IOT Based Swachch Bharat Abhiyan

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Abstract - *Nowadays numbers of actions are taken to improve the level of healthiness and cleanliness in the country. People are getting more and more active in doing all the things possible to clean and healthy their surroundings. Various actions are also taken by the government to increase cleanliness like "Swachch Bharat Abhiyan". By this project and Research paper, we tried to build an IOT system which will notify the corporations continuously by sending data to server and to empty the bin/dustbin on time by SMS. In this IOT based system, we will put an Ultrasonic sensor with PIC18F4550 microcontroller, on top of the garbage bin which will detect the different levels of garbage inside it according to the total size of the dustbin. When the garbage will reach the maximum level, a notification will be sent to the corporation's office by Text Message, and then the employees can take further actions to empty the dustbin [1]. This IOT based system will help in cleaning the India in a better way.*

Key Words: **PIC Microcontroller; PIC18F4550; Dustbin; Ultrasonic Sensor; ADC; LCD Display; GSM; TCP; Thingspeak; ThingView**

1. INTRODUCTION

The idea of this project came from the current scenario of dustbin in our areas. This is also shown in below figure 1.1. Due to overflow of dustbin by garbage, the environment and our society will be unhealthy. To overcome from this, this project can be helpful.

Fig -1.1: Current scenario of Dustbin in our area

IoT or Internet Things refers to the network of connected physical objects that can communicate and exchange data among themselves without any human intervention. Any object in the physical world which can be provided with an IP address to enable data transmission over a network can be made part of IoT system by embedding them with electronic hardware such as sensors, software and networking gear. IoT is different than Internet as in a way it transcends Internet connectivity by enabling everyday objects that utilizes embedded circuits to interact and communicate with each other utilizing the current Internet infrastructure [1]

PIC is a microcontroller family developed by Microchip Technology and has wide range of uses in embedded systems. The "PIC" originally was referred to Peripheral Interface Controller [2, 3]. It is widely used in many applications like home automation, electric motor controlling, health monitoring, etc.

Sensors are Electronic devices that detect and respond to some type of input from the physical environment. Sensor modules have extra electronic circuitry along with a sensor that helps interface them with microcontroller.

The ultrasonic sensor works on the principle of SONAR and RADAR system which is used to determine the distance to an object. An ultrasonic sensor generates the high-frequency sound (ultrasound) waves. When this ultrasound hits the object, it reflects as echo which is sensed by the receiver as shown in below figure 1.2.
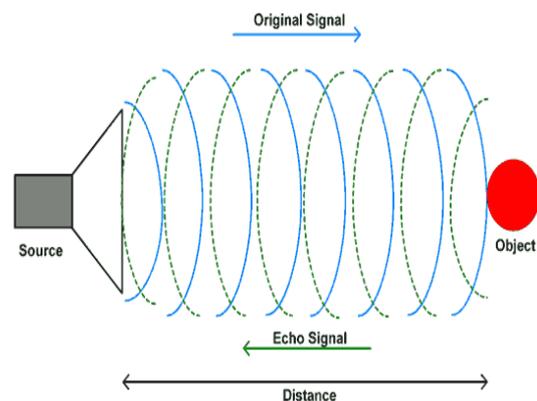

Fig -1.2: Ultrasonic Working Principle [2]

By measuring the time required for the echo to reach to the receiver, we can calculate the distance. This is the basic working principle of Ultrasonic module to measure distance.

Once we get the time we can calculate distance from the speed of sound. HC-SR04 can measure up to range from 2 cm - 400 cm [2].

SIM800 enables GPRS to embedded applications. The Transmission Control Protocol (TCP) is standard transport

layer internet protocol which used in establishing and maintaining communication in between a server and client which is used in IOT (Internet of Things) embedded applications [2].

ThingSpeak server is an open data platform and API for the Internet of Things that enables you to collect, store, analyze, visualize, and act on data from sensors.

ThingView enables you to visualize your ThingSpeak channels in an easy way, just enter the channel ID and you are ready to go.

