Smart Bin

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Abstract: *The IoT garbage monitoring system is a very innovative system which will keep cities clean.The aim of this paper is to monitor and manage garbage. It is a thought of upgrading a normal dustbin to smarter one using ultrasonic sensor for garbage level detection and then sending the level to the user and clear the dustbin if it has crossed threshold. This helps the cities to be clean by informing about garbage level. The idea of Smart Bin is for schools, colleges, factories and hospitals.*

Keywords: *ESP8266, Internet of Things, MQTT, Webserver*

I.   Introduction

Garbage management is sorting, transporting, processing, reusing, eliminating and monitoring garbage materials.Waste management is a crucial and can be achieved through the proposed system.It is becoming a major issue due to high population density. Due to poor collection of garbage and pilling up in public places is answerable to bad management. This improper management will further lead to incurable disease to living beings. In order to overcome all of it smart management is need of the hour.

According to survey it is found out that internet of things (IoT) is trending. IoT has come up with solution for day to day problems, collection of garbage is one of them.Internet of things is simply a network of internet connected objects able to send and receive data. It is commonly abbreviated as IoT. In simple terms, it is sending and receiving of data by system or devices that are connected via internet.Optimizing the process of trash collection is the main purpose of the smart solutions provided by industry [1].The purpose of this work is to present a cost-effective smart trash bin for localized and small-scale cases, such as small parks, university campus and hospitals [1].

II.   Hardware

Ultrasonic Sensor:

Fig .1

A simple ultrasonic range finder using Nodemcu microcontroller is presented. This ultrasonic rangefinder can measure distances up to 400 cm with an accuracy of1centimeter. The microcontroller and the ultrasonic transducer module HC-SR04 forms the basis of this circuit. This module sends a signal to the object, then picks up the reflected echo and outputs a waveform whose time period is proportional to the distance. The microcontroller accepts this signal, performs necessary processing and displays the corresponding distance on the web server. HC-SR04 is an ultrasonic sensor module designed for embedded system projects like smart bin.

It has a resolution of 1 cm and the ranging distance is from 2 cm to 400cm. It operates from a 5V DC supply and the standby current is less than 2mA.The HC-SR04 has four pins namely Vcc, Trigger, Echo, GND and they are explained in detail below.

1) VCC: 5V DC supply voltage. 2) Trigger: A trigger signal for starting the transmission is given to this pin. The signal must be a pulse of 10uS high time. When the module receives a valid trigger signal it gushes 8 pulses of 40KHz ultrasonic sound from the transmitter. This sound echo is picked up by the receiver. 3)Echo: At this pin, the module outputs a waveform with high time proportional to the distance.4) GND: connected to ground.

NodeMcu:

Fig.2

The Nodemcu development board is a prototyping platform based on the ESP8266 microcontroller, which as in built WiFi functionality. The microcontroller is a low powered and has enhanced version of Tensilica's L106 Diamond 32 bit processing core, with an in built 10 bit analog to digital converter used by the gas sensor. It works on 2.4 GHz and can act as an AP or a client, or both. It has in built support for communication protocols such as I2C, SPI and UART. Here, UART is being used during the development process for debugging. ESP8266 12-E board soldered on the nodemcu consists of the smd esp8266 microcontroller, a 26 MHz crystal (internal PLL increases the clock speed to 80MHz), a WiFi antenna and all the required components necessary for the chip to function under the RF shield of the secondary PCB.The nodemcu development board has the ESP-12E soldered on for the user. It also has a USB to Serial converter to program the chip, and a AMS1117v33 linear voltage regulator. This makes it easier for the user to program the chip, and also it can accept greater voltages as a voltage regulator is already built in.The NodeMCU is powered directly by a lithium ion cell due to the high input range of the ESP8266 microcontroller. The development board supports the Arduino IDE, which is used for this projectalong with the.

Gas Sensor (MQ-135):

Fig.3

MQ-135 gas sensor applies $SnO2$ which has a lower conductivity in theclear air as a gas-sensing material. Inatmosphere there are many polluting gases, the conductivity of this gas sensor raises as concentration of the polluting gas increases. MQ-135 performs a gooddetection to smoke and other harmful gas, especially sensitive to ammonia, sulfide and benzene steam. Its ability to detect various harmful gas and lower cost makes MQ-135 an ideal choice of different applications of gas detection
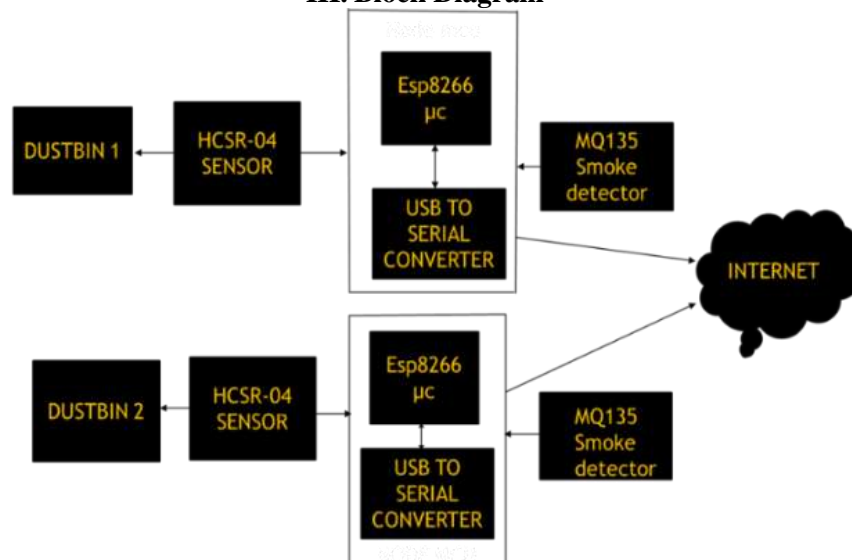
III. Block Diagram

