GPS Based Garbage Tracking System

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***Abstract* — In this paper, an innovative way to solve the issue of Garbage collection is proposed by designing an efficient system as standout point when compared to the previously proposed garbage collection systems. In present smart garbage collection system, smart dustbin(s) filling with waste would be located and an alert would be sent to the parent server connected by Wi-Fi to communicate with the system server. The system would automatically generate an efficient route to the available garbage trucks enabled with smart GPS monitoring system, which in turn would be integrated with an algorithm for maximum collection of waste and fuel efficiency. In the present work the system is designed in such a way that the customers would also be able to book for a personal garbage disposal. The customers or the agencies can communicate with this system directly via an application designed specifically for booking and tracking purposes.**

Keywords*——*Smart Garbage system, Smart Dustbin, Alert system, Server (Cloud storage), Wi-Fi module, Maximum waste collection, Fuel efficiency, personal customer service.

I. ARCHITECTURE

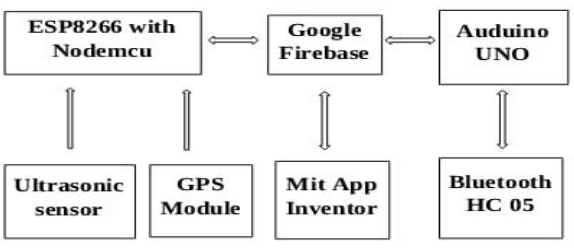

Fig 1 : Block diagram

This paper explains GPS based garbage tracking system based on IOT platform. Fig 1 shows the complete block diagram of GPS based garbage tracking system. Waste products are being dumped into dustbin(s) that are kept at certain defied locations, which are enabled with sensors that detect the amount of garbage filled. Then Nodemcu esp8266 module is used along with the ultrasonic sensors which in turn transmits an alert message with respect to the amount of latter to the truck driver along with static location given by the module. The ESP8266 fitted to every garbage truck provides dynamic location of the vehicle, this address is also sent to the truck driver. Then the particular truck driver near to the dustbin location will lock the ride and all other drivers will be blocked. This data will be compressed systematically and algorithmically to create an efficient path way for the GPS Smart trucks to track the Smart dustbin(s). the truck driver will collect the garbage from the locked location. The customers will also be able to book for personal assistance via the web or mobile application. The live tracking would be enabled in the latter who gives a hassle free experience to the customers and the company itself.

II. HARDWARE COMPONENTS

A. ESP8266 with NodeMCU

ESP8266 with NodeMCU is based on ESP-12 module. This module helps in establishing connection with the cloud platform.The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability. It has very few external components on the module. ESP8266 is encorporated with 1 MiB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi as shown in Fig 2.

Fig 2 : ESP8266 NodeMCU

To suit the purpose of the present work , Ultrasonic sensors are used. These sensors are used to enable functionalities in the proposed Smart Dustbin.

B. The Ultrasonic sensor

It is coded such that it will detect the amount of Garbage filled in the bin as shown in Fig 3 and will give output depicted by 3 LEDs symbolizing the latter. The LEDs acts as the level indicator for the Smart Dustbin.

Fig 3 : Ultrasonic sensor

C. GPS module

It is a small electronic circuit that allows to connect to our Arduino board as shown in Fig 4 in Smart Dustbin. Once it is connected it allows us to get the position and altitude. It also allows us to get speed, date and time on Universal Time Coordinated (UTC).

Fig 4 : GPS module

D. The Arduino UNO

It is based on microchip ATmega328P microcontroller which is an open source microcontroller and was developed by Arduino.cc. The board is equipped with the sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits as shown in Fig 5 used in Garbage Truck. The board has Digital pins, 6 analog pins and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. The Arduino UNO can be powered by an external battery and it can also be done using a USB cable. The ATmega328 on the Arduino UNO comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol.

