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SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

WINTER SEMESTER - 2022

GARBAGE MONITORING SYSTEM

A Report

submitted by

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CSE3009 – Internet of Things – J Component

B1 - Slot

Faculty Name – Dr.A.Saraswathi Priyadharshini,

Department of Analytics,

SCOPE

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Abstract:

In this report we'll explore the GMS device i.e. Garbage watching System, that is detected the overflow of garbage from the bin. Its main purpose is to point the municipal corporation regarding the overflowing of a bin by causation a text message to them together with the placement of the bin. The IOT Garbage watching system may be a terribly pioneering system which can facilitate to stay the cities clean. This arrangement monitors the rubbish bins and notifies regarding the extent of garbage collected within the garbage bins via an internet page. For this the system uses inaudible (Ultrasonic) sensors placed over the bins to discover the rubbish level and compare it with the rubbish bins depth. The system makes use of AVR family microcontroller (node MCU, Wi-Fi modem, wireless local area network electronic equipment for causation information. The dashboard in laptop is employed to display the standing of the extent of garbage collected within the bins. The dashboard provides a graphical read of the height of bins. The digital display screen shows the standing of the rubbish level. The system tries to make the process garbage collection smart. Therefore, this method is capable to endorse cleanliness by informing regarding the rubbish levels of the bins by providing data of the cans via Thingspeak server and Arduino software. In this paper we aim on displaying garbage levels of the dustbin in terms of centimeters and inches.

Introduction:

Waste management is an important issue that needs to have a concern in every country including India. As reported India generates 62 million tons of waste each year. About 43 million tons (70%) are collected of which about 12 million tons are treated, and 31 million tons are dumped in landfill sites. Waste management in India at this time, is still limited and manually, the officer will clean up at a specified time according to the schedule, this is very ineffective because the trash can have been fully before the garbage collection schedule, the delay of garbage collection will cause the garbage on the trash can overflow and smell. Waste volume produced by inefficient waste management would cause insects, bacteria and viruses multiply rapidly that can infect humans. Traditional waste management techniques including garbage burning system would cause air pollution produced, which is widely visible in cities like Delhi can lead to health problems to the surrounding community. With a large amount of waste, India certainly needs a system to assist the waste management process properly and efficiently. Internet of Things (IoT) refers to a technology that can connect the embedded system devices to run various functions that can be used and controlled through internet

connectivity. It has been widely used to support Smart City Management in transportation. IOT can be a great solution to this problem of tackling waste with minimum human efforts. Io based research on waste management has been largely conducted, say Smart Garbage System (SGS). Another study proposed a waste management system using the method of grouping the garbage location. Traditional IOT based systems does not provide any information about the time limit of waste transport and the location of the garbage can to the users. Our focus of this research is on the utilization of IoT technology in designing and implementing android application on smartphone for Smart Garbage Monitoring System, to improve the function of waste management in each region and make it work more efficiently and optimally. The system doesn't need a server to process the data, because entire process of the system will be run by an android application on a smartphone, The system is designed to read the garbage volume in garbage can and determine the time of garbage transport in which the entire system can work in real time without any human intervention in its process.

Literature Survey:

1. **Title: IoT: smart garbage monitoring using android and real time database**

- **Authors:** Riyan Hadi Putra, Feri Teja Kusuma, Tri Nopiani Damayanti, Dadan Nur Ramadan

- **Proposed System:** The use of ultrasonic sensor, GPS and GSM Module on the garbage can aims to provide the data on the garbage and send it to the real time database, in which the data will be processed by the monitoring application on smartphone to determine the time of garbage transport purposely to prevent any buildup.

- **Advantages:** The system doesn't need a server to process, because the entire process of will be run by android application on a smartphone. Test results showed the capability of the system in monitoring the garbage can with the minimum distance between the wastes by three meters.

- **Disadvantages:** The information on the height level of garbage can be synchronized in real time to smartphone, with an average delay on the EDGE network of 4.57 seconds, HSPA+ of 4.52 seconds and LTE of 3.85 seconds.

- **Bibliography:** Riyan Hadi Putra, Feri Teja Kusuma, Tri Nopiani Damayanti, Dadan Nur Ramadan. IoT: smart garbage monitoring using android and real time database

2. **Title: IOT Based Garbage Monitoring System**

- **Author:** Smitha Lingadahalli Ravi, Shradha, Mrs. Pramodhini R. Nitte.

- **Proposed System:** The dustbins are interfaced with Arduino base system having ultrasonic sensor along with central system showing the Current status of garbage on display and web browser HTML page with Wi-Fi module.

- **Advantages:** The displays text output by Arduino software (IDE), including the complete error message and other information.

- **Disadvantages:** We can't see the level of garbage in a bin remotely from anywhere. It requires server to check the status of the bin.

- **Bibliography:** Smitha Lingadahalli Ravi, Shradha, Mrs. Pramodhini R. Nitte. IOT Based Garbage Monitoring System.

3. **Title: IoT Based University Garbage Monitoring System for Healthy Environment for Students.**

- **Authors:** Muhammad Nasir Khan and Fawad Naseer.

- **Proposed System:** The paper targets Universities' Garbage Monitoring System, by installing a simple 5 step procedure system: Ultrasonic Sensor -> Arduino UNO -> Wi-Fi Module -> University Sweeper Monitoring Room -> LED blink on map.

- **Advantages:** This is a less complex system, and so can be effectively used by workers. The LEDs attached to the MAPs helps to find the location precisely.

- **Disadvantages:** The system is not software included and thus should put desktop and clouds first. Also, it is not possible for determining the quality of garbage thrown by the student. It is important to use more factors for determining the type of garbage: wet/dry.

- **Bibliography:** Muhammad Nasir Khan and Fawad Naseer. IoT Based University Garbage Monitoring System for Healthy.

4. **Title: Smart Garbage Monitoring and Clearance System using Internet of Things**

- **Authors:** SV Kumar, T. Senthil Kumaran, AK Kumar, Mahantesh Mathapati.

- **Proposed System:** The paper targets on solving the metropolitan waste disposal issue, by installing 4 major modules in the dustbin i.e., IR sensor, LCD display, Web, GSM. They have a display screen and two LEDs for telling the status of the dustbin and the information is shared on Web to the other servers and users for maintenance. It also shares the location of the bin using GPS.

