Trash Monitring System Using Arduino

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Abstract: In this recent world, urbanization has increased tremendously. At the same phase, there is increasing amount of in waste production. Waste management has been a crucial issue to be considered. This report is a different way to achieve this good cause. In this report, smart bin is built on a microcontroller based platform Arduino - Uno board, which is interfaced with Ultrasonic sensor. It will stop overflowing of dustbins along roadsides and localities as smart Dustbins are managed in real time. Once these smart bins are implemented on a large scale by replacing the traditional bins, the waste can be quickly managed to its efficient level as it avoids unnecessary lumping of wastes on roadside. Foul smell from these rotten wastes that remain untreated for a long time, due to negligence of authorities and carelessness of public may lead to long term problems. Breeding of insects and mosquitoes can create nuisance around promoting unclean environment. This may even cause dreadful diseases. The goal of this project is to keep our environment clean. It also aims at creating a clean as well as green environment.

*Index Terms –***Smart Bins, Ultra Sonic Sensor, GPS and GSM Module.**

I IUTRODUSTION

1.1 About Domain/Area

Though the world is in a stage of up gradation, there is yet another problem that has to be dealt with. Garbage! Pictures of garbage bins being over full and the garbage being spilled out from the bins can be seen all around. This leads to various diseases as large number of insects and mosquitoes breed on it. A big challenge in the urban cities is solid waste management. Hence, smart dustbin is a system which can eradicate this problem or at least reduce it to the minimum level. Our present Prime Minister of India, Sri Narendra Modi ji has introduced the concept of implementing 100 smart cities in India."Swachh Bharat Abhiyaan" was initiated to ensure a clean environment. Majority of viruses and bacterial infections develop in polluted environment. Safe guarding the environment using technology sources is needed at present. Majority of the public environment seems to be polluted with the waste material. Amounts of waste are largely determined by two factors: first, the population in any given area, and second, its consumption patterns.

- Most of the cities, towns and villages in India are not well designed to facilitate the suitable garbage collection methods.
- Common Public dustbins are filling over with the garbage and no one is concerned to clear them up as and when they get completely packed with over flowing garbage.
- Keeping in view of this big problem, it will be a good suggestion to do something to deal with this unmanaged waste and from this; the concept of 'Smart Dustbin' came out.

1.2 About the Definition

The smart bins are used as ultrasonic sensors which detect the garbage. The container is divided into three levels of garbage being collected in it. Every time the garbage crosses a level the sensors receives the data of comes garbage to the bin. This data is further goes to the servo motor threw the Arduino Uno circuit board. Placing the ultrasonic sensors at the top of the bin, like on the cover of the bin. The comparison is done with help of microcontroller. After analyzing the image an idea about level of garbage in the can and from the load cell sensor, weight of garbage can be known. Accordingly, information is processed that is controller checks if the threshold level is exceeded or not. This is convenient to use but economically not reliable. Instead of using plenty of bins in an unordered fashion around the city, minimal number of smart bin scan be used. Using only one sensor at the surface level in stead of three not only makes it affordable but also achieves the same result.

- To design a "Smart Dustbin" which is an Ultrasonic Sensor enabled in bin which automatically detects the garbage and set the code in the Arduino circuit board which help to open and close after detect the garbage .
- Smart bin is built on a microcontroller based platform Arduino Uno board which is interfaced with Ultrasonic sensor. And it's connected with the servomotor.

II OBJECTIVES

2.1 AEIOU Framework

AEIOU Design Thinking Worksheets developed by Mark Baskinger and Bruce Hanington is an interrelated framework that guides designers in thinking through a problem or scenario from a variety of perspectives: activities, environments, interactions, objects, and users. They are useful in organizing thoughts, observations, and ideas into distinct categories. AEIOU differs from our Drawing Ideas Quick-Start Worksheets in its formality and strict adherence to these five dimensions of a design space.

Fig. AEIOU Canvas

Activity (A) Canvas

Activities observation record sheet involves micro observation of the activity process. It includes activities which are done by users.

Environment (E) Canvas

Environment observation involves the observation of surrounding like activities that take place in. The atmosphere at project or in such field areas is very crucial. Environments involved in our project are places with overflowed trash in bin.

Interaction (I) Canvas

Interaction observation involves the observation that who is interacting or communication with whom and for what purpose at project. The interactions involved in our project are Common people, Students, etc.

Object (O) Canvas

Object observation record sheet involves the observation of object or materials or components used for project. Object involved in project are bin, GPS, Ultrasonic sensors, Plastic.

