IOT BASED SMART TRASH CAN

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Abstract : Garbage segregation by the government body is currently done manually. The individual Municipal body does the sorting on his own by the workers which is unsanitary. Also, people who live in rural areas as well as illiterate people have little to no awareness about sanitary garbage disposal. It leads to compilation of hazardous waste in heaps of garbage. So, the system becomes treacherous. The Municipal Bodies can only implement so much. Hence, automatic segregation is required. So, there is need for smart solutions in the society where these wastes are divided in broadly two categories: Dry and Wet. There is the need to divide the Trash into two parts in order to make separation easier and economical as well. The purpose of this Project is to arrange the category of thrown garbage intelligently to maintain the cleanliness and make it easier to dispose the trash. A Smart trash can will give small incentive to a user after depositing Garbage. It will automatically segregate the trash into mainly two categories, 'Wet' and 'Dry'.

I. INTRODUCTION

People don't always segregate Wet and Dry garbage. In the public trash cans, people carelessly throw all kinds of trash regardless of the consequences. Hence, automatic segregation of waste is needed. Current segregation systems are applied at only Industrial level and not at household level. They are not implemented on public Trash cans widely. Waste Segregation helps to make the process easier in order avoid hazardous waste collected together and non-disposable plastic components which are very hard to recycle. This project focuses on dividing trash into two main categories: wet and dry. This is achieved using couple of sensors namely Moisture sensor and Ultrasonic sensor. These sensors are interfaced on Arduino UNO Board [1]. An RFID reader will be used in order to create a unique user database. The user who puts the waste in bin will be given an incentive in the form of restaurant coupons or a small change of money. This is purely a reward-based system. So, it will encourage the general public to throw more garbage in the bin to avoid littering on the roads. The plastic waste will be given prominence between dry and wet in the form of greater incentive. This is because the plastic is recyclable. Dry waste can be managed easily so it will be given the least prominence.

II. PROPOSED SYSTEM:

Segregation part:

Stage 1: User ID

The user will scan their respective user ids in order to maintain the database on cloud server. When the id matches the registered user, the garbage will allow the user to deposit the trash.

Stage 2: Detection

The trash can consist of 2 main parts. The sensing part will be done in a cylindrical structure and the second part is arrangement of trash can which is done using Stepper motor which rotates the trash can into the respective classified type of garbage [3]. Firstly, an ultrasonic sensor will be able to detect the garbage thrown in the can. This sensor will also be used to determine the fullness of the garbage can. If the garbage can is empty, the ultrasonic sensor will give a distance reading of the bottom surface of trash can [1]. Whereas when full, the distance can be set manually to the point where the trash can stops taking inputs.

Stage 3: Sensors

Both moisture sensor and Ultrasonic sensor will take inputs simultaneously, the dry garbage won't need any sensor because it will be assumed a default case. The sensors will be installed in a cylindrical structure before depositing into the main Can. Here it will be determined which type of garbage it really is and will give that input to Servo and stepper motors.

Stage 4: Motors & Compartments

When the category of garbage is determined, the inputs will be given firstly to stepper motor installed at the bottom of main can. When it is dry garbage, the motor will not rotate since it is a default case. When it is wet garbage, the motor will rotate 180 degrees. This will allow the respective garbage to get dumped into that category by a servo motor which is installed at the bottom of the cylindrical structure. The flap will open and allow the garbage to fall into the Main can. The stepper motor will come back to its original default state when the garbage is dumped.

Stage 5: Incentive system

This part is an experimental design in order to encourage general public to recycle more plastic and throw more garbage in the can. Basically, the user will be assigned his unique user database and the inputs are taken from the Sensors. Once it is determined what type of garbage it is, the user will be given reward points based on the type of trash he/she throws. Plastic having the most

points. A simple ESP8266 will be used to communicate with the cloud server. We have used Thingspeak server to display the data on cloud. The points given will later be converted into equivalent Incentive which will be recorded on the user database.