- **Advantages:** All the major functionalities are present in the system. Also, since the information can be shared via web it is easily and widely available to people.

- **Disadvantages:** The expense of building this prototype is very high. Due, to a lot of complicacies there are a lot of things that can go wrong. Also, since Web is involved, there are potential security vulnerabilities.

- **Bibliography:** SV Kumar, T. Senthil Kumaran, AK Kumar, Mahantesh Mathapati. Smart Garbage Monitoring and Clearance System using Internet of Things.

5. **Title: Internet Of Things Based Garbage Monitoring System**

- **Authors:** Sagnik Kanta, Srinjoy Jash, Himadri Nath Saha.

- **Proposed System:** The paper talks about a unique system architecture which involves RFID, GPS, GIS. Apart from this, hardware which includes Ultrasonic Sensors, Wifi-Modem and RFID tags are attached to the dustbin. Also, they talked about adding chemical sensors.

- **Advantages:** The system they have proposed is very smart/intelligent, also they talked about adding chemical sensors to the distinguish between Bio-Degradable and Non-Biodegradable waste.

- **Disadvantages:** The given prototype is very expensive to build and even harder to manage. Also, since the expense is already high so we can use Raspberry Pie instead of Arduino ATmega 2560 for better performance.

- **Bibliography:** Sagnik Kanta, Srinjoy Jash, Himadri Nath Saha. Internet Of Things Based Garbage Monitoring System

Proposed Work:

Motivation/Overview:

The existing system has the limitations as time intense, trucks go and empty the containers, even they're empty. the price is high with insanitary setting. Even the dangerous odour causes the unhealthy setting. So planned model talks regarding the way to create use of the recent advancements in technology to form our place clean and tidy. The implementation starts by setup ESP8266 by flashing the newest version of the microcode. This alters the Blank libraries expeditiously communicate and avoid manufacturing error. To flash the newest microcode, transfer the ESP8266 flasher tool and the latest microcode from the web which might be within the bin format and flash the ESP8266 with it. Once the ESP8266 flashing done, alternative parts may be other to the configuration. Thingspeak server can be used to measure the exact level of bin and display it effectively on the dashboard.

In simple terms, we plan on using a ESP8266 micro-controller, and mount a Ultra-Sonic Sensor on it. We plan on measuring the height of the container/dustbin. We know ESP8266 is a WI-FI integrated microcontroller. So, we plan on sending the percentage of the dustbin level, to our Web-Application. Therefore, according to the dynamic level-interpretation the garbage van can rote it's path.

Materials required:

Hardware:

1. NODE MCU
2. Ultrasonic Sensor
3. Jump Wires
4. B-Chord.

Software:

1. Arduino
2. Thingspeak.

Architecture:

• For this the system we used a ultrasonic sensor, placed over the bins to detect the garbage level and compare it with the garbage bins depth. The system makes use of ESP8266 microcontroller. Also, note that system is powered by a 12V transformer. We then plan on using Arduino software for configuring the functionality.

• The dashboard of Thingspeak gives a graphical view of the garbage bins and highlights the garbage height with the respect of time at which the data is collected.

• Thus, this system helps to keep a metropolitan city clean by informing about the garbage levels of the bins by providing dynamic data of the bins via IOT and a simple server platform.

Algorithm:

i. Start
ii. Connect the Ultrasonic Sensor to the NODEMCU.
iii. Configure the code to NODEMCU.
iv. Place the system at the top of a dustin.
v. Connect to Thingspeak Server.
vi. Dynamic Values will be shared on your dashboard.
vii. Monitor the values of height.
viii. End.

Flowchart:

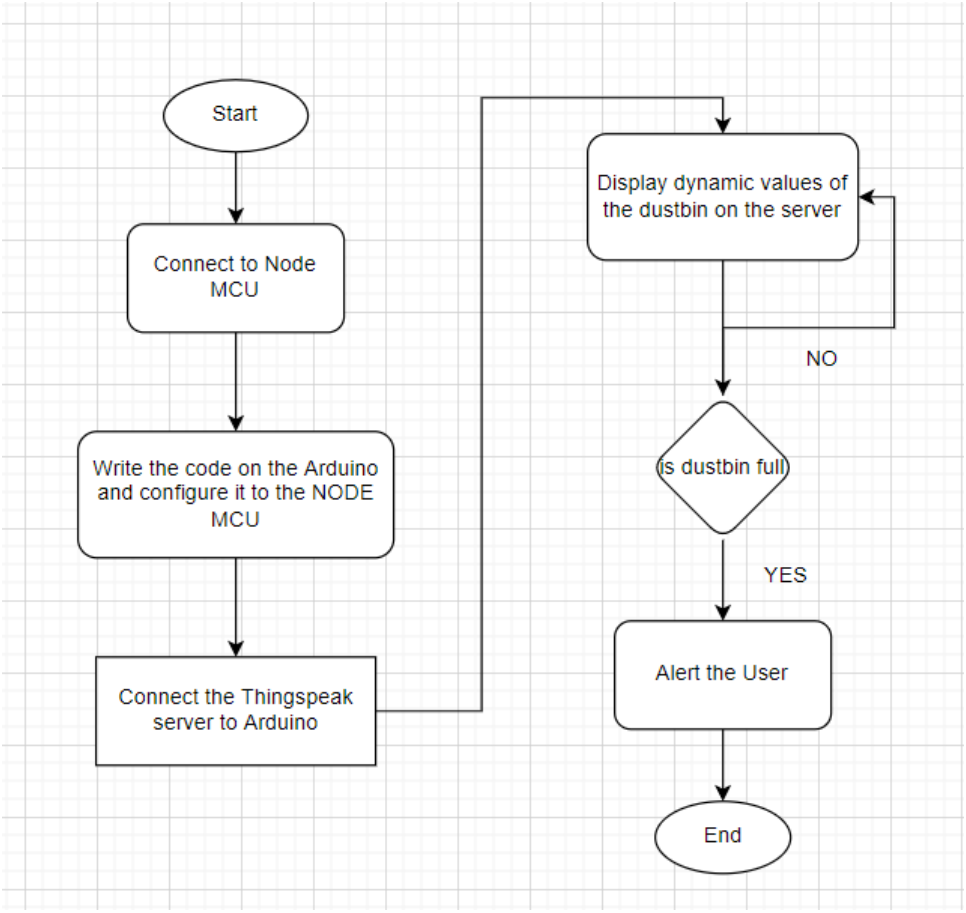

Fig: Flowchart of the Architecture.