User (U) Canvas

User observation record sheet involves the observation of how user uses the product for their need or to get a solution from a problem and what responsibilities they perform. Users involved in our project are people walking by, drivers, near school, for clean environment.


Fig.1IOT Based Bin

All cities current waste collection considered here as a case work, logistics is carried out by emptying containers according to predefined schedules and routes which are repeated at a predefined frequency. Such a system has major disadvantage:
Time consuming, high costs, Greater traffic and congestion, unnecessary fuel consumption, increased noise and air pollution as a result of more trunks on the road.
All the above disadvantage are a result of lack of real time information resulting in unsuccessful collection of waste. The government itself finds this as a big problem and a big hurdle in between smart city. There is an urgent need to optimize the management of this service. In this system, ultrasonic sensor is used to monitor the level of garbage level. Ultra-Sonic Sensor is used to monitor the near by persons and

automatically drivers the DC Motor to open the lid of the dustbin. The dustbin is uploaded to the cloud using IOT. These helps for clearing the wastage from dustbin.

2.2 Product Development Canvas
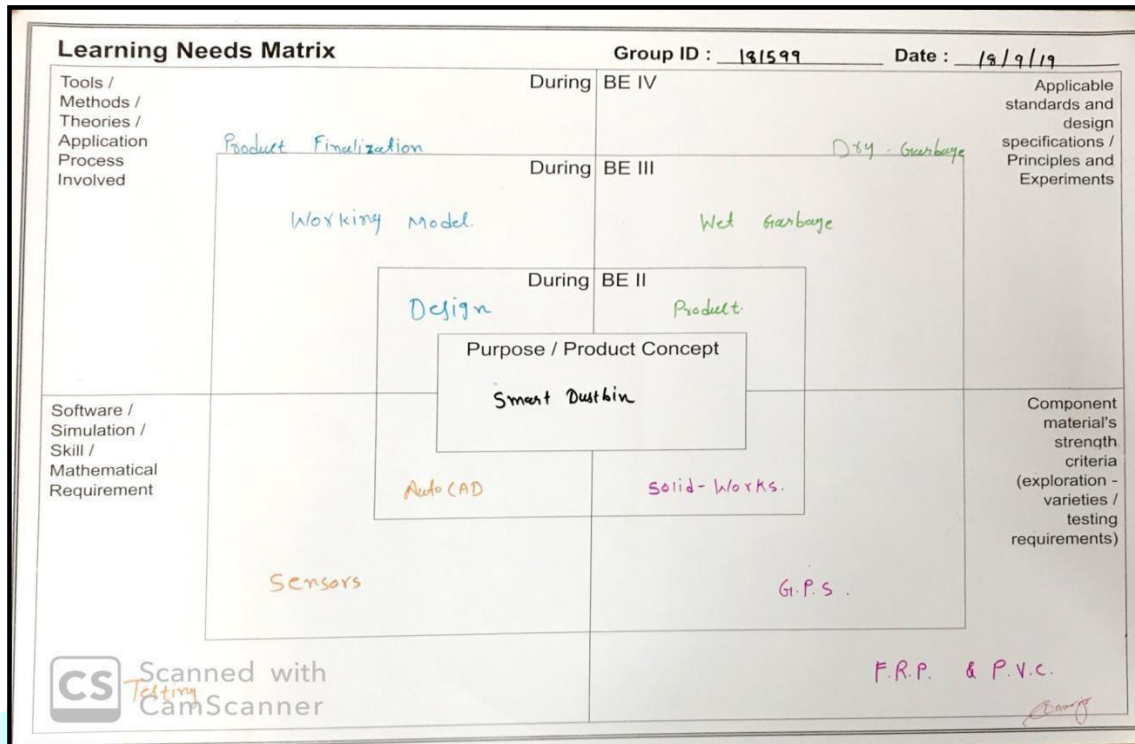
Purpose
Providing cleaning whenever and wherever

People
Student
Employees
Travelers
Shop keepers

Product Experience
Clean environment
Fresh air
Comfort

Product Function
To provide comfort
Clean environment and safe area for children.

Product Features
Cleanliness
Fresh air
Diseases free area.

Key Component
Bin
GPS
sensor

Customer Revalidation
Very clean area while walking.
Good and may have an trend for cleanliness and dustbin.

Reject/Redesign/Retain

Nothing is added for decoration

Hence no extraun necessary charges.

