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GARBAGE MONITORING AND MANAGEMENT USING INTERNET OF THINGS

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Abstract - *Internet of Things (IoT) is enabled by the rapid increase of various devices like RFIDs, sensors, and actuators. The Internet of Things (IoT) is a system of interrelated computing devices that are provided with unique identifiers to transfer data over a network. IoT enabled waste management is going to be implemented in Smart city. Smart city means a developed urban area that creates sustainable economic development and high quality of life by excelling in multiple key areas. The concept of the project is, the ultrasonic sensor which is placed in the lid of the dustbin will detect the depth of the dustbin and the data will be stored in the microcontroller. The stored data is transferred to cloud server through WIFI and finally it will be displayed on the webpage.*

Key Words: ***Internet of Things (IoT), Smart Cities, Waste Management***

1. INTRODUCTION

The vast amount of earth population will move to urban areas, thus, forming vast cities in future [2]. Such cities require a smart sustainable infrastructure to manage citizen's needs and offer fundamental and more advanced services [3]. The adoption of Future Internet technologies enhanced by the use of the Internet Protocol (IP) on numerous wireless sensors enables the Internet of Things (IoT) paradigm. When Wireless Sensor Networks (WSNs) are applied in a city, they