Technology Used:

1.Hardware and Software

Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing HC-SR04 ultrasonic sensor. "The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats or dolphins do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-touse package. From 2cm to 400 cm or 1" to 13 feet.

2. Ultrasonic Sensor

The Ultrasonic Sensor is used to measure the distance with high accuracy and stable readings. It can measure distance from 2cm to 400cm or from 1 inch to 13 feet. It emits an ultrasound wave at the frequency of 40KHz in the air and if the object will come in its way then it will bounce back to the sensor. By using that time which it takes to strike the object and comes back, you can calculate the distance. Distance can be measured by equation 1.

Distance = Time * sound speed /2. ----------(1)

Where Time = the time between an ultrasonic wave is received and transmitted. It has four pins. Two are VCC and GND which will be connected to the 5V and the GND of the Arduino while the other two pins are Trig and Echo pins which will be connected to any digital pins of the Arduino. The trig pin will send the signal and the Echo pin will be used to receive the signal. To generate an ultrasound signal, you will have to make the Trig pin high for about 10us which will send a 8 cycle sonic burst at the speed of sound and after striking the object, it will be received by the Echo pin.

3.Node MCU

Node MCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The NodeMCU ESP8266 development board comes with the ESP-12E module containing ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor supports RTOS and operates at 80MHz to 160 MHz adjustable clock frequency. NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects.

Connections:

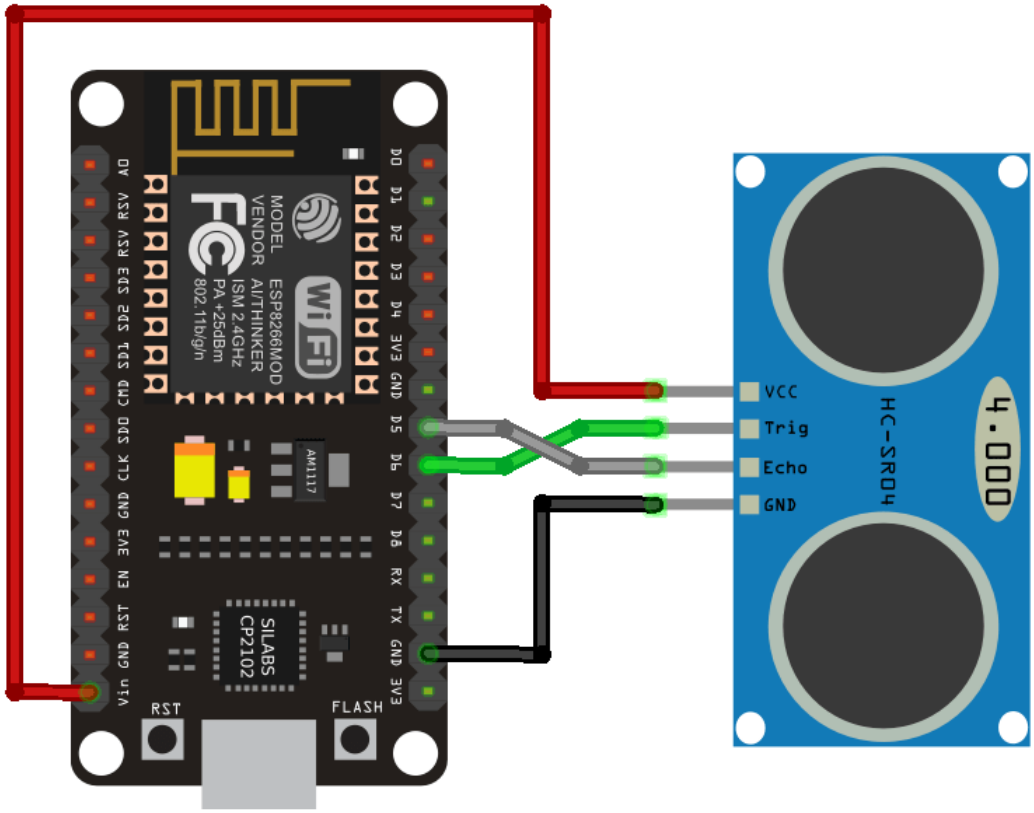

Fig: Connections.

Results and Discussion:

Code Screenshots:

garbage | Arduino 1.8.19 (Windows Store 1.8.57.0)

File Edit Sketch Tools Help

garbage

```
#include <ThingSpeak.h>
#include <WiFiClient.h>
#include <ESP8266WiFi.h>
const int trigPin = 12;
const int echoPin = 14;

//define sound velocity in cm/uS
#define SOUND_VELOCITY 0.034
#define CM_TO_INCH 0.393701
WiFiClient client;

char ssid[] = "Redmi Note 10 Pro";
char pass[] = "parth3110";
//------------------------------------------
unsigned long mychannelNumber = 1700085;
const char * writeAPIKey = "I4768LQU52UPDALL";
//------------------------------------------
long duration;
float distanceCm;
float distanceInch;

void setup() {
  Serial.begin(115200); // Starts the serial communication
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
  pinMode(echoPin, INPUT); // Sets the echoPin as an Input
  WiFi.begin(ssid, pass);
```

Fig: Code (1).

Fig: Code (2).

