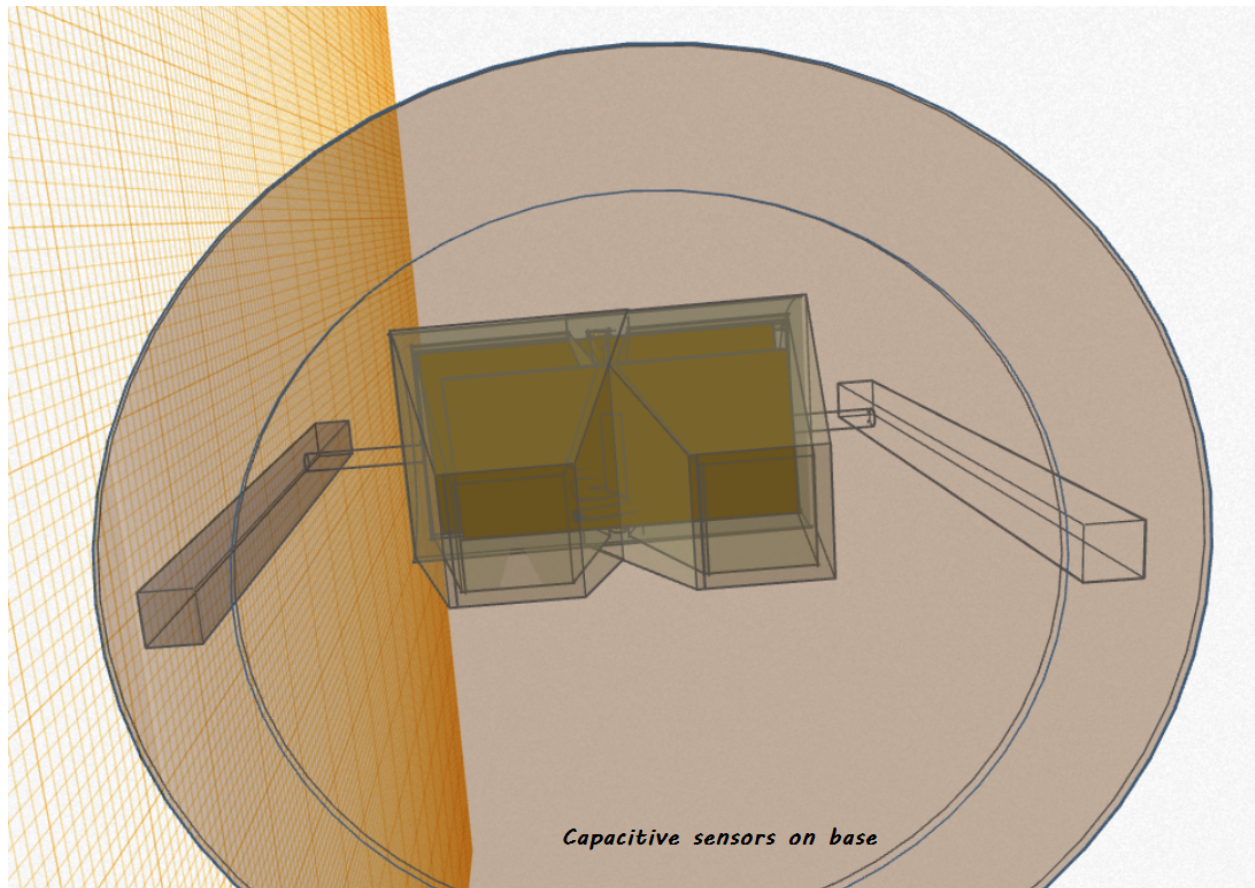
5) Automatic Emptying out

Whenever waste level inside the dustbin reaches the maximum permitted value, the alert is generated on the website/app. In order to empty out the dustbin, the user just has to hold a polythene bag below one of the lids. With the press of a button on the dustbin, or a click on a button on the website/app itself, would automatically open the lid on the base of the dustbin, and the garbage falls out. The lid then automatically closes itself too. The use of a stepper motor is preferred here, as it can lock onto a certain position, which would be while closed and while open, in this case. The below figure is one method that could be used to open the lid using the stepper motors.
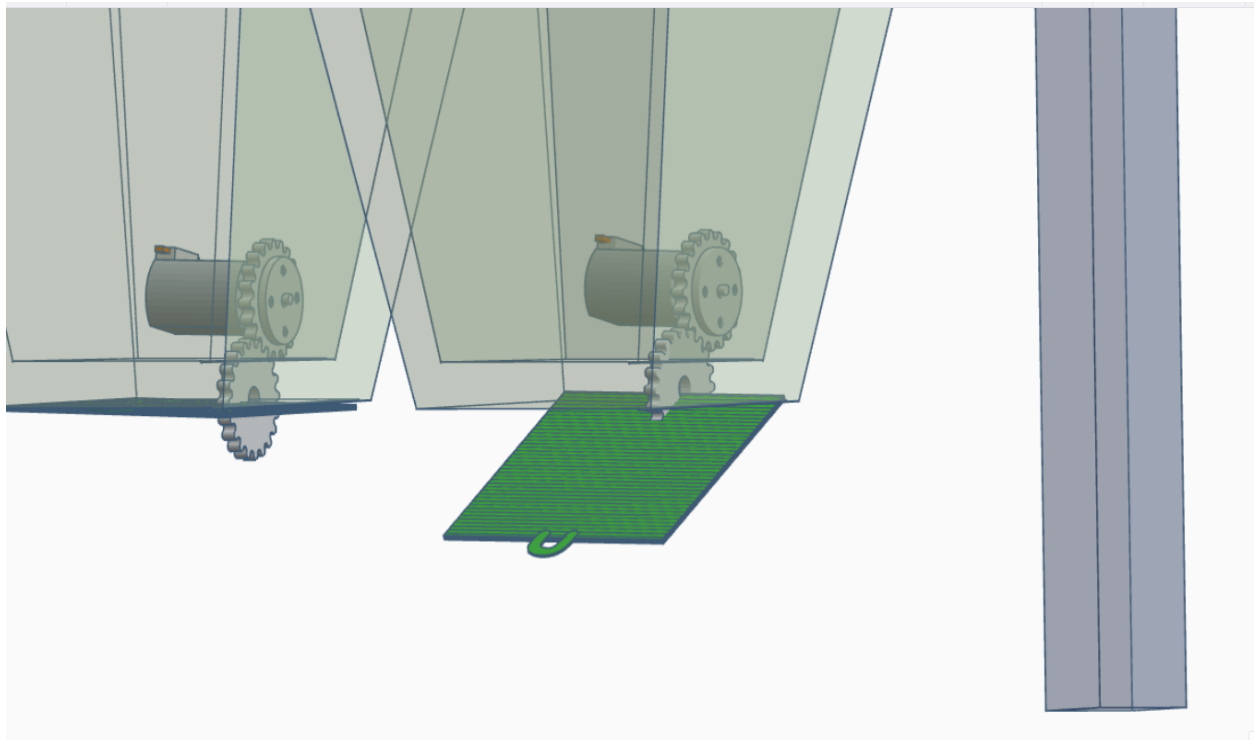
IoT Working:-