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III. COMPONENTS:

a) Arduino Uno:

It's a single-board microcontroller, designed to make the application of interactive objects or environments more accessible. Sense the environment by receiving input from variety of sensors. Can be programmed with the Arduino software IDE. [5] The Atmega328 on the Arduino Uno comes preburned with a bootloader that allows us to upload new code to it, without the use of an external hardware programmer. The microcontroller can also be programmed through the ICSP (In-Circuit Serial Programming) header. It works on Windows, Linux as well as Mac platforms.

b) Ultrasonic Sensor:

The ultrasonic sensor is used to measure the distance to an obstacle. We measure the time which it takes to signal to come back. An ultrasonic sensor has two mesh holes one part is for sending the sound out and the other one is microphone, which can measure the sound again. One of the advantages of ultrasonic sensing is its outstanding capability to sense deep details without any disturbance. Ultrasound can propagate through
any kinds of media including solids, liquids and gases except vacuum. Time taken by pulse is for to and fro travel of ultrasonic signals, while we need only half of this.
Therefore, time is taken as time/2. Distance = Speed * Time/2

c) NodeMCU ESP8266 Wi-Fi Module:

Node MCU is an ELUA based firmware for the [6] ESP8266 Wi-Fi SOC from Espressif. The Node MCU firmware is a companion project to the popular NodeMCU dev kits, ready-made open source development boards with ESP8266-12E chips. It's a SOC with integrated MQTT protocol stack that can give any microcontroller access to the Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi- Fi networking functions from another application processor.

d) Soil moisture sensor:

The sensor includes a potentiometer to set the desired moisture threshold. When the sensor measures more moisture than the set threshold, the digital output goes high and an LED indicates the output. When the moisture in the soil is less than the set threshold, the output remains low. The digital output can be connected to a micro controller to sense the moisture level. The sensor also outputs an analog output which can be connected to the ADC of a micro controller to get the exact moisture level in the solid.