Compiling:

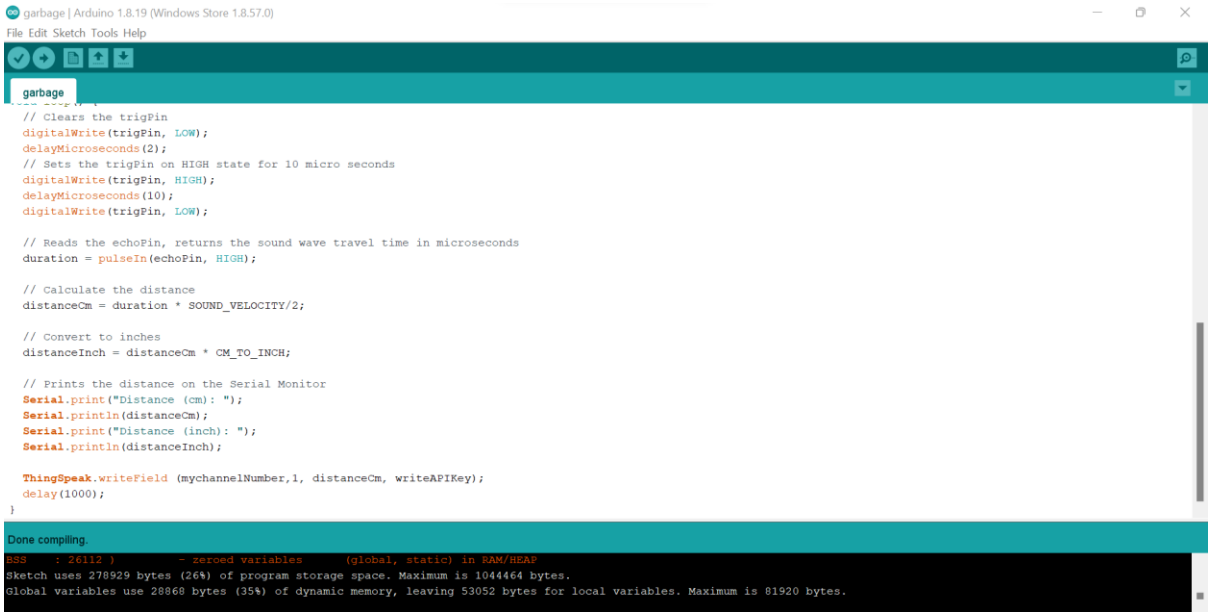

Fig: Compilation of Code

Demonstration:

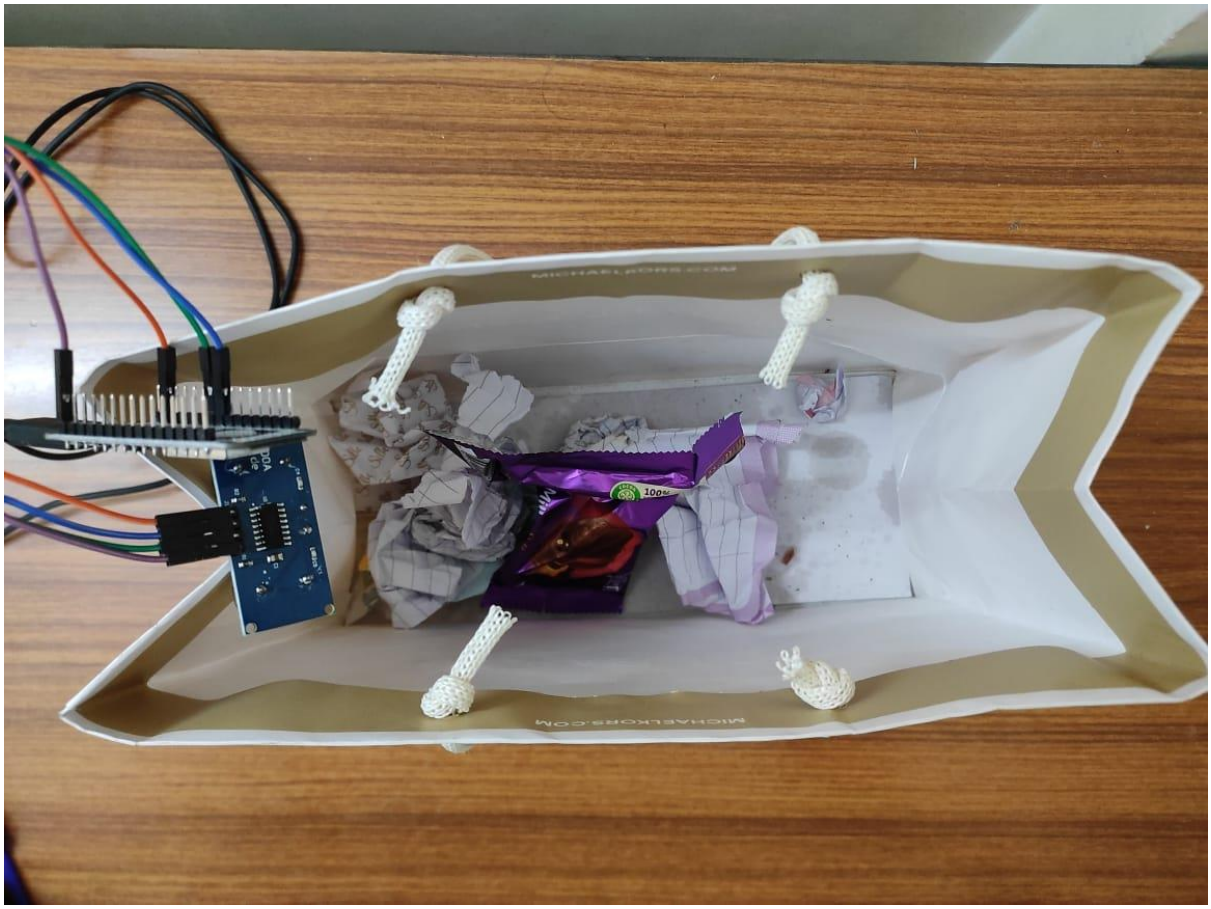

Fig: Deploying Sensors (1)

