Garbage Monitoring System

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Abstract— Waste management is one of the primary problems that any country faces. The main issue in the waste management is that the garbage bin gets overflowed before the beginning of the next cleaning process. Overflowed garbage bins are creating bad smell and making an unhygienic environment. And due to this situation number of diseases are taking lives of people because of bacteria and viruses which are spreading rapidly. For better health and environment surrounding should be clean and healthy. To overcome these problems efficient garbage collection systems are getting developed. Some designs where useful and some of designs where not beneficial at all. The main cause of the work is to develop a clean city a smart garbage managing system. The system proposes alert system for emptying the dustbin by sending a message to the municipal web server based on garbage level. Whole system is based on IoT. The system uses ultrasonic sensor, infrared sensor, air quality sensor, NodeMCU, GPS, GIS, LED, and servo motor. Also, system uses blynk framework. This system will allow the authorized people to manage cleaning of dustbin through IoT.

Keywords: NodeMCU, GPS, LED, IoT, Garbage Collection

I. INTRODUCTION

In Pune city, current waste collection is carried out by collecting garbage through different sources such as collecting garbage on regular bases into trucks, if municipality does not clean it backup option is Adar Poonawalla garbage collecting system and sometimes other NGO's who has taken strong decision to make Pune City clean. This results in unsuccessful collection of waste. The Pune Municipal itself finds this as a big problem in Pune's Smart City initiative. There is an urgent need to optimize the management of service to reduce infrastructure, operating and maintenance costs. In this paper we are trying to solve this problem with the help of IoT based smart dustbin. Using different hardware such as sensors we can develop a module which can give a better solution. IoT is a recent communication technology so with the help of it we can build any user-friendly system. Main objective of this module is to change traditional garbage system into remotely monitor garbage system. Another motive is to stop overflow of garbage and improve environment quality. It will focus on reducing traffic, diseases, cost and human efforts.

II. LITERATURE REVIEW

In [1], once the truck comes close to the bin, RFID sends the information. Ultrasonic sensors measure level of waste, buzzer to alert the truck regarding garbage level with the use of LCD.

[2] Here main focus is on route planning where alert is sent to web interface. Centralized database is used for authentication of user. Once analysis is done reports are generated.

In [3] whenever the garbage collecting truck comes close to dustbin mounted with RFID tag, there is a communication with RFID reader. And data is altered between ES tag and RFID reader. If data verification by ES tag is valid then data is arranged in specific format else it discards the data. For compression of waste, piston is used which is a bit expensive.

The main aim of the recycle system planned in [4] is 3R card which stands for reduce, reuse and recycle. This card is used for access to bin and user credentials are authenticated with the help of database. If credentials are valid then lid of bin is opened and it can dump recyclable waste into the bin else lid remains close. After dumping weight of waste is calculated and this information is displayed to the user using LCD. Later weight is converted into user points.

From above all reviews this module will have certain features. Our module will work with blynk framework which is a real time-based application. Smart bin will have ultrasonic sensor embedded in it which will be useful for checking the level of the garbage. Using infrared sensor implementation of new feature is done that is automatic opening of lid. To differentiate between toxic and non – toxic garbage, an air quality sensor is used. And GPS is used for location of bin.

III. SYSTEM ARCHITECTURE

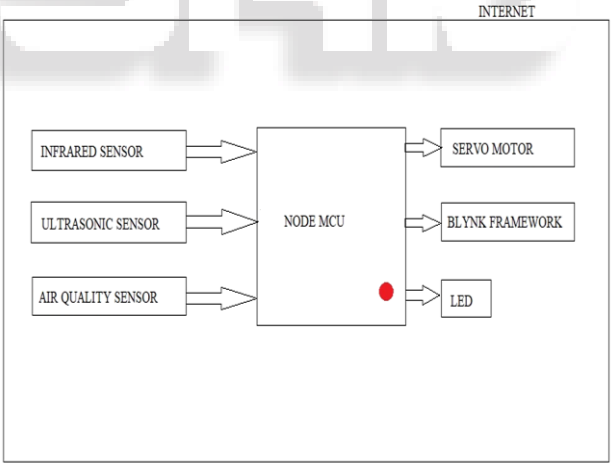

Fig. 1: Block diagram

Microcontroller used for this module is NODEMCU Arduino which has in built Wi-Fi. Since it is less expensive than Raspberry Pi we are using Arduino UNO. Also it has USB port which will be used for connecting device. Infrared LM393 sensor is connected to NODE MCU using jumper wires. In this module infrared is connected with servo motor TowerPro MG996R to NODE MCU for opening lid of bin when required. Ultrasonic Adraxx HC SR04 sensor is used for checking the level of garbage present inside bin where it will show level is full, half or empty on Blynk framework. For understanding of hazardous waste air quality sensor MQ 135 is implemented in this project. Overall communication interface of module is internet. Basic waterfall model is

applied. All sensors are connected to NODE MCU using wires but with the help of USB cable hardware is connected to laptop. A Google map is used for fastest route calculation. This saves time and fuel as optimized path provided by google map is used for collection of garbage. Location co-ordinates for bin and phone location of truck driver can be used for implementing this feature. Dustbin is mounted at a particular place which won't be changed by anyone, so fixed co-ordinates can be added on google map. No live status of bin location is required, just the drivers position is changed.

IV. HARDWARE COMPONENTS

A. *Adraxx HC-SR04*

HC-SR04 is an ultrasonic sensor. It uses sonar to measure the distance of an object. It has good range accuracy and also gives stable readings in an easy to use package. It is not affected by any dark material or sunlight.

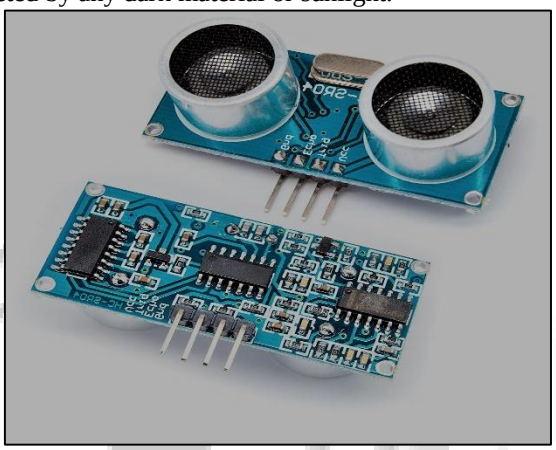

Fig. 2: Ultrasonic Sensor

B. *ESP8266 NodeMCU CP102 board*

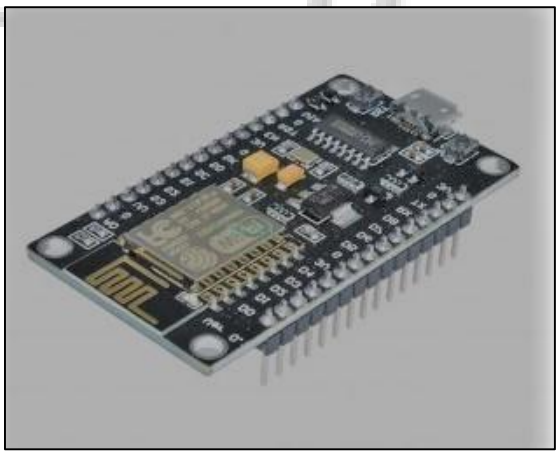

Fig. 3: NodeMCU

This the development kit based on the ESP8266. ESP8266 is low cost wi-fi microchip. It integrates everything on a single board. It is helpful to power up the development in the fastest way combined with NodeMCU firmware. Also it has micro USB port for power, programming and debugging.

C. *Jumper Wires*

Fig. 4: Jumper wires

These are simple wires that only that have connector pins at each end and allows them to be used to connect the points without soldering. Male to male, female to female, male to female are three different types of jumper wires.

D. *USB-A to Micro-USB cable*

Fig. 5: USB cable

Universal Serial Bus allows person to connect an electronic device to a computer. USB-A is used for other devices. Micro USB cable is a mini version of USB interface.

E. *MQ135 Air quality sensor*

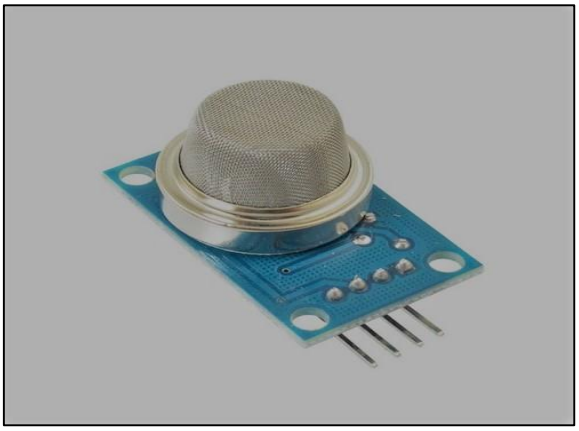

Fig. 6: Gas sensor

This sensor is to check the quality of air. This can help us to detect whether the garbage is hazardous or not. If it is toxic, then the garbage should be collected as early as possible otherwise it will lead to breeding of mosquitoes, unhealthy and stinky air.

F. LM393 Infrared Sensor

Fig. 7: Infrared sensor

Infrared sensor along with servo motor is used to open or close the lid automatically. Whenever someone comes close enough to dustbin then the lid gets opened otherwise it's closed.

G. Tower Pro MG996R Servo motor

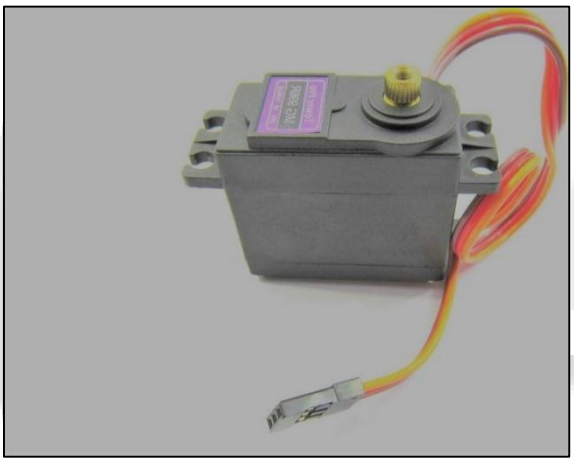

Fig. 8: Motor

This is used for automatic opening of lid. 180 or 360 degree motor is rotated which leads to opening and closing of the bin. This helps to lessen the effort of people and more attractive system is implemented.

V. FLOWCHART

This is the basic flow of the module which tells what operation is performed by it. Basic waterfall model is used while implementing smart garbage bin. Arduino language is used while coding which is writing in Arduino IDE.

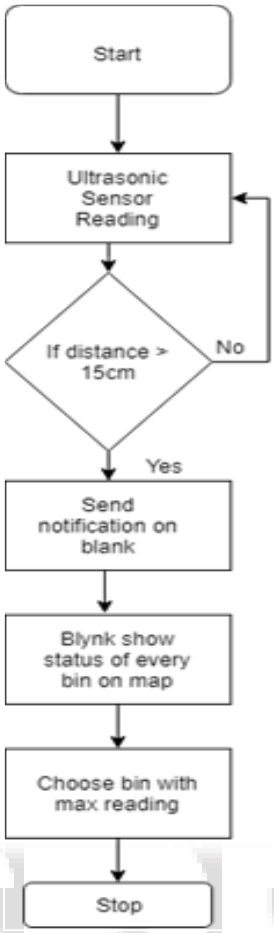

Fig. 9: Flow of system

VI. RESULTS

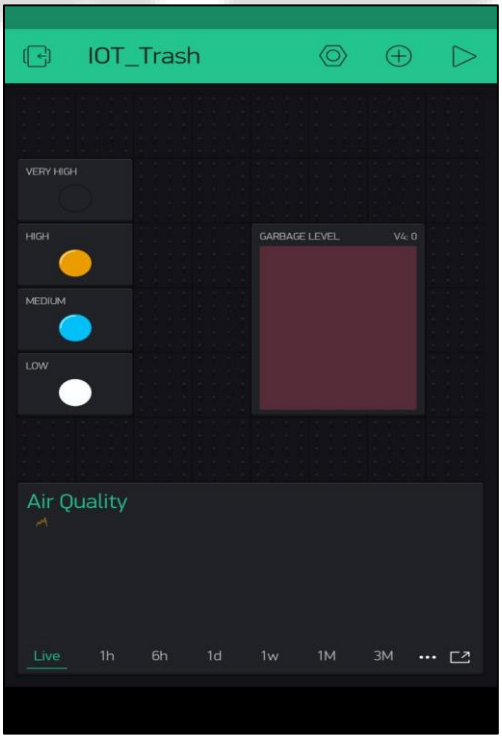

Fig. 10: Blynk Software

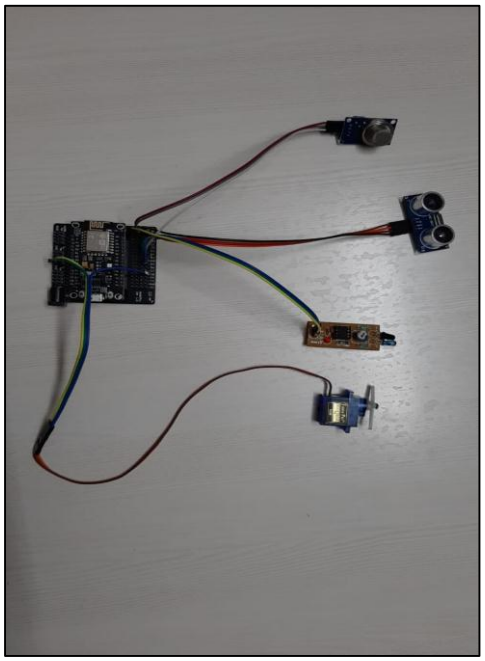

Fig. 11: Sensors Connected to microcontroller

VII. CONCLUSIONS

This module will focus on cleanliness of city. Investment is little high but it will be more useful for long time than traditional garbage system. It will reduce human efforts. Main advantage of this module is level detection feature will prevent overflowing of garbage.

It's always a healthy choice for using such prototypes in our locality which will benefit tremendously. It can be used in both private, public sectors as well as in Government sectors. For improving the existing waste management system, reducing costs, increasing efficiency and increasing profits it will be beneficial.

VIII. FUTURE SCOPE

We can add feature like compression through which capacity of bin can be increased since it is compressing dry waste. Number of similar models can be implemented for receiving optimized path using route algorithm for garbage collecting vehicle's driver, who will get the short path so that it will reduce cost of fuel needed for vehicle and it will be time efficient.

ACKNOWLEDGEMENT

We would like to take this opportunity to express my profound gratitude and deep regard to our guide Prof. R. P. Karande for her exemplary guidance, valuable feedback and constant encouragement. Her valuable suggestions were of huge help for our project. Her perceptive criticism kept us working to make this project in a much better way. Working under her was an extremely knowledgeable experience for us.

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