The paper is organized as follows: Section 1 discuss about the introduction of IOT based Swachch Bharat Abhiyan. Section 2, gives a detailed block diagram with the materials used for this project. A section 3 talk about the Experimental setup of complete project with the result on ThingSpeak Server & ThingView App. Section 4 is for the conclusion of the entire project. At last References are mentioned.

2. BLOCK DIAGRAM

Here we are going to develop IOT based Swachch Bharat Abhiyan project using MPLAB X IDE with XC8 compiler and flash the PIC18f4550 chip using PIC kit3. MPLABX IDE is an Integrated Development Environment which is developed by Microchip which is used to develop a code for PIC microcontrollers.

The block diagram of complete IOT based Swachch Bharat Abhiyan project is shown in below figure 2.
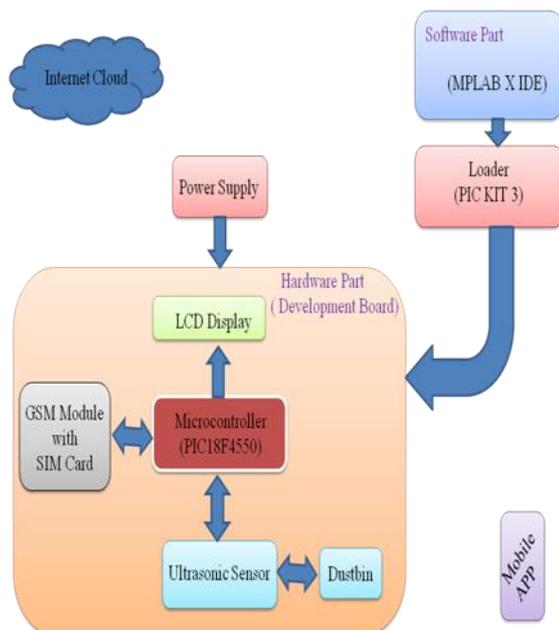

Fig -2.1: Block Diagram of Complete Project

Hardware Part: PIC18F4550 microcontroller is used as heart of the system. PIC is a microcontroller family developed by Microchip Technology and has wide range of uses in embedded systems. The "PIC" originally was referred to Peripheral Interface Controller [2,3]. This PIC

Development board will be at top of the Dustbin. So, once the garbage will be added into the dustbin, Ultrasonic sensor will measure the distance from top.

Fig -2.2: Ultrasonic module HC – SR04 [1]

HC-SR-04 has an ultrasonic transmitter, receiver, and control circuit. In an ultrasonic module HCSR04, we have to give trigger pulse, so that it will generate ultrasound of frequency 40 kHz. After generating ultrasound i.e. 8 pulses of 40 kHz, it makes echo pin high [2]. Echo pin remains high until it does not get the echo sound back. So the width of echo pin will be the time for sound to travel to the object and return. The waveform is given in below Figure 2.3.
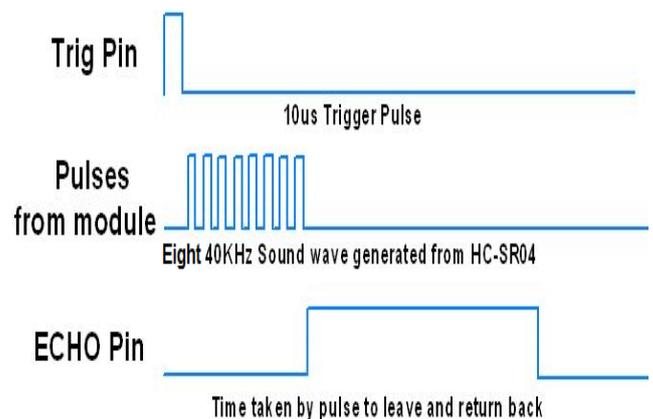

Fig -2.3: Ultrasonic Timing Diagram [2]