2.3 Learning Need Matrix

Learning's Need Matrix for the use by the students across all engineering branches. This tool was developed for exploring its usage in the semester IV, when a refinement is carried out in the Product Development Canvas. The purpose of LNM is to identify the requirements of learning among the team members. While a new product/process is under development based on a unique idea, the team members need to learn and explore a lot of new skills and documents, methods and guidelines.

Each learning need identified is required to be mentioned in form of a word. Using a sticky note, it should be pasted in a particular quadrant considering time line decided to accomplish the learning/exploring. Below is the LNM format.

Fig. lnm Canvas

Top-right quadrant identified the learning requirement regarding applicable standards, design specification, exploration and understanding of scientific principles and identification of different types of experiment to be performed over a period of time.

Top-left quadrant suggests making identification of learning the use of various tools, processes, methods of application, theories to apply tools involved.

The lower-left quadrant contains identified needs for learning of software, simulation techniques, skills, mathematical learning requirements and so on.

Lastly, the lower-right quadrant shall have the needs identified pertaining to an understanding of various alternative materials, its strength and other properties, standards, as well as its testing requirements, depending upon envisaged quality.

III LITERATURE SURVEY:

In the above mentioned papers, we notice different studies that emphasize on the need to be able to

manage the amount of waste being generated and what percent of people actually take up the responsibility and take steps to ensure this. Also, we can see how IOT modules are used to detect or track the waste for different waste bins or locations to be specific. We can also observe how with the use of IoT we can communicate between different devices and provide better solutions. we can observe that a major percentage of waste is generated by building in different forms. This tends to put forward a simple observation that a very minor percentage of people actually take up the responsibility and regulate the amount of waste being generated from these main sources. Therefore this is succeeds a proper solution.

In and we can see how the Ultrasonic sensors placed at appropriate position and ideal conditions can help detect the level of the waste generated and so be used to detecting the amount generated and equally take action on the same. Also in we can observe that minimal number of sensors placed at appropriate places can prove cost effective and very efficient but still a way for proper real time notification is not present. The paper explain show thew if I chip can be used to communicate between different devices and therefore bring about many solutions in embedded systems. Therefore our literature survey identifies.

IV REQUIREMENT SPECIFICATION

4.1 Arduino

The Arduino Uno R3 is an open-source microcontroller board based on the ATmega328 chip. It features 14 digital input/output pins, 6 analog input pins, an onboard 16 MHz ceramic resonator, a USB connection port, a DC power jack, an ICSP header, and a reset button for the microcontroller. This board includes everything needed to support the microcontroller, making it easy to get started—simply connect it to a computer via a USB cable or power it with a DC adapter or battery.

Unlike previous models, the Uno does not use the FTDI USB-to-serial driver chip. Instead, it incorporates the Atmega16U2 (or Atmega8U2 up to version R2) as a USB-to-serial converter. The Arduino Uno can be powered through the USB connection or an external power supply, with the power source selected automatically.

External power can be supplied via an AC-to-DC adapter (wall-wart) or battery. The adapter connects through a 2.1 mm center-positive plug into the board's power jack, while battery leads can be connected to the GND and VIN pin headers of the power connector. The board can operate on an external supply ranging from 6 to 20 volts. However, if supplied with less than 7V, the 5V pin may output less than five volts, potentially leading to instability. Conversely, using more than 12V could cause the voltage regulator to overheat and damage the board. The recommended voltage range for the Arduino Uno is 5V to 12V.

Features

- Operating Voltage: 5V
- MCU: ATMEGA 328P
- Input Voltage (recommended): 7-12V.
- Input Voltage (limit): 6-20V.
- Digital I/O Pins: 14
- PWM Digital I/O Pins: 6
- Analog Input Pins: 6
- DC Current per I/O Pin: 40 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB
- Flash Memory for Bootloader: 0.5 KB
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz

Arduino is an open source, computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can

sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by any one. Arduino boards are available commercially in preassembled form, or as do it yourself kits. Arduino board design variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers.