IV. BLOCK DIAGRAM:

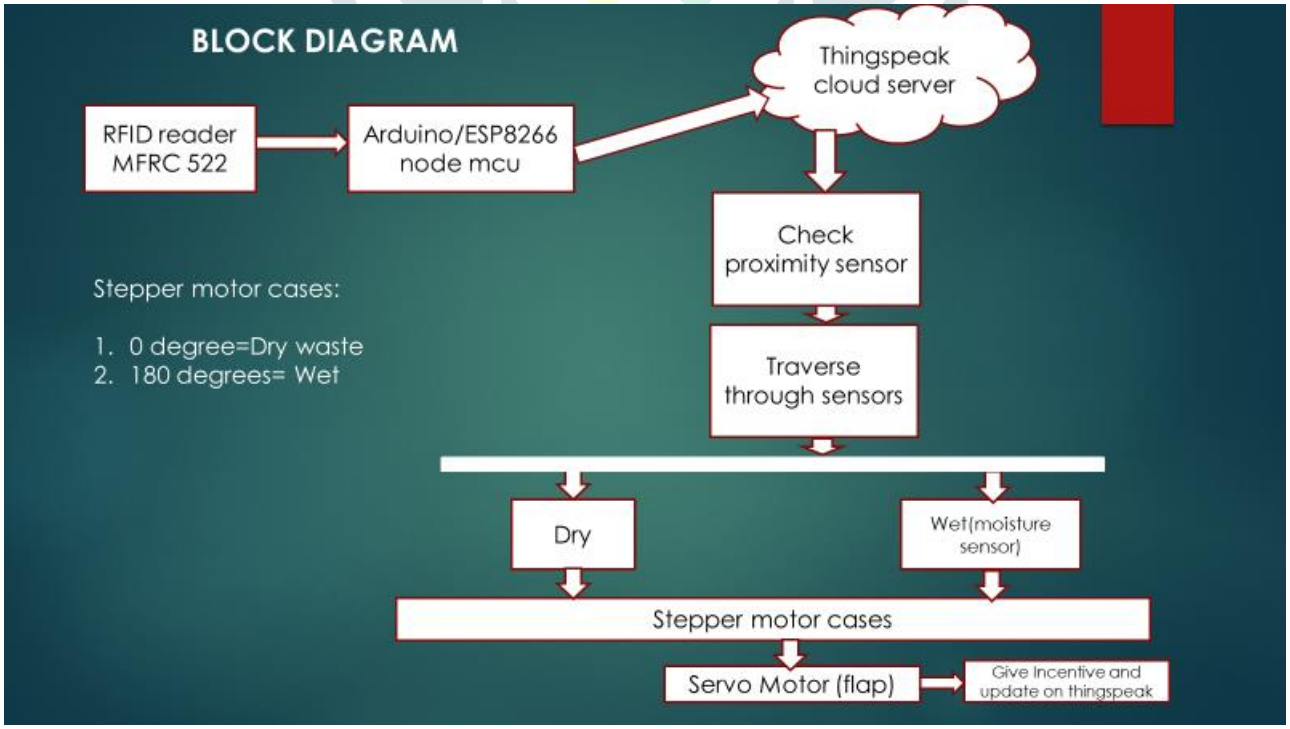

Fig.1: Block diagram of the system

Algorithm:

1. Accept input from RFID from user and store into the database of Thingspeak.
2. Allow the system to accept garbage.
3. Take inputs from Ultrasonic sensor and Moisture Sensor simultaneously.
4. If Dry, turn Servo motor flap 180 degrees to OPEN and let the garbage fall into the bucket. Give Incentive.
5. If Wet, Turn the Stepper motor 180 degrees to turn the bucket towards the Wet compartment.
6. Open the flap. Give Incentive.
7. Continue this process until the Ultrasonic sensor on the top of the bucket has distance value less than or equal to 5cm.
8. Send this value to Thingspeak Server.
9. Stop accepting the garbage from the user and wait for collection

Working of Thingspeak along with Segregation system:

Firstly, we accept the RFID of the user using MFRC522, which in turn writes '1' on one of the GPIO pins of the Arduino. This enables the system to accept garbage by taking inputs from Moisture Sensor and Ultrasonic Sensor. The ESP8266 writes the RFID user data in a JSON feed. When the segregation part is over, the ESP8266 checks the garbage level by using the ultrasonic Sensor. If the distance between bottom and top is less than 5 cm, the system will not accept more Garbage. This variable is then uploaded to Thingspeak. This is uploaded as a timestamp which can be seen in figure 2, which will later be used for analyzing and survey purposes.