The level of garbage in a dustbin will be display on 16 * 2 LCD display. The connection of each pin with PIC Microcontroller is shown in below Figure 2.4.
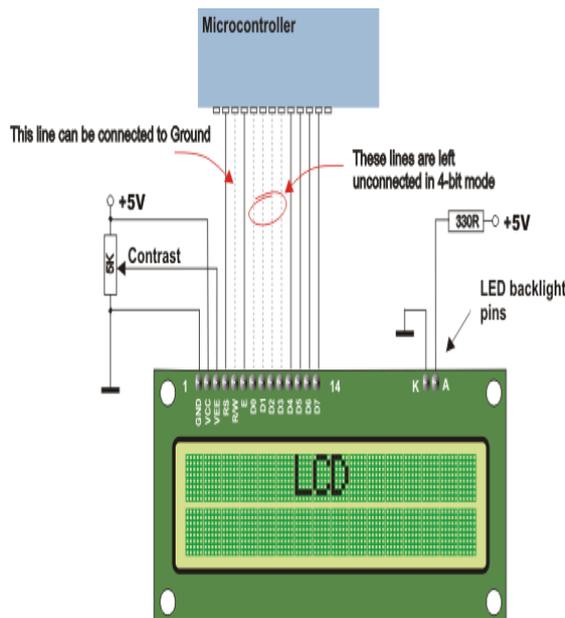
Fig -2.4: Connection of LCD Display with uC

SIM800 Modem can work with any GSM network operator SIM card just like a mobile phone with its own unique phone number. SIM800 GSM/GPRS modem is plug and play modem with RS232 serial communication supported. Hence Advantage of using this modem will be that its RS232 port can be used to communicate and develop embedded applications.

Fig -2.5: SIM800 GSM MODEM [2]

Applications like SMS Control, data transfer, remote control and logging can be developed. SIM800 modem uses AT commands to work with supported features [2].

The Transmission Control Protocol (TCP) is standard transport layer internet protocol which used in establishing and maintaining communication in between a server and client which is used in IoT (Internet of Things) embedded applications [2]. TCP is communication protocol of internet. Following AT commands are used for sending data to server through GPRS written during programming in MPLAB X IDE.

This GSM MODEM has to be serially (UART) connected with PIC Microcontroller to send and receive data from either way.

1. **AT**

To check the Communication of GSM

2. **ATE0**

Turn Off/On Echo

3. **AT + CIPMODE = 0**

For Transparent Mode

4. **AT + CIPMUX = 0**

For Single connection

5. **AT + CGATT?**

GPRS Attach?

6. **AT+CSTT="APN","USERNAME","PASSWORD**"

Sets APN, username and password for Internet

7. **AT+CIICR**

Bring up Wireless Connection

8. **AT+CIFSR**

Get local IP

9. **AT+CIPSTART=\"TCP\",\"api.thingspeak.com\",\"80\"**

Start-up TCP connection

10. **AT+CIPSEND**

Send data [2, 3]

Here, we are using Thingspeak server for TCP Client. Thingspeak is an open IOT platform where anyone can visualize and analyze live data from their sensor devices [2]. Also, we can perform data analysis on data posted by remote devices. To use Thingspeak we should sign up & create Channel.

Apart from Thingspeak server, even we can check the updates of dustbin by ThingView mobile APP (Application).

Software Part: MPLABX IDE is an Integrated Development Environment which is developed by Microchip which is used to develop a code for PIC microcontrollers [2, 5]. Here, XC8 compiler used for compiling the program. PIC KIT 3 loader is used to flash the program from MPLAB X IDE to PIC Microcontroller [6].

3. EXPERIMENTAL SETUP & RESULT

The complete set up of IOT based Swachch Bharat Abhiyan is shown in below Figure 3.1.

This complete system will be place at the top of the dustbin to measure the level of dustbin. Ultrasonic sensor measures the distance and ADC converts this Analog value to Digital and that distance is scaled into 5 different levels at PIC