Arduino/Genuine Uno is a microcntroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform, for an extensive list of current, past or outdated boards see the Arduino index of boards.
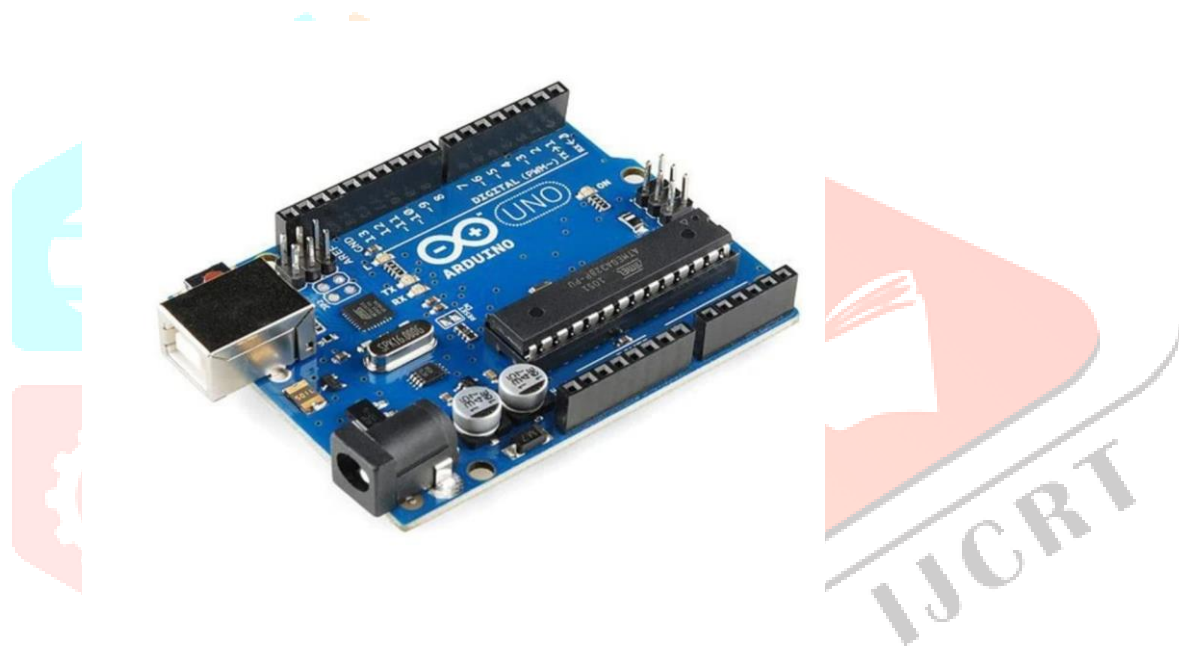
● Power USB-Arduino board can be powered by using the USB cable from your computer. All you need to do is connect the USB cable to the USB connection

● Power (Barrel Jack)
Arduino boards can be powered directly from the AC mains power supply by connecting it to the Barrel Jack.

● Voltage Regulator
The function of the voltage regulator is to control the voltage given to the Arduino board and stabilize the DC voltages used by the processor and other elements.

● Crystal Oscillator
The crystal oscillator helps Arduino in dealing with time issues. How does Arduino calculate time? The answer is, by using the crystal oscillator. The number printed on top of the Arduino crystal is 16.000 H9H. It tellsus that the frequency is16,000,000 Hertz or 16 MHz

● Arduino Reset
You can reset your Arduino board, i.e., starts your program from the beginning. You can reset the UNO board in two ways. First, by using there set button (17) on the board. Second, you can connect an external

reset button to the Arduino pin labelled RESET.

Analog pins- The Arduino UNO board has five analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it in to a digital value that can be read by the microprocessor.

Main microcontroller- Each Arduino board has its own microcontroller. You can assume it as the brain of your board. The main IC (integrated circuit) on the Arduino is slightly different from board to board. The microcontrollers are usually of the ATMEL Company. You must know what IC your board has before loading up a new program from the Arduino IDE. This information is available on the top of the IC. For more details about the IC construction and functions, you can refer to the data sheet.

ICSP pin- Mostly, ICSP (12) is an AVR, a tiny programming header for the Arduino consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often referred to asan SPI (Serial PeripheralIn terface), which could be considered asan"expansion" of the output. Actually, you are slaving the output device to the master of the SPI bus.

Power LED indicator. This LED should light up when you plug your Arduino into a power source to indicate that your board is powered up correctly. If this light does not turn on, then there is something wrong with the connection.

TX and RX LEDs On your board, you will find two labels: TX (transmit) and RX (receive). They appear in two places on the Arduino UNO board. First at the digital pins 0 and 1, to indicate the pins responsible for serial communication. Second, the TX and RX led (13). The TX led flashes with different speed while sending the serial data. The speed of flashing depends on the baud rate used bythe board. RX flashes during the receiving process.