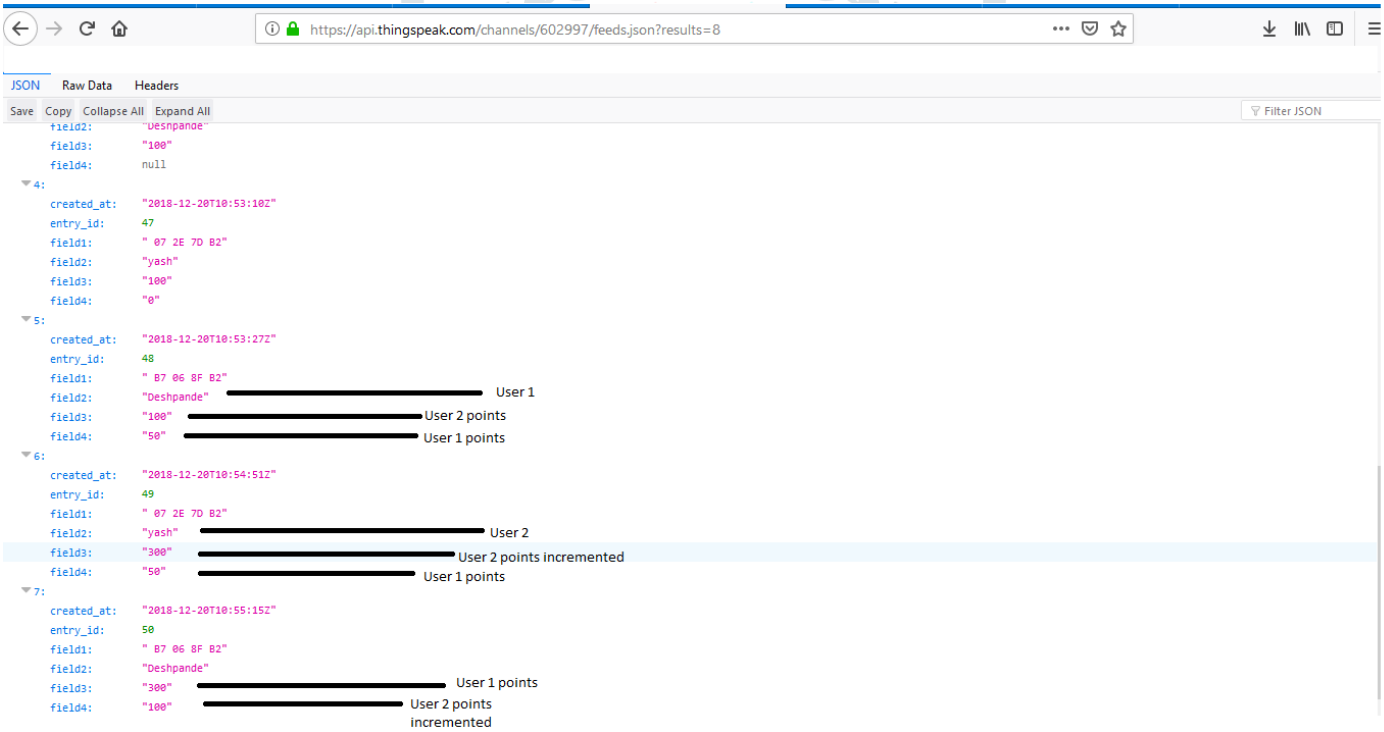

Fig 2: Incentive system json feed

IV. RESULTS

Table 1: Segregation of materials (success or failure)

Garbage Item	Wet or Dry	Segregated (Y/N)
Vegetable Waste	Wet	Yes
Wrappers and paper	Dry	Yes
Tea bag/fluids	Wet	Yes
Rotten Fruits	Wet	Yes

- RFID scans individual UID and stores the database in a json feed.
- The Ultrasonic sensor above the bucket detects the level of garbage and uploads it on Thingspeak Chart. This can be used later for analyzing the time of pickup of garbage (for municipal corporation)
- Incentive will be given based on points. Dry:-50 points and Wet:-100 points.

VI. FUTURE SCOPE:

a) This trash can may be used on streets as well as for household purposes. This trash can will introduce the waste separation infrastructure at ground level starting from public, which can be used in major restaurants and public places.
b) The incentive system is proposed to have an impact on the attitude of general public, for the benefit of environment as well as the Municipal corporation.
c) The cloud data can be used to determine what time of the day the quantity of garbage is the most in the bins for public spaces. Accordingly, the municipal corporation can be consulted to carry out collection of garbage at the earliest to avoid contamination.
d) The incentive system can be further transformed into government rewards or rewards for the customer for Trash can used in the restaurants to build a community of people to spread awareness and to recycle and dispose trash properly.
e) Building an Android App to maintain a database of the user instead of using RFID technology.
f) Adding more industrial level sensors to segregate more variety of items.

VII. CONCLUSION:

a) The segregation was be done in three categories, dry wet and plastic.
b) The user will have a uniquely maintained database which he can monitor to collect incentives regularly.
c) The real time values of Fullness of Garbage are maintained on the cloud. This will allow the system to alert the municipal authorities to collect Garbage sooner, to empty trash can again

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