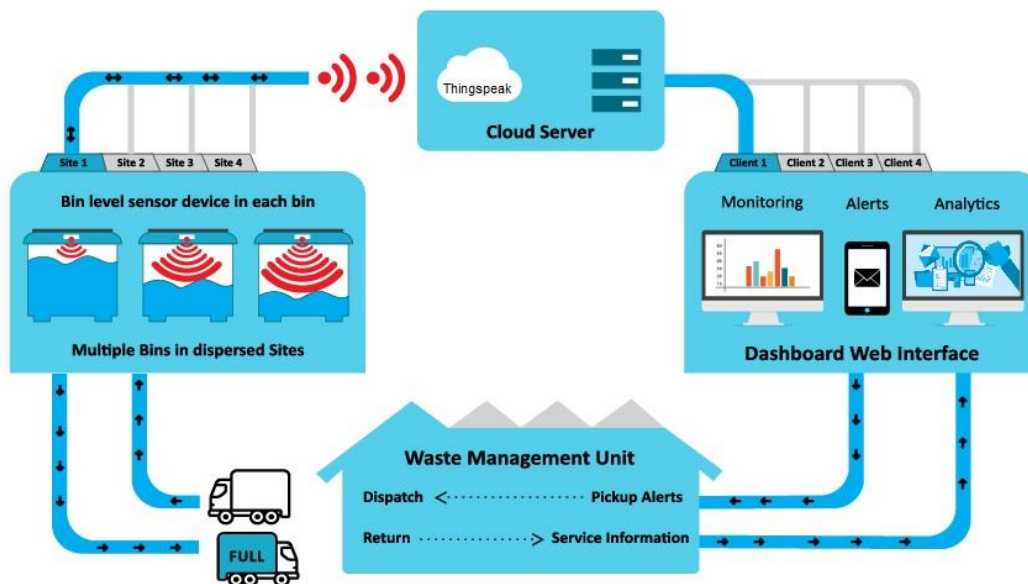# SMART WASTE MANAGEMENT SYSTEM

One of the essential component of a smart city is a Clean and Green Environment, and the crux of it is a Smart, Intelligent and Connected Waste Management System.

In Espha, I have developed a System where the Waste bins are equipped with a Compactor and a Bin Level Detection System.

Basic Layout of Smart Waste Management

Basic Idea:

Mostly the Garbage bins are Underutilized, if the waste is **compressed regularly** it could lead to significantly higher storage of waste in the same volume of Bin, leading to lesser numbers of pickup turns and improved efficiency. For the same we can incorporate a solar based compactor which works on Linear Actuator Principle would work on the inputs from the Arduino Board.
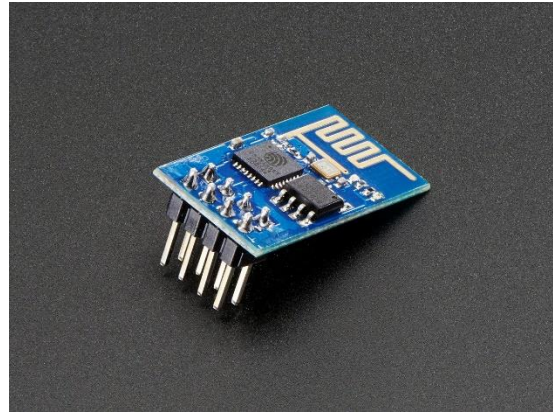
Requirement :

Sensors and Actuators Involved:

➢ Ultrasonic (HC-SR04) or IR Sensors are used to identify bin levels.