Digital I/O- The Arduino UNO board has 14 digital I/O pins (15) (of which 6 provide PWM (Pulse Width Modulation) output. These pins can be configured to work as input digital pins to read logic values (0 or 1) or as digital output pins to drive different modules like LEDs, relays, etc. The pins labelled can be used to generate PWM.

AREF- AREF stands for Analog Reference. It is sometimes, used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

- Microcontroller-ATmega2560

- Operating Voltage -5V

- Input Voltage (recommended)-7-12V

- Input Voltage (limit)- 6-20V

4.2 Ultrasonic sensor

The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 2 cm to 400 cm or 1 to 13 feet. The operation is not affected by sunlight or black material, although acoustically, soft materials like cloth can be difficult to detect. It comes complete with ultrasonic transmitter and receiver module.

Features

● Supply voltage: 5V (DC).

● Supply current: 15mA.

● Modulation frequency: 40Hz.

● Output: 0 – 5V (Output high when obstacle detected in range).

● Beam Angle: Max 15 degrees.

● Distance: 2cm – 400cm.

● Accuracy: 0.3cm.

● Communication: Positive TTL pulse.

4.3 Servo motor (SG90)

There are lots of servo motors available in the market and each one has its own speciality and applications. Most of the hobby Servo motors operates from 4.8V to 6.5V, the higher the voltage higher the torque we can achieve, but most commonly they are operated at +5V. Almost all hobby servo motors can rotate only from 0° to 180° due to their gear arrangement so make sure you project can live with the half circle if no, you can prefer for a 0° to 360° motor or modify the motor to make a full circle. The gears in the motors are easily subjected to wear and tear, so if your application requires stronger and long running motors you can go with metal gears or just stick with normal plastic gear.

Next comes the most important parameter, which is the torque at which the motor operates. Again there are many choices here but the commonly available one is the 2.5 kg/cm torque which comes with the Tower pro SG90 Motor. This 2.5 kg/cm torque means that the motor can pulla weight of 2.5kg when it is suspended at a distance of 1cm. So if you suspend the load at 0.5cm then the motor can pull a load of 5kg similarly if you suspend the load at 2 cm then can pull only 1.25. Based on the load which you use in the project you can select the motor with proper torque. The below picture will illustrate the same .
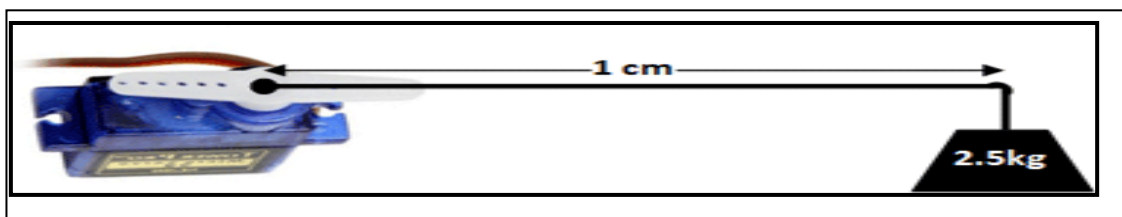
4.3.1 Working of a Servo Motor

The servo motor has some control circuits and a potentio meter (a variable resistor,akapot) connected to the output shaft. In the pot can be seen on the right side of the circuit board. This pot allows the control circuitry to monitor the current angle of the servo motor.

If the shaft is at the correct angle, then the motor shuts off. If the circuit finds that the angle isnot correct, it will turn the motor until it is at a desired angle. The output shaft of the servo is capable of traveling somewhere around 180 degrees. Usually, it is somewhere in the 210-degree range, however, it varies depending on the manufacturer. A normal servo is used to control an angular motion of 0 to 180 degrees. It is mechanically not capable of turning any farther dueto a mechanical stop built on to the main output gear.

The power applied to the motor is proportional to the distance it needs to travel. So, if the shaft needs to turn a large distance, the motor will run at full speed. If it needs to turn only a small amount, the motor will run at a slower speed. This is called proportional control.

Switch

In electrical engineering, a switch is an electrical component that can disconnect or connect the conducting path in an electrical circuit, interrupting the electric current or diverting it from one conductor to another.

Here we using a simple switch which can help us to engage and disengage to power supply and working of servo motor.

Battery

A power supply is responsible for providing a circuit with all the power it will need during normal operation. It provides the circuit with a certain voltage and current. For proper operation, we need to find away to convert the voltage of our main supply (battery or wall adapter) down to 5V.