Fig 5 : Arduino UNO

E. Bluetooth HC 05

HC 05 module is a Bluetooth SPP (Serial Port Protocol) module, which is easy to use and designed for the transparent wireless serial connection setup as shown in Fig 6 used in Garbage Truck. The HC 05 Bluetooth Module can be used in a Master or Slave configuration, which makes it a great solution for wireless communication. This serial port Bluetooth module has EDR (Enhanced Data Rate) of 3Mbps modulation with complete 2.4GHz radio transceiver and baseband. It uses external single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping) feature. The Bluetooth module HC 05 is a master/slave module whose default setting is slave. The Master module can initiate a connection to other devices but the slave modules cannot initiate a connection to another Bluetooth device, but can accept connections. The user can use it for a serial port replacement to establish connection between the MCU and GPS.

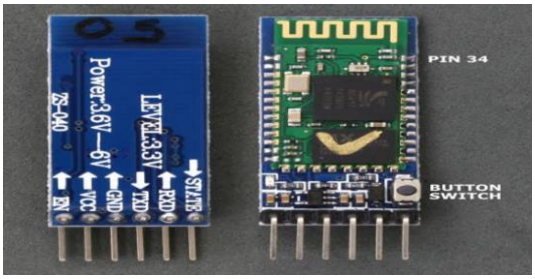

Fig 6 : Bluetooth HC 05

F. Robot Chassis

The framework of an artificial object that supports the object in its construction and use is called a chassis. An example of a chassis is a vehicle frame as shown in Fig 7, the underpart of a motor vehicle on which the body is mounted. If the running gear such as wheels and transmission are included, then the assembly is described as a rolling chassis. In case of vehicles, the frame together with the running gear like engine, transmission, drive shaft forms the rolling chassis. An under body (sometimes referred to as "coachwork"), which is usually not necessary for integrity of

the structure, is built on the chassis to complete the vehicle. In an electronic device, the chassis consists of a frame on which the circuit boards and other electronic components are mounted. The metallic material like aluminium alloy is usually used to make chassis. This is because the alloy is more stiff and compressive strength of metal is superior compared to wood or synthetic polymer. The chassis essentially functions as a more extensive pillar bedding, providing a metal-onmetal bearing surface that has reduced potential shifting under the stress of recoil.

Fig 7 : Robot Chassis

G. LM293D Motor driver

The Motor Driver is a module as shown in Fig 8 that allows to control the working speed and direction of two motors simultaneously. It is an integrated circuit chip usually used to control motors in autonomous robots. Motor Driver acts as an interface between Arduino and the motors. This Motor driver is designed and developed based on LM293D IC. It is a 16 pin Motor driver designed to provide bidirectional drive currents at voltages from 5V to 36V.

Fig 8 : LM293D Motor Driver

H. Battery

A battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices as shown in Fig 9 such as flashlights, smartphones, and electric cars. The battery's positive terminal is the cathode and its negative terminal is anode. Anode is a source of electrons that flow through an external electric circuit to the cathode. A redox reaction takes place where higher-energy components gets converted into lower-energy components. This takes place when the battery is connected to external load, and the free-energy difference is delivered to the external circuit as electrical energy. Common fuels such as gasoline have higher energy efficiency than the batteries which is somewhat offset by the higher efficiency of electric motors in converting chemical energy to mechanical work, compared to combustion engines.

Fig 9 : 12V Battery

III. SOFTWARE REQUIREMENTS

A. Google Firebase

Firebase is a mobile and web application development platform as shown in Fig 10 developed by Firebase, then acquired by Google in 2014. The Firebase Realtime Database is the first product of Google Firebase, an API that synchronizes application data across iOS, Android, and Web devices, and stores it on Firebase's cloud. Software developers are assisted in building real-time, collaborative applications. Firebase Analytics is a cost-free app measurement solution that provides insight into app usage and user engagement. A realtime database is provided by Firebase and backend as a service. The service provides application developers an API that allows application data to be synchronized across clients and stored on Firebase's cloud. Secure file uploads and downloads for Firebase apps, provided by Firebase storage regardless of network quality. The developer can use it to store images, audio, video, or other usergenerated content. Firebase Storage is backed by google cloud storage.

Fig 10 : Google Firebase platform

B. Mit app inventor

As shown in Fig 11, Mit App Inventor is an app inventor for android based device, developed in an web source application. The data stored in Ubidots can be displayed in the Mit App. The App has the functionalities that would assist the customer and the driver(Eg :Truck Break-Down Alert , Unexpected Garbage Filling Alert, Traffic Alert etc.). It allows one to create software applications for the Android operating system (OS). It uses the graphical interface. It allows users to drag-and-drop visual objects to create an application that can run on Android devices. The MIT App Inventor also supports the use of cloud data via an experimental Firebase component.

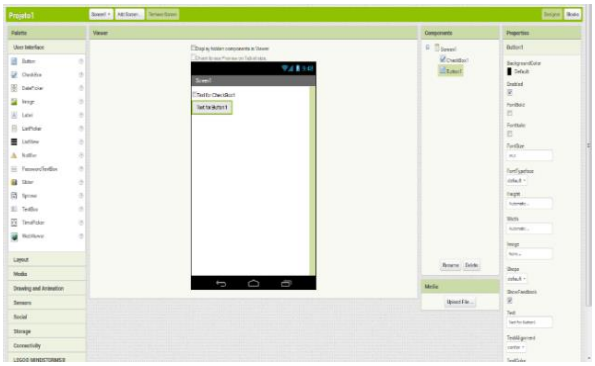

Fig 11 : Mit app inventor

IV. RESULT

If the truck breaks down to technical faults, the garbage wouldn't be collected on time. To tackle this problem, with the active location enabled in the truck helps to precisely locate the broken truck. Immediately the early truck(s) would be assigned to collect the scheduled garbage collection. If the garbage is unexpectedly filled to its capacity in the truck then it would deploy the same function mentioned earlier. The other and probably the major problem faced is that customers find it difficult to use this service. The smart dustbin model fitted with ultrasonic sensors is shown in the Fig 12a and the prototype of the work is shown in Fig 12b.

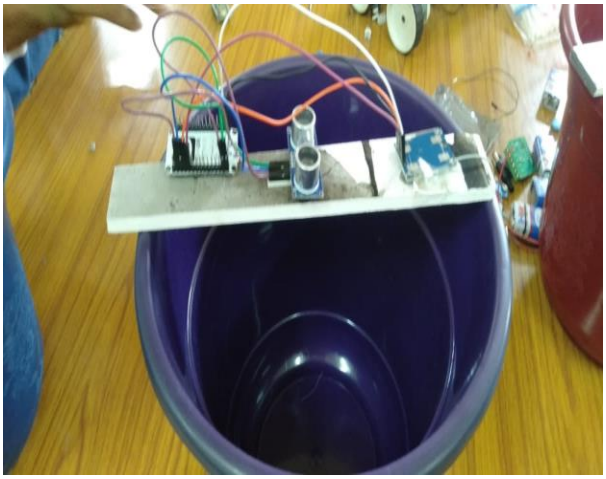

Fig 12a : Smart Dustbin model

Fig 12b : Prototype of the work

V. CONCLUSION

In the present work, Ultrasonic sensors are introduced for efficient and economic garbage collection. This implementation of Smart Garbage Tracking System using IoT, assures the cleaning of dustbins soon when the garbage level reaches its maximum. The developed system provides improved database for garbage collection time and amount of waste at each location. The technologies which are used in the proposed system are designed in such a way that operators and citizens both will find it user friendly to monitor the garbage information of various places. Hence, an IoT Concept based on software project with electronic devices used, is the one that will be great service to the world and make it a better place to live in.

VI. REFERENCES

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