➢ Switch along with Servo motor to trigger the Linear Actuator for Compacting the Waste bin.
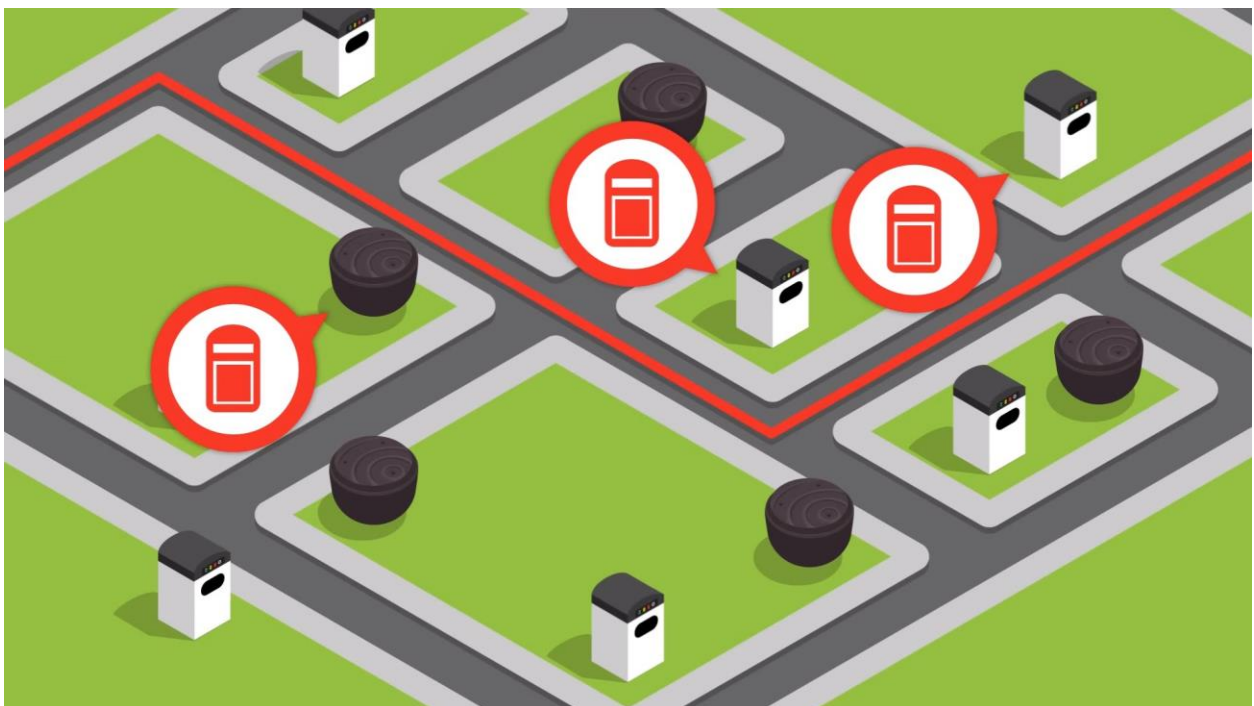
➢ Arduino and ESP8266(ESP-01) or NodeMCU.

> ➤ Other Sensors like Air Quality sensors can used to identify Foul smells which will also be used to predict pickup schedules based on Anomalies.

API's Involved:

-Google Maps for providing route

For Providing optimum path for bin waste collection.

-The Bin level data has been integrated with Thing speak IOT cloud, for reporting and analysis.


- I also have a great User Interface to view the route mapping, placement of Bins in the City etc.

Working

Hardware Side:

1. At Hardware Side, I have employed an Ultrasonic Sensor to know the fill % of dustbin and upload it to cloud. Further, data is uploaded to channel only if there is significant change.
2. On the basis of this Fill %, we can also run compactor, fill % is more than 45-55%. However, I wasn't able to implement this here.
3. We can employ two or more HC-SR04 and take average instead of one sensor in order to avoid false alarms due to non-uniformity.
4. I have assigned bin Id to each smartbin. So, we can manage the bins easily, and saving cost of GPS sensor (around 1000 Rs.).
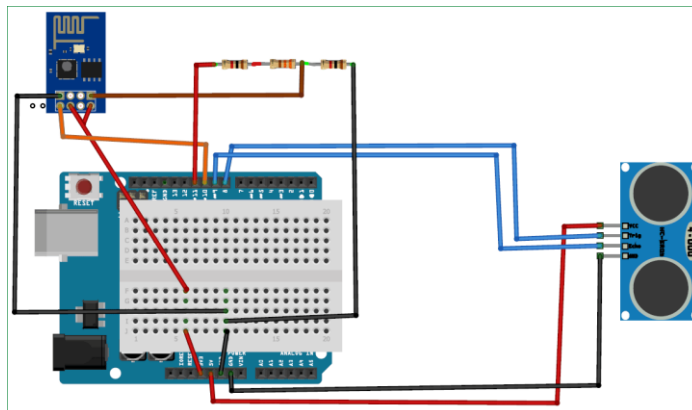
Cloud Channel Side:

1. On channel I am uploading sensor data. Reason for using thingspeak:

i.   Much easier to manage huge data in JSON format.
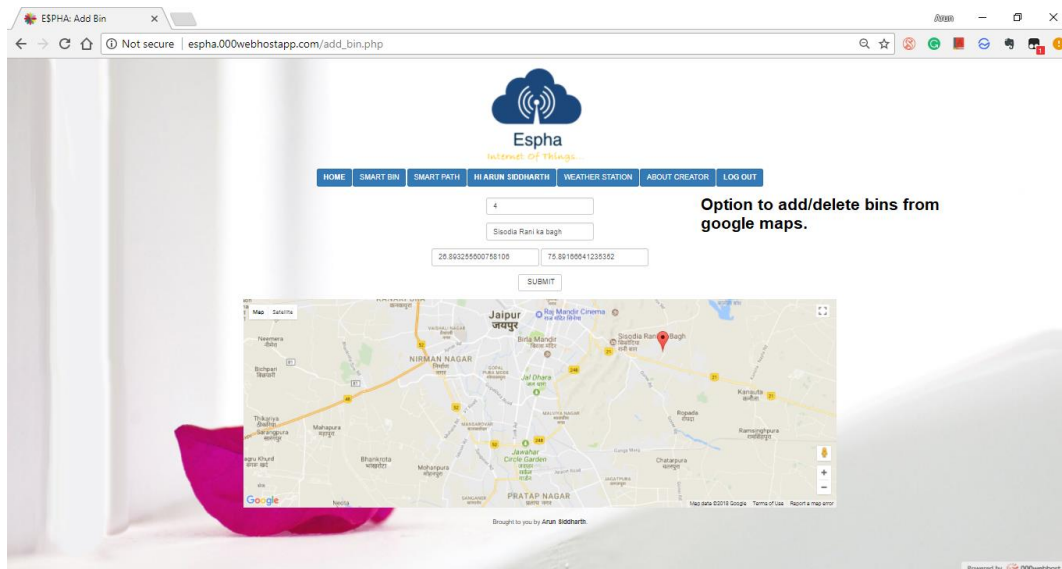ii.   Can easily plot data and can do MATLAB analysis.

UI Side:

On Espha(website) side, I have at first made a secure login/register system with OAuth verification. On login, we have two options one to show bins, add bins, delete bins and another to create a route on basis of fill % of bins.
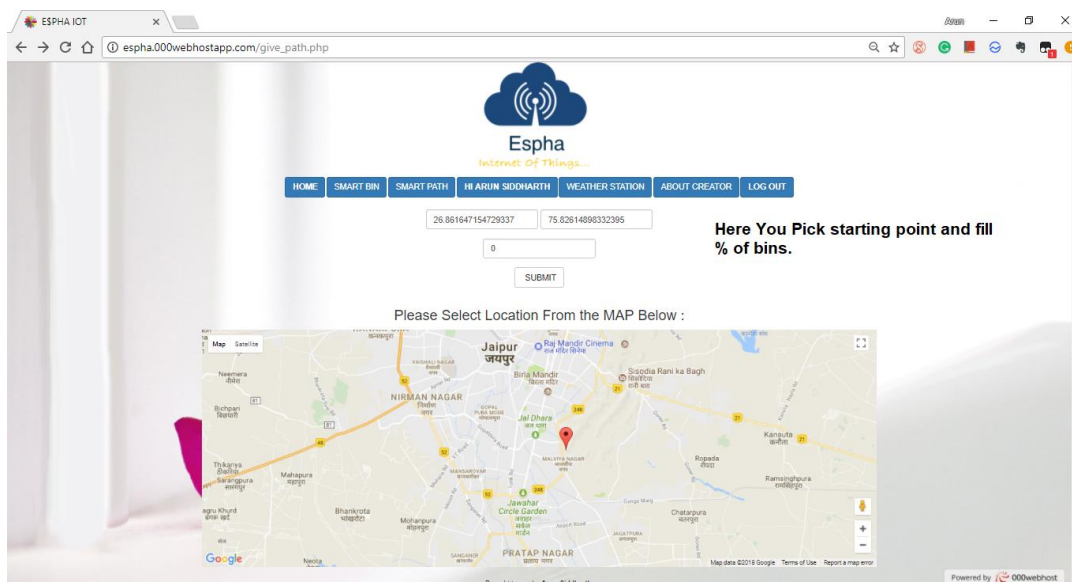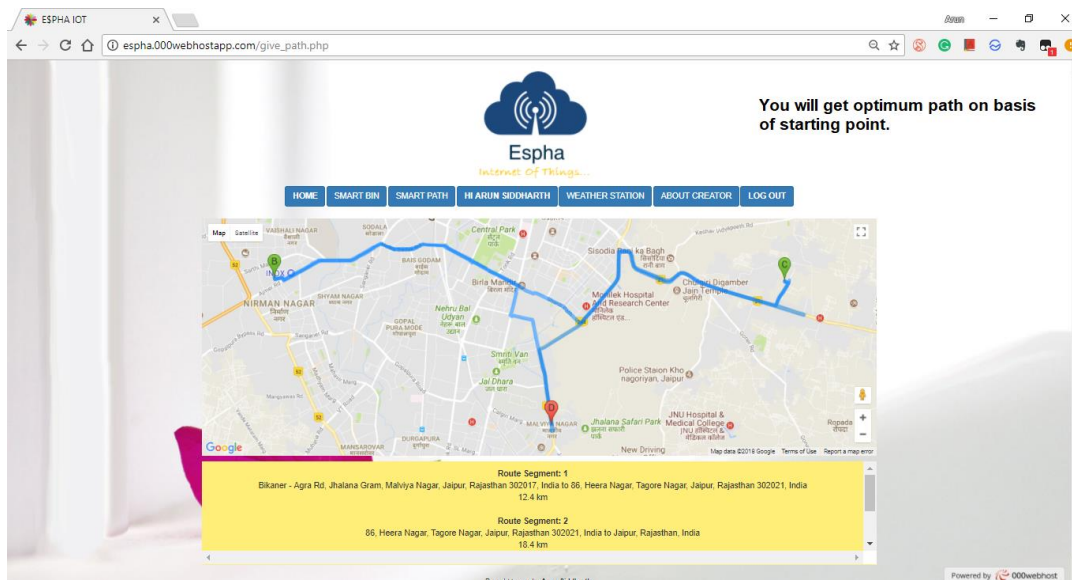
Few Snippets are:
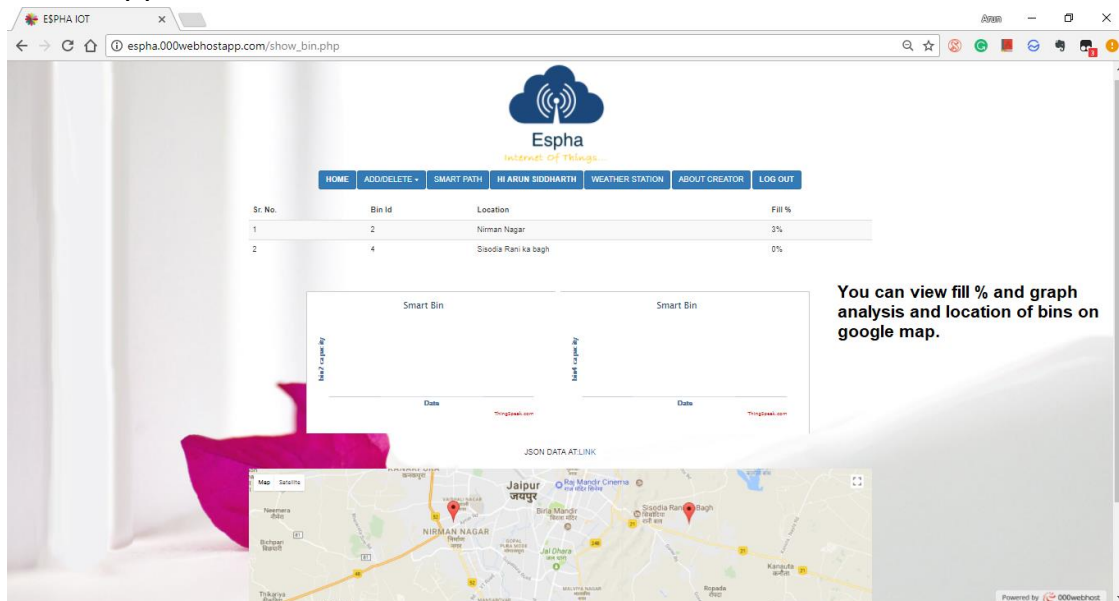
View of Show Bins

View Of Add/delete Bins

Adding Starting Point of Bins.

Getting optimum path.

CONCLUSION:

Public can also view the collection rates and which is the nearest empty bin to their house. Growing Smart Cities could be a huge potential market for such systems. Cost of this system is about 847(esp, uno and hc-sr04).+ Compactor system(according to bin).

This is an initiative to take the Swachh Bharat campaign to the next level.