A power supply is responsible for providing a circuit with all the power it will need during normal operation. It provides the circuit with a certain voltage and current.

Jumper wires

The term "jumper wire" simply refers to a conducting wire that establishes an electrical connection between two points in a circuit. A jump wire is an electrical wire, or group of them in a cable, with a connector or pin at each end, which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.
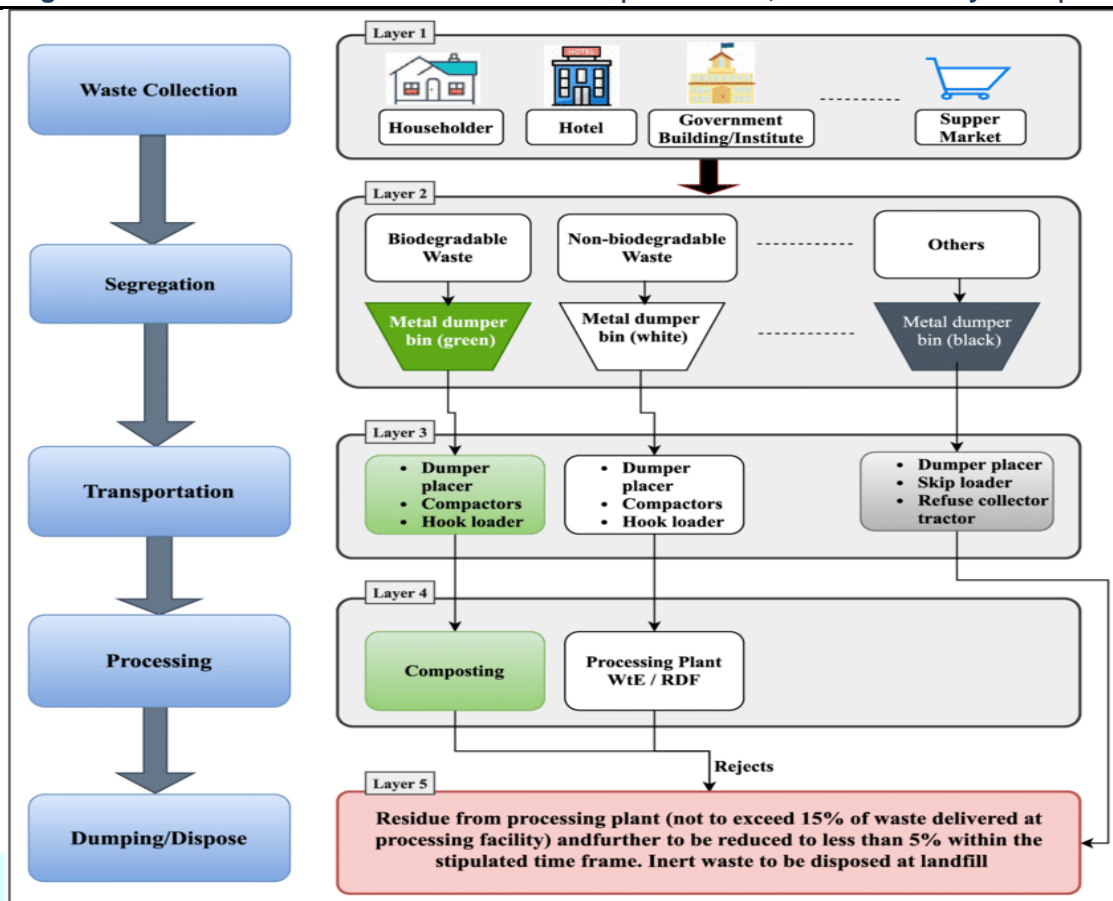
Fig. Flow chart of information of smart garbage

Monitoring application can control the time to determine when the maximum limit for the garbage can must be transported. It is aimed to repeat the time calculation in the limit of transportation as shown in above Figure. The phrogress bar shows the height level in the garbage can and the button "date" and "clock" would provide the selection of time limit for the next garbage transport. Mean while, the button "confirm" is for making confirmation if the garbage can have been transported and to update the time limit of transport, button "go to" will open the location of the garbage can based on the latitude and longitude provided on the database.

The waste collection process is composed of an innovative lifting system bilateral, automated and mono-operator devices which, able to collect waste from various types of ground level and underground containers/bins.

