

Smart Dustbin

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Abstract: This paper is about smart dustbin designed by combining the knowledge of internet of things, sensors and electronics. The dustbin is made with low cost approach and will have a unique ID so that each dustbin can be identified on the online database. The dustbin will display data on the screen about how much the dustbin is filled and that same data is sent on the online database (cloud), then to the Ahmedabad Municipal corporation office (AMC). Thus, when the dustbin is completely full, authority will get notification and then authority will send pickup vans for collecting waste. The project also has a GSM module which will be used to send SMS on the mobile number of AMC authority when dustbin is not able to connect to internet.

Keywords: Ultrasonic sensor, LCD, GSM, Wemos D1, IOT.

I. INTRODUCTION

India, generates tons of waste daily which is completely impossible to manage due to which deadly diseases spreads widely and reputation of the country is judge as unhygienic and untidy [1]. This problem exists because of overflowing of the dustbins so proper waste collection system should be designed. Another reason for this project is that one cannot check the amount of garbage in the dustbins manually, as there are plenty of dustbins and requires real time monitoring for proper efficiency.

When the dustbin is connected to the internet and it will alert the authority when it gets full and thus also reduce the operation cost because garbage collection vans goes daily and many time it comes empty handed, however by using this project it will go when the dustbin is actually filled. Dustbins are connected to the internet and which is also controlled by internet via Mobile Application this is known as internet of things. There are many places where Wi-Fi or internet is not accessible or available therefore GSM module is also present in the system which will send short message service to authorities.

The smart dustbin is equipped with LCD, Ultrasonic sensor, Wemos D1, GSM module. Sensors will detect the percentage of dustbins that is filled and sends its data to LCD which is displayed in front of the dustbin and to Wemos D1, Wemos D1 will upload the data on the cloud and when the dustbin is about to get completely full (above 85%) it will alert the authority via mobile application as well SMS services.

II. COMPONENT USED

A. Ultrasonic Sensors:

Ultrasonic proximity sensors uses special sonic transducer, sound wave is transmitted and received

alternately. Sensors emits sonic waves, sonic waves get reflected when it strikes an object and receives back or collected by the sensors. After emitting sonic wave ultrasonic sensors will switch to receive mode. It will calculate the time taken by sending and receiving waves by sensor which is directly proportional to the distance between object and sensor [2].

B. ESP8266 Board Wemos D1:

It is basically an Arduino kit with ESP8266, so no additionally ESP module attached with a Arduino. Arduino was introduced in 2005 to provide less cost, easy for people to create project that can interact with the environment. Arduino UNO and Wemos D1 have same pin layout which means all the project codes that works on Arduino UNO will work on Wemos D1 but it should have matching libraries that work with ESP8266 platform.

Table 1. Microcontroller Specification

Microcontroller	ESP8266 EX
Operating Voltage	3.3V
Digital I/O Pins	11
Analog Input pins	1 Max
Clock speed	80 MHz/160 MHz
Flash	4M bytes
CPU	32 bit RISC CPU
GPIO	16 including I2C and SPI
Weight	25g
Length	68,6mm
Width	53,4 mm

C. GSM Module:

Global system for mobile communication is commonly known as GSM. It's a standard module which was made in European Tele communication standards Institute, developed in Finland for 2G protocols [3]. In 2014 its popularity in 219 countries with more than 90% of market share it was declared global standard for communication via mobile phones [4]. GSM networks works into different carrier frequency ranges for 2G and bands of 3G separated into different frequency. Module operates in 900MHz or 1800MHz because of frequency spectrum in the range of 850MHz to 190MHz.

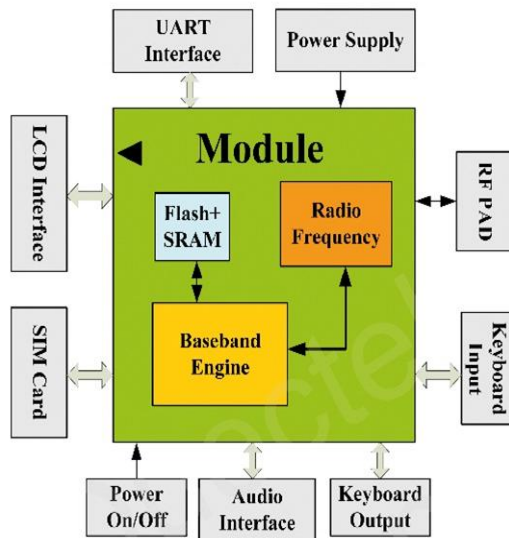


Fig. 1. GSM Module Block Diagram

III. SURVEY AND COST ANALYSIS

Data Analysis and Survey are of Ahmedabad city located in Gujarat. Ahmedabad Municipal Corporation takes care of waste management in Ahmedabad. Currently AMC is working on RFID tags which would be there on all the vehicles owned by them. Basically when AMC will get a call from a person informing about overflowing of the dustbin then it would send a waste collection vehicle which would be nearby. Hence it is parallel project to our smart dustbin.

Table II. Survey Data

Ahmedabad City	
Area	466 sq KM
Wards	64
Total Staff	12500
Waste	3600 TPD
Vehicle + Equipment	1173
Budget	Rs 329 crore
Residential Collection	
Total Resident Units	14.5 lac
Vehicle Used	600
Vehicle Capacity	1 ton
Waste Collected	1700 tons per day
Collection Points	

Waste Collection Points	941
Total Dustbins	1147
Dustbin Capacity	7 cubic meter
Waste Collected	900 TPD
Transfer station	
Transfer Station	6
Capacity	400 TPD
Cost of Transfer Station	Rs 5.5 crore
Ongoing Project	
Tech. Used	RFID+ GPS
Vehicles deployed	900
Capital cost	Rs 2,81,44,095
Operation	RS 1,98,05,123
Cost Analysis	
Components	Retail Price
Wemos D1	Rs 600
Ultrasonic Sensor	Rs 100
LCD	Rs 120
GSM Module	Rs 1000
TOTAL	Rs 1820
Our Project	Approx. Rs.2500 per dustbin deployed

IV. WORKING

Ultrasonic sensor is placed inside the dustbin which will sense the amount of garbage filled inside, the sensor will transmit signal at fix interval of time generally 10 seconds via communication using Wemos D1, signal are sent to the firebase, a cloud based web application. On cloud, the capacity of dustbin is indicated in percentage and graph can be plotted with respect to time.

LCD is placed on the dustbin and is connected to Wemos D1, so LCD will display level of the garbage. It will be notified to the authority when the content in the garbage crosses 85% and mobile application made for the workers who are not savvy will display level of garbage. Even if internet is not available, there is GSM module present in the system which will send SMS to the authority.

The system consist of

- Ultrasonic Sensor
- Wemos D1

- GSM Module
- LCD 16x2
- Power Supply
- Dustbin

V. FIREBASE

Firestore is web and mobile development application provided by the Google Inc. It has features like analytics, development, stability and other products. These features include a cloud database which can be done in real time and also compatible with arduino development board. To write to the correct database an application program interface (API) is provided by the firebase system which is unique parameter which must be written in code.

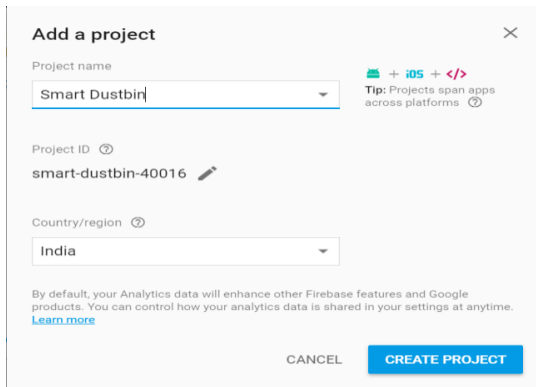


Fig. 2. Creating Project in Firebase

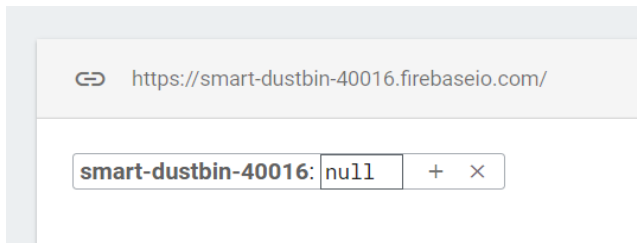


Fig. 3. Displaying Values in Firebase

VI. MOBILE APPLICATION

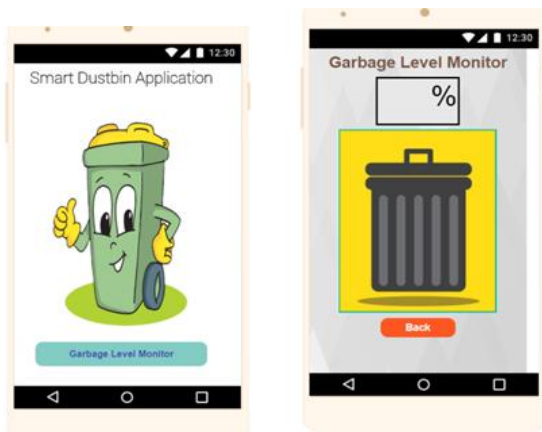


Fig. 4. Smart Dustbin Application

Smartdustbin.apk an android application is developed using Thunkable App Builder which an online software development software which provides GUI to directly design app without having to write a single line of code with the help of block and design layouts. To make the whole system user friendly, simple mobile application is required as many of the workers in Municipal Corporation are not Tech savvy.

The Fig. 5 shows block coding of applications and one feature of Thunkable is that it will design the code for the app in background. We have included firebase component in the app so that app can read data from the database created and it will display data in the app automatically.

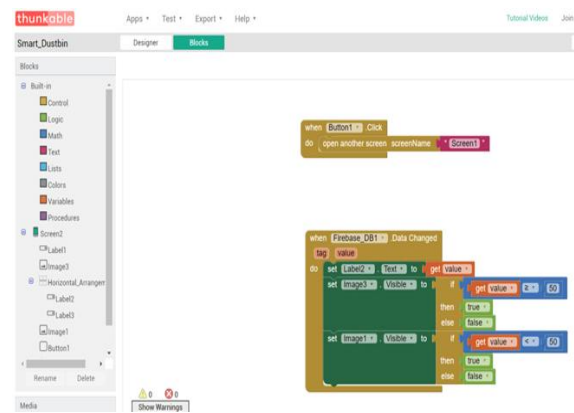


Fig. 5. Block Coding in Thunkable

VII. CONCLUSION

With this project we have design and successfully tested a system that is user friendly which is going to solve real world problems. After conducting the survey and making this project, we conclude that this project will make difference in the practices currently used by civic body with an affordable cost. If deployed in the mass it will eliminate multiple problem like timely waste collection, littering and efficient use of garbage collection trucks which will save fuel and will reduce pollution. If using this technology, it is a step towards creating smarter cities with the basic knowledge of internet of things and sensors, as basic parameters are hygiene and cleanliness which are topic of concern for smart cities. We believe that this research paper will encourage others to do work on similar topic.

VIII. REFERENCES

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