We use an ESP8266 Wifi module with our arduino board to send data (the level of waste in the dustbin) to a third party app, Blynk; and receive commands (empty buttons).

The ESP8266 Module has a micro-chip itself, on which a firmware version of AT commands is installed. We first need to update it with the desired firmware version, which can be done with a specific circuit connection (in which the GPIO0 pin is grounded) and a flasher. Once updated, we can then unground the same pin, and check for the version with the command AT+GMR on the serial monitor of the Arduino IDE.

With the desired circuit set again, we would need to set up a new project on the blynk app, get its authorisation key and upload it in our code. After setting up the required layout, for example buttons and data value displays (level indication, from the ultrasonic distance sensors). The user can then simply start using it.

One alternative to blynk app is a web page, which would display the concerned data. The above-mentioned webpage can be visited by entering an IP address in a web browser, which is generated by the wifi module with a particular firmware, and Arduino IDE code.

The former firmware is available here:
https://github.com/Edragon/esp_firmware/tree/master/Firmware/AT-other/AI-THINKER/At_firmware_bin1.54

The flasher is available here:
https://drive.google.com/file/d/0B3dUKfqzZnIwVGc1YnFyUjgxelE/view

The Blynk libraries used are available here:
http://help.blynk.cc/en/articles/512105-how-to-install-blynk-library-for-arduino-ide

More Libraries used-

1. Servo library, which is pre-installed on the arduino IDE
2. Stepper library which is pre-installed on the arduino IDE
3. Library for inductive proximity sensor
4. Library for IR sensor:
   https://www.arduinolibraries.info/libraries/infrared#:~:text=An%20object%20oriented%20library%20for,IR%20signals%20on%20the%20Arduino.&text=The%20library%20contains%20classes%20for,and%20rendering%20of%20IR%20signals.
5. Library for LCD:
   https://github.com/fdebrabander/Arduino-LiquidCrystal-I2C-library

Challenges:-

1. Unnecessary opening of the lid, due to any obstruction in the close proximity of the opening lid, even when there is no intention of waste disposal.

2. Capacitive sensors need to be tested first, with objects of different materials, to determine the threshold of detection (taking into account, the error percentage of the sensor).(For example, dielectric of paper is 3.7, while that of air is 3.0. The difference of this capacitance must be sensed, and this difference must be greater than the error of the sensor.) Also, their best possible arrangement on the base of the dustbin, such that its effective.

3. The effectiveness of moisture/wetness sensor needs to be tested out on different kinds of waste. Also, there are drawbacks like dry leaves, which should ideally go into wet waste bin, but the sensor would not detect it, and hence it would go in the dry compartment instead.

4. The inductive proximity sensor also need to be tested out, in different scenarios, to identify any practical situation errors.

5. The mechanical strength of the emptying lid-motor system need to be tested out. Its construction can also pose a challenge.

Conclusion:-

➢ After addressing the above challenges, and if possible, finding out better alternatives to the ones proposed here, the dustbin can find many uses and practical world applications.

➢ One possible solution to the waste segregation problem could be to have a button that could be manually pressed, and which opens the respective compartment in the bin, overriding the sensor programming. Thus, using human intelligence where sensors fail.

➢ Although, in the implementation of a contact free waste disposal into the system; keeping in mind the present pandemic scenario , the button pressing system is a drawback. Other alternatives could be hand gestures, which could be possible to implement at this level, maybe in the future.

➢ The proposed waste detecting bin is an attempt to step further in solving the problem of waste management and segregation at the lowest rung while intertwining smart technology, upon which better future versions could be based.

➢ Our project ultimately helps in keeping the surrounding clean and the mission Swachh Bharat can be implemented easily.