The technologies being used for waste collection process are Radio Frequency Identification (RFID), Global Position System (GPS), General Packet Radio Service (GPRS), and Geographic Information System (GIS). The collection trucks are embedded with RFID reader which helps in retrieving all the bin information from the RFID tags/ wireless ultrasonic and infrared sensors which also amended with SIM card and a replaceable Lithium battery placed in each bin. These sensors used advanced ultrasonic measurement and digital signal processing techniques for better accuracy to identify the waste fill level in the bin. The sensor can be remotely configured to read the fill levels periodicallyat set intervals. The sensor can also be configured to store the readings frequently and sent to server whenever it breaches a threshold level. The live alerts in form of SMS and emails will be sent directly from server to centralized system. The location of the bins is identifying by GPS and centralized system will pass this message to truck drivers to initiate waste collection process. A mobile app/ web application for truck drivers shall also be provided where the routes and bins to pick up can be seen by Drivers. This app also has facility to upload real-time photograph of underground bins and exact weight.

V IMPLEMENTATION

5.1 Program

```
#include

//servolibrary

Servo servo;

int trigPin=5;

int echoPin = 6;

 intservoPin=7;

int led= 10;

long duration, dist, average;

longaver[3];//arrayforaverage

 void setup()

{ Serial.begin(9600);

servo.attach(servoPin);

 pinMode(trigPin, OUTPUT);

pinMode(echoPin, INPUT);

servo.write(0);//closecaponpoweron

 delay(100);

servo.detach();

}

void measure()

 { digitalWrite(10,HIGH);

digitalWrite(trigPin, LOW);

 delayMicroseconds(5);

 digitalWrite(trigPin, HIGH);

 delayMicroseconds(15);

digitalWrite(trigPin, LOW);

 pinMode(echoPin, INPUT);

duration=pulseIn(echoPin,HIGH);

dist=(duration/2) /29.1;//obtaindistance

}
```

```
voidloop(){

for(inti=0;i<=2;i++){//averagedistance measure();

aver[i]=dist;

delay(10);//delaybetweenmeasurements

}

dist=(aver[0]+aver[1]+aver[2])/3;

if(dist<50){

//Changedistanceasperyourneed

 servo.attach(servoPin);

delay(1);

 servo.write(0);

 delay(3000);

servo.write(150);

delay(1000);

servo.detach();

}

Serial.print(dist);

}
```
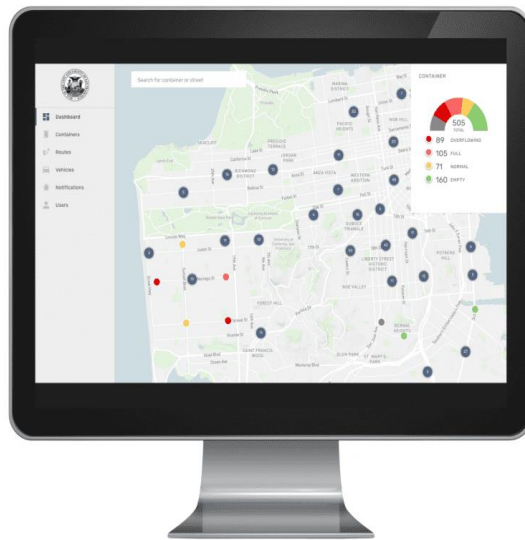
5.2 Smart Waste Management Platform

A smart waste management platform uses analytics to translate the data gather in your bins into actionable insights to help you improve your waste services. You can receive data on metric such as:

Locations prone to overflow

o   The number of bins needed to avoid overflowing waste
o   The number of collection services that could be saved
o   The amount of fuel that could be saved
o   The driving distance that could be saved

These data insights will help you transform your waste management to greener, cleaner, and smarter avenues.

5.2.1 Intelligent Routing

The data on the fill levels of bins also enables smart routing. With a digital overview of the fill levels of bins, waste collectors can use the smart waste management software to optimize their collection routes.

Instead of driving along fixed collection routes, waste collectors can use the data insights to switch to dynamic routes. This way, they only pick up bins that are in need of service, instead of spending long hours driving pre-planned collection routes and picking up every single bin regardless of fill level.

5.2.2 Container Tracking

A digital overview of your containers and waste inventory is an essential component of smart waste management. Container tracking provides you with transparency of your waste planning processes thanks to high-accuracy data on the location and movements of bins.