microcontroller PIC18F4550. Those 5 levels are 0,50,75,90 and 100. The distance as well as level of dustbin will be display on 16*2 LCD Display. After each 10 minutes, data will be keeps on update to the Thingspeak server by TCP/IP AT command send through GSM SIM 800, irrespective of levels.
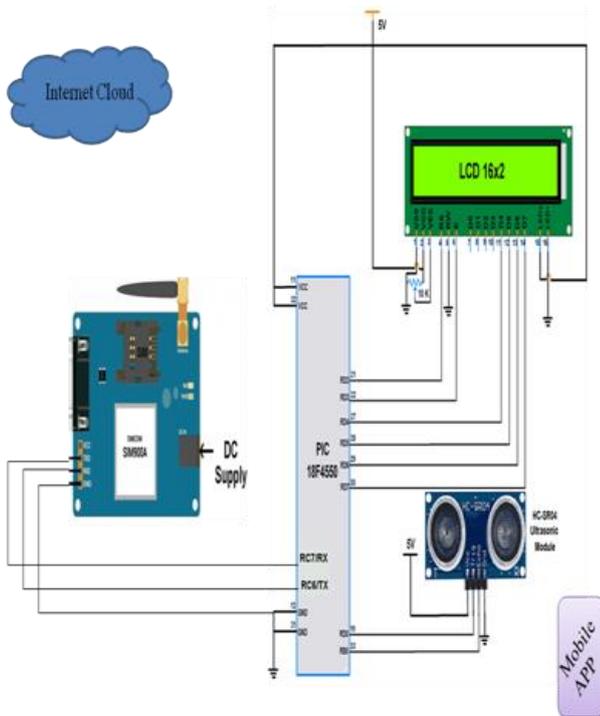

Fig -3.1: Experimental Set up

But if Dustbin level reaches to 100, then the SMS will be also sent to the corporation's office person who is responsible to empty the dustbin when it's filled completely. The Screen shot of Thingspeak server is shown in below figure 3.2.
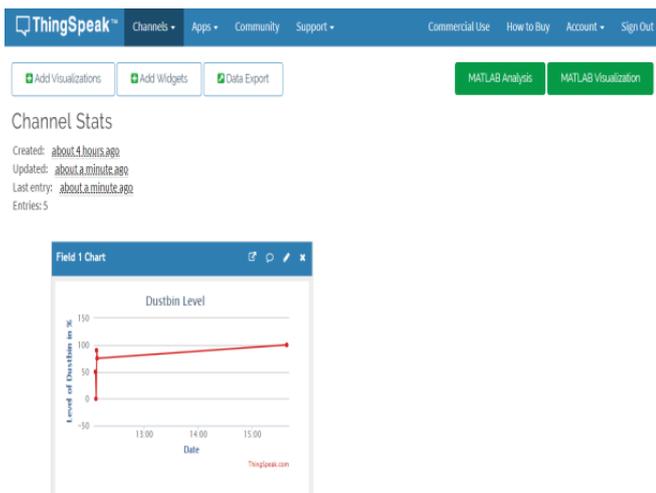

Fig -3.2: Result at Thingspeak Server

To check the updates of dustbin, ThingView App can be used. Channel ID has to be entered once to view all updates in ThingView App. The Screen shot of ThingView App is shown in below figure 3.3.
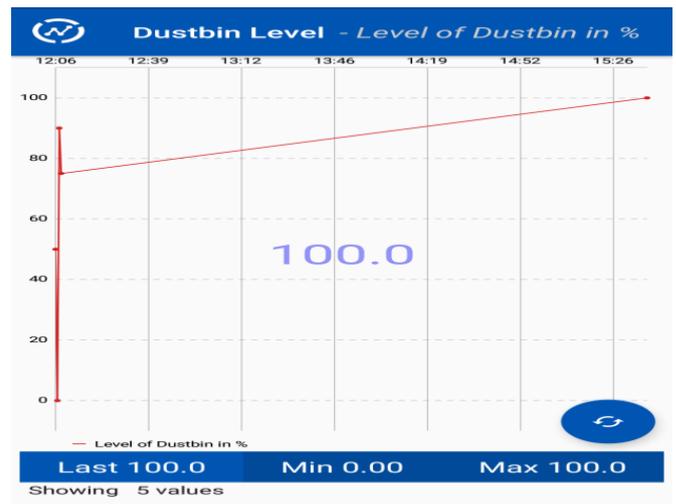

Fig -3.3: Result at ThingView Mobile App

4. CONCLUSIONS

To make Bharat as Swachch Bharat, We have used IOT (Internet on Things) and Ultrasonic distance measurement technique. This technique will be very helpful, not only to the environment but also to the society. The sensor used in this Swachch bharat abhiyan project, is better than parallex's PING sensor that can able to detect object in range 3m but this having range of 2 cm - 400 cm [7].

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