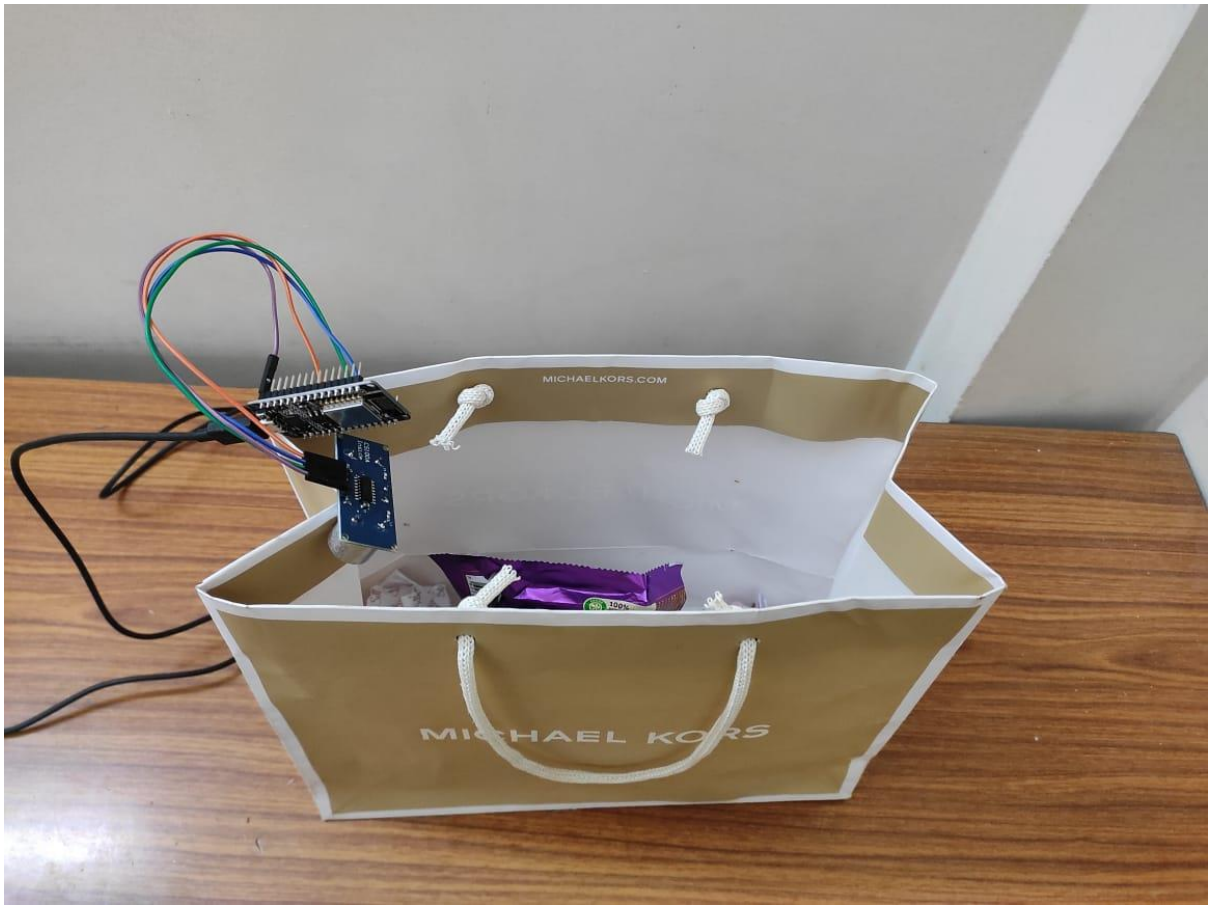

Fig: Deploying Sensors (2)

Output Screenshots:

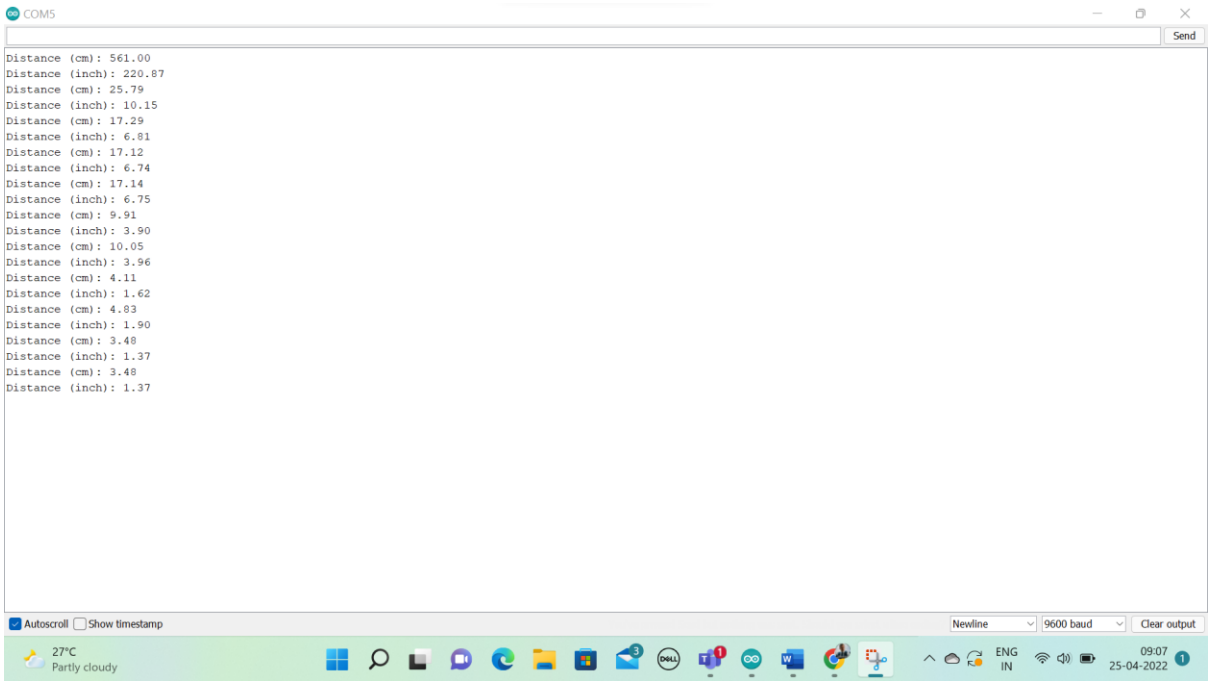

Fig: Output Serial Window

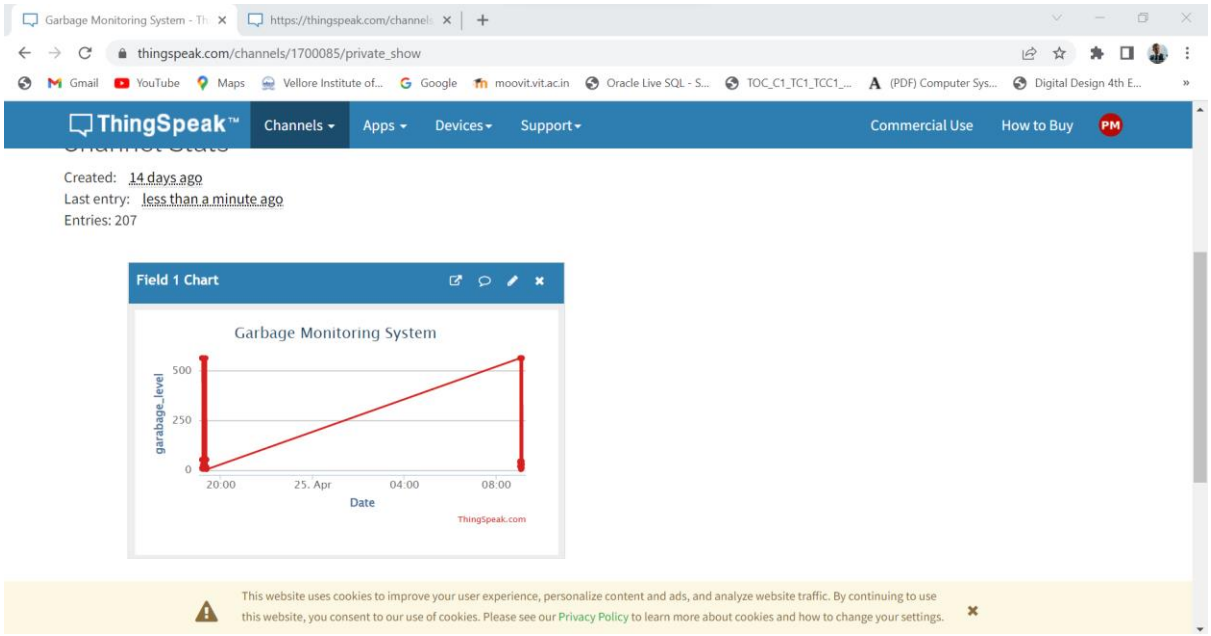

Fig: Dashboard (Thingspeak).

Analysis:

We can clearly see the results being displayed on the serial window of the Arduino software. The results are displayed based on the height measured by ultrasonic sensor that is placed on the dustbin. With time as the bin starts to get full readings starts to decrease. The results are shown both in cm and inches. Also, we have connected the server of Thingspeak to our system, in order to show the values that are attained by sensor to be displayed on the dashboard that we have created. Note that the value of the height bin is measured across X-axis along with the time and date on the Y-axis. Thus, dynamic values are visible showing the status of dustbin. With this, the process of Garbage Monitoring is automated for a Metropolitan city.

Conclusion and Future Work:

The main objective is to take care of the extent of cleanliness within the town and kind and setting which is higher for living. By victimization this system we will perpetually check the level of the garbage within the dustbins that are placed in numerous elements of town. If a selected garbage can has reached the utmost level, then the staff will be au fait and that they will now take sure actions to empty it as presently as potential. the staff will check the standing of these bins anytime on their mobile phones. this could convince be an awfully helpful system if used properly. The system will be used as a benchmark by the folks that are willing to require one step further for increasing the cleanliness in their revered areas.

We proposed a system where garbage can is monitored with a central system showing this standing of garbage on Mobile (web browser) with the assistance of Wi-Fi. The central system is created from microcontroller and Ultrasonic and Wi-Fi sensors area units which will in turn help us to access and know the status of bins that are deployed across the ciy.

Also, there are also new technologies that are coming to play in the filed of IOT, including Fog and Edge computation. These new technologies can also play an important role in development of such systems at a wider level. There are a lot of different sensors that can also be deployed for understanding the status of the can, including weight and chemical sensors. Fog Computing implemented on Waste Management System, will be decent idea, as this IOT implemented is implemented at a level where we need scalability.

References:

1. Riyan Hadi Putra, Feri Teja Kusuma, Tri Nopiani Damayanti, Dadan Nur Ramadan. IoT: smart garbage monitoring using android and real time database
2. Smitha Lingadahalli Ravi, Shradha, Mrs. Pramodhini R. Nitte. IOT Based Garbage Monitoring System.
3. Muhammad Nasir Khan and Fawad Naseer. IoT Based University Garbage Monitoring System for Healthy.
4. SV Kumar, T. Senthil Kumaran, AK Kumar, Mahantesh Mathapati. Smart Garbage Monitoring and Clearance System using Internet of Things.
5. Sagnik Kanta, Srinjoy Jash, Himadri Nath Saha. Internet Of Things Based Garbage Monitoring System
6. https://randomnerdtutorials.com/esp8266-nodemcu-hc-sr04-ultrasonic-arduino/
7. https://create.arduino.cc/projecthub/abdularbi17/ultrasonic-sensor-hc-sr04-with-arduino-tutorial-327ff6
8. https://docs.arduino.cc/built-in-examples/sensors/Ping

Annexure:

Source Code:

```
#include <ThingSpeak.h>

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#include <ESP8266WiFi.h>

const int trigPin = 12;
```

```
const int echoPin = 14;

//define sound velocity in cm/uS
#define SOUND_VELOCITY 0.034
#define CM_TO_INCH 0.393701
WiFiClient client;

char ssid[] = "";
char pass[] = "";
//---------------------------------------
unsigned long mychannelNumber = ;

const char * writeAPIKey = "";
//---------------------------------------
long duration;
float distanceCm;
float distanceInch;

void setup() {
  Serial.begin(115200); // Starts the serial communication

  pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output

  pinMode(echoPin, INPUT); // Sets the echoPin as an Input
```

```
  WiFi.begin(ssid, pass);

  ThingSpeak.begin(client);
}

void loop() {
  // Clears the trigPin
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  // Sets the trigPin on HIGH state for 10 micro seconds
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  // Reads the echoPin, returns the sound wave travel time in microseconds
  duration = pulseIn(echoPin, HIGH);

  // Calculate the distance
  distanceCm = duration * SOUND_VELOCITY/2;

  // Convert to inches
  distanceInch = distanceCm * CM_TO_INCH;

  // Prints the distance on the Serial Monitor
  Serial.print("Distance (cm): ");
```

```
  Serial.println(distanceCm);
  Serial.print("Distance (inch): ");
  Serial.println(distanceInch);

  ThingSpeak.writeField (mychannelNumber,1, distanceCm, writeAPIKey);

  delay(1000);
}
```

Review 1 PPT: (Note: The ppts can be a little deflected as there are plugin problems).

TEAM

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2

PROBLEM STATEMENT

TO DEVELOP A IOT BASED INTELLIGENT GARBAGE WATCHING SYSYTEM FOR SMART CITIES.

3

ABSTRACT

- Our intent is to work on GMS device i.e. Garbage Monitoring System, that is detected the overflow of garbage from the bin. Its main purpose is to point the municipal corporation regarding the overflowing of a bin by causation a text message to them together with the placement of the bin. The IOT Garbage watching system may be a terribly pioneering system which can facilitate to stay the cities clean. This arrangement monitors the rubbish bins and notifies regarding the extent of garbage collected within the garbage bins via an internet page.

4

INTRODUCTION

Waste management is an important issue that needs to have a concern in every country including India. As reported by the Report of Study from Ministry of Environment and Forest, that only 38,653 million tons of waste handled in 360 cities, and garbage increased 7% from 2015 -2016. Waste management in India at this time, is still limited and manually, the officer will clean up at a specified time according to the schedule, this is very ineffective because the Trash Can has been fully before the garbage collection schedule, the delay of garbage collection will cause the garbage on the trash can overflow and smell. Waste volume produced by inefficient waste management would cause insects, bacteria and viruses multiply rapidly that can infect humans.

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LITERATURE REVIEW:

- Title: IoT: smart garbage monitoring using android and real time database Putra, Riyan & Kusuma, Feri & Damayanti, Tri & Ramadan, Dadan. (2019).
- Proposed System: The use of ultrasonic sensor, GPS and GSM Module on the garbage can aims to provide the data on the garbage and send it to the real time database, in which the data will be processed by the monitoring application on smartphone to determine the time of garbage transport purposely to prevent any buildup.
- Advantages: The system doesn't need a server to process, because the entire process of will be run by android application on a smartphone. Test results showed the capability of the system in monitoring the garbage can with the minimum distance between the wastes by three meters.
- Disadvantages:The information on the height level of garbage can be synchronized in real time to smartphone, with an average delay on the EDGE network of 4.57 seconds, HSPA+ of 4.52 seconds and LTE of 3.85 seconds.

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- Proposed System: The dustbins are interfaced with Arduino base system having ultrasonic sensor along with central system showing the Current status of garbage on display and web browser HTML page with Wi -Fi module.
- Advantages: The displays text output by Arduino software (IDE), including the complete error message and other information.
- Disadvantages: We Cant see the level of garbage in a bin remotely from any where. It requires server to check the status of the bin.

8

Literature Review:

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- Proposed System: The paper targets Universities' Garbage Monitoring System, by installing a simple 5 step procedure system: Ultrasonic Sensor-> Arduino UNO -> Wi-Fi Module -> University Sweeper Monitoring Room -> LED blink on map.
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- Disadvantages: The system is not software included and thus should put desktop and clouds first. Also, it is not possible for determining the quality of garbage thrown by the student. It is important to use more factors for determining the type of garbage: wet/dry.

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- Advantages: All the major functionalities are present in the system. Also, since the information can be shared via web it is easily and widely available to people.
- Disadvantages: The expense of building this prototype is very high Due, to a lot of complicacies there are a lot of things that can go wrong. Also, since Web is involved, there are potential security vulnerabilities.

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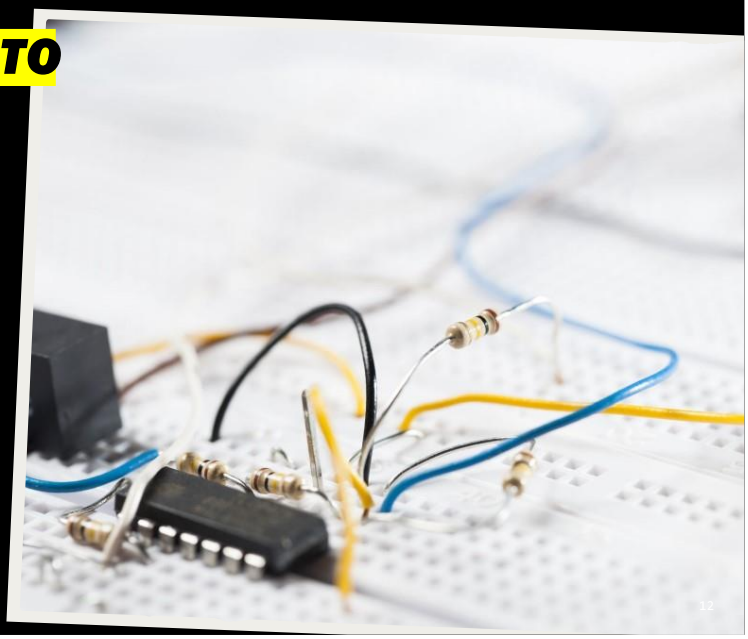
- Advantages: The system they have proposed is very smart/intelligent, also they talked about adding chemical sensors to the distinguish between Bio-Degradable and Non-Biodegradable waste.
- Disadvantages: The given prototype is very expensive to build and even harder to manage. Also, since the expense is already high so we can use Raspberry Pie instead of Arduino ATmega 2560 for better performance.

11

WHAT WE PLAN TO DO?

- To make a cheap, rigid IOT system in-order to tackle the challenges of garbage disposal.
- We would be using these 3 major entities in our project: Node MCU, Wi-fi Modem, Ultrasonic Sensors for realising the status of the bin remotely.
- Further Details which include Flowchart, Pseudo Code and Demonstration will be presented in the next Review.



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Review 2 PPT: (Note: The ppts can be a little deflected as there are plugin problems).

GARBAGE MONITORING SYSTEM

IOT - J COMPONENT

1

TEAM

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2

PROPOSED IDEA

The existing system has the limitations as time intense, trucks go and empty the containers, even they're empty.

The price is high with insanitary setting. Even the dangerous odour causes the unhealthy setting.

So planned model talks regarding the way to create use of the recent advancements in technology to form our place clean and tidy

4

PROPOSED IDEA

CONT...

We plan on using a ESP8266 micro-controller, and mount a Ultra-Sonic Sensor on it. We plan on measuring the height of the container/dustbin.

We know ESP8266 is a WI-FI integrated microcontroller. So, we plan on sending the percentage of the dustbin level, to our Web-Application. Therefore, according the dynamic level-interpretation the garbage van can rote it's path.

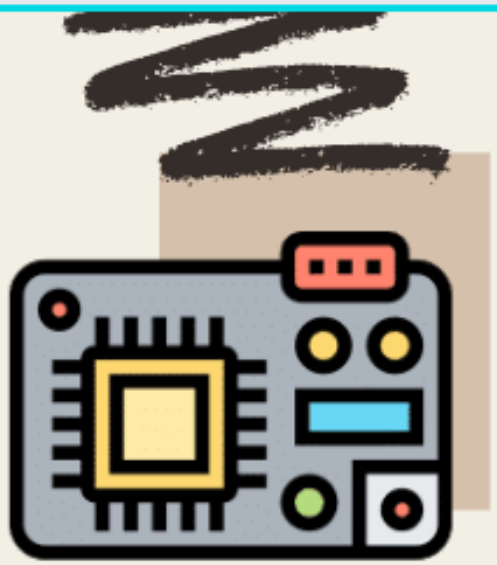
5

TOOLS: HARDWARE

ESP8266
Micro-Controller

ULTRASOINC SENSOR
Sensor

F2F WIRES AND B-CHORD
Connections



6

TOOLS: SOFTWARE

ARDUINO
Programming

THINGSPEAK/UBIDOTS
API

7

FLOWCHART/ ARCHITECTURE

This is a simple flowchart for our Smart GMS model.

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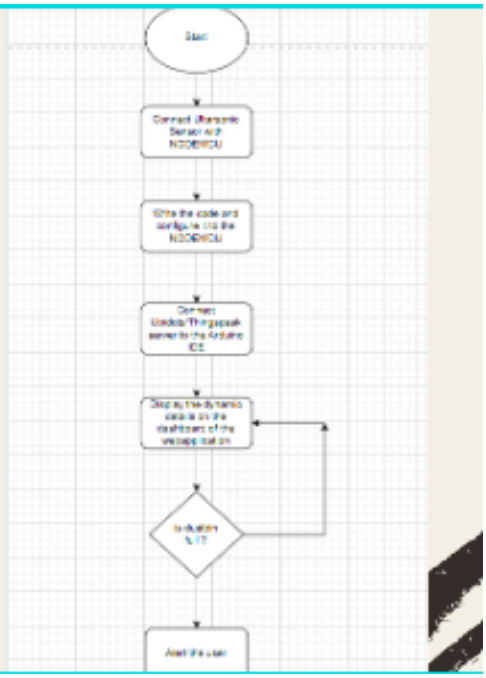

ALGORITHM

1. Start
2. Connect the Ultrasonic Sensor to the NODEMCU.
3. Configure the code to NODEMCU.
4. Place the system at the top of a dustin.
5. Connect to Thingspeak Server.
6. Dynamic Values will be shared on your dashboard.
7. Monitor the values of height.
8. End

METHODOLOGY

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MODERN SOLUTIONS
ALTERNATIVE METHODOLOGY
RFIDs
FOG and EDGE Nodes
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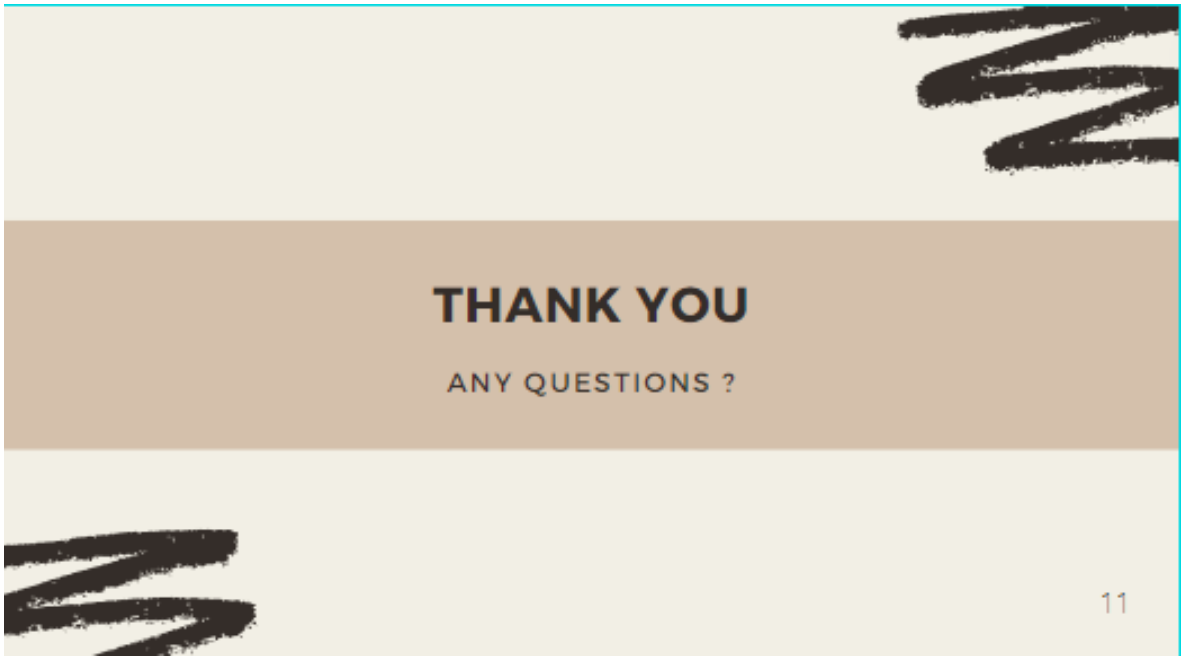
THANK YOU
ANY QUESTIONS ?
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