Integrating container tracking as part of your waste solutions will enable you to optimize your inventory management so you can easily schedule container maintenance, keep track of damage bins, and protect your bins against theft.
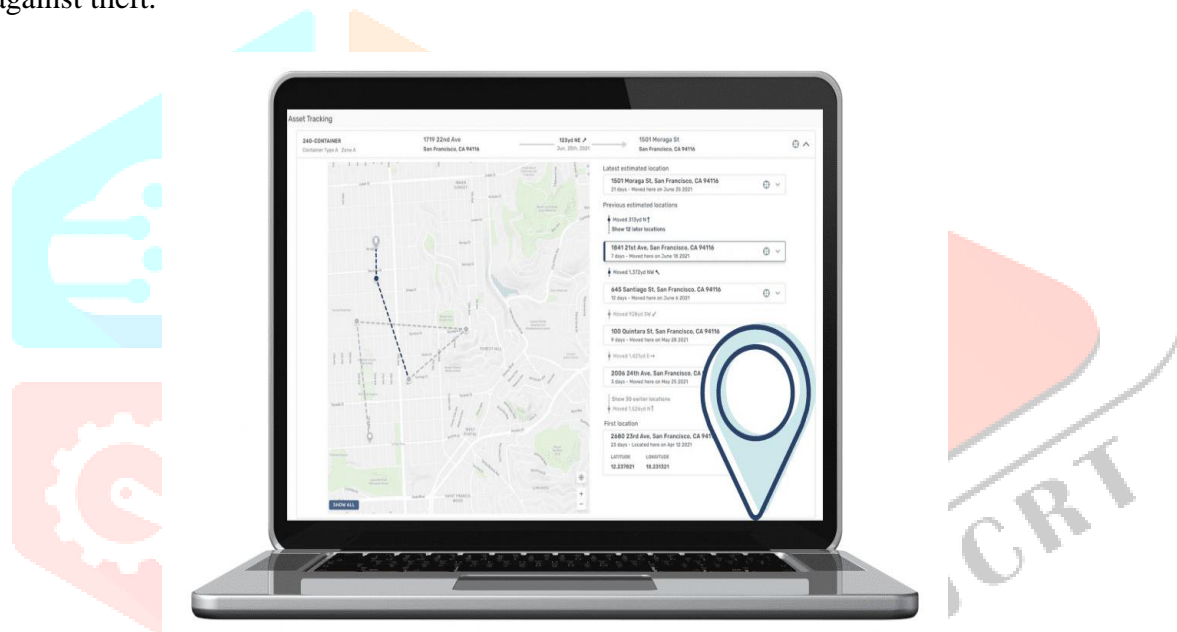
VI FUTURE WOEK

Automatic garbage fill alerting system helps us to reduce the pollution. Many times garbage dustbin is overflow and many animals like dog or cow enters inside or near the dustbin. Also some birds are also trying to take out garbage from dustbin. This project can avoid such situations. And the message can be sent directly to the cleaning vehicle instead of the contractor's office. Apart from this, differentiation can be made between dry trash bin and wet trash bin collecting plastic dry waste and biodegradable waste respectively. To implement this methane and smell sensors can be used. This helps in distinguishing the waste at the source and hence reducing the requirement of manpower.

To enhance it further, an automated system can be developed which is able to pick up waste in and around the bin, segregate them and put them in respective bins.
We have try to new innovation in this project like we think about fit the GSM module which helps to send a message to particular service room and around the smart bin area it indicates dustbin was full in shortly please collect the garbage from the bin.
New one adding feature is solar panel which is natural recourses and its works on solar energy it's fully automated and all the components of smart bin works upon the solar energy.
Another we think on artificial intelligence its guide to peoples which compartment is dry west and wet west it is very helpful for blind peoples who don't look where is the compartment of dry and wet garbage. In this

feature we need to proximity sensors and computer master in artificial intelligence

VII CONCLUSION

We able to know how people suffer from this problem and we also got to knew about the working functionality of cleanliness.

This project work is the implementation of Automatic Garbage Fill Alerting system using Ultrasonic sensor, Arduino Uno, Buzzer and Wi-Fi module. This system assures the cleaning of dustbins soon when the garbage level reaches its maximum. It will take power supply with the help of Piezo electric Device. If the dustbin is not cleaned in specific time.

Then the record is sent to the Sweeper or higher authority who can take appropriate action against the concerned contractor. This system also helps to monitor the fake reports and hence can reduce the corruption in the overall management system. This reduces the total number of trips of garbage collection vehicle and hence reduces the overall expenditure associated with the garbage collection. It ultimately helps to keep cleanliness in the society. Therefore, the Automatic Garbage Fill Alerting system makes the garbage collection more efficient.

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