Fig.4

In above mentioned system whole circuit is place at the top of the dustbin. If the distance sensed by the circuit is greater than the threshold then the web page will show the lid is open. In general, ultrasonic sensor transmit head sends trigger pulses continuously to the dustbin and the echo pulses reflects back to the ultrasonic sensor whenever there is object in front of the sensor. The Nodemcu checks the garbage level continuously using ultrasonic sensor. If trash is not exceeding the limit as maximum then cyclically checks the distance. Once the level of the trash reaches a particular threshold values no ultrasonic sensor gives to Nodemcu. The Nodemcu updates the webserver according to the input value. The smoke detector will detect if there is any garbage fire.
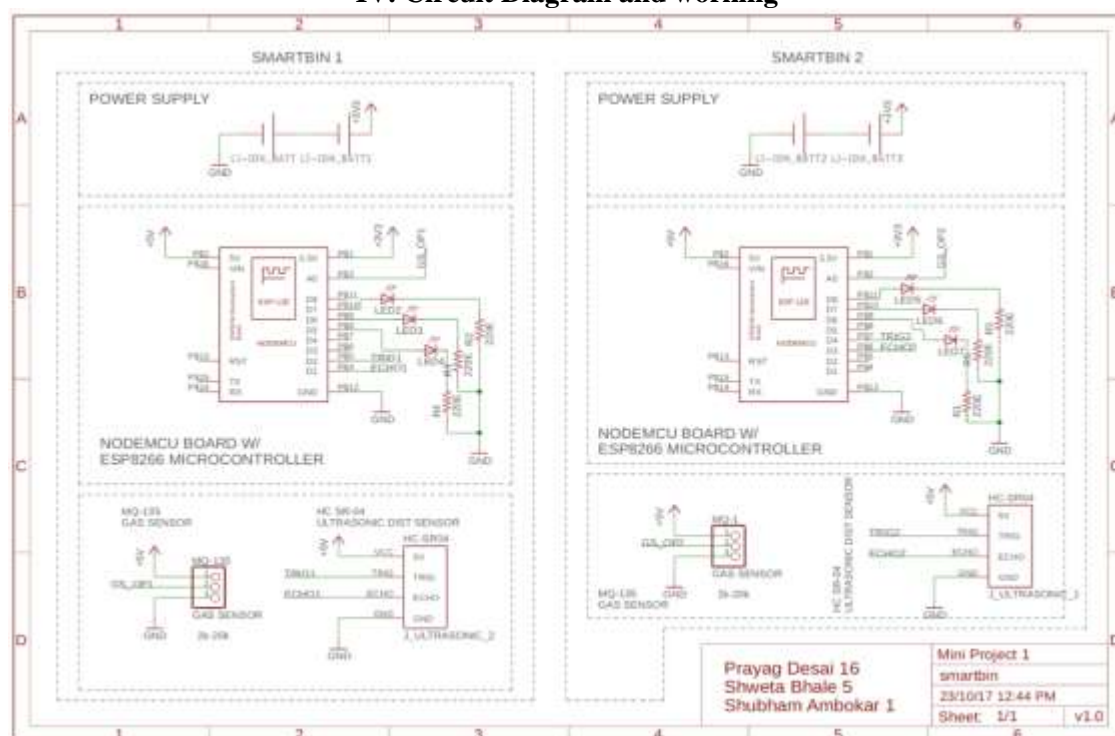
IV. Circuit Diagram and working

Fig.5

The power for the circuit is taken directly from the 18650-lithium ion battery. The ESP8266 microcontroller sends a trigger pulse of 10uS to the HC-SR04 ultrasonic sensor and the sensor returns a pulse directly proportional to the distance measured. The MQ-135 gas sensor returns an analog value directly proportional to the amount of gas detected, which is converted to 3.3V logic by the voltage divider, as the uC requires 3.3V IO, and the internal 10-bit ADC converts this this signal to a value between 0 and 1023, which is compared with a threshold of 300 for smoke and garbage fires.

If the amount of garbage reaches a certain level, the led connected to the development board glows to show that it is full. One microcontroller acts as a webserver and one as a simple web connected client. The two devices use MQTT communication protocol to communicate between them. The broker used is an online one, so the data of the dustbins can be accessed from anywhere as long as it is connected to WIFI.

V. Result

A simple web display is created by the webserver of one of the bins acting as the center of them all, which gets the information from the other bins and displays it to the user. The user can access the webpage from their browser as long as they are connected to the same network.This web functionality makes the smart bin an IoT connected device with complete access of information to the user.

Fig.6

VI. Conclusion

Waste collection is an essential city service. Ample opportunity exists worldwide for smart technology to increase efficiency and improve the quality of waste collection services.When everything around the world is shifting itself to technology, then why not the dustbin? Dustbin is an essential part of the cleanliness mission and thus need to be looked after well [3]. Thus, it is our responsibility to bring in such technology to upgrade waste management. Our project has been made and tested, it was a step from our end to contribute towards cleanliness.Various features like durability, affordability, prevention against damage and maintenance issues are addressed when the smart bin is designed. This smart bin can contribute towards clean and hygienic environment building a smarter and healthier life style. Awareness should be created among people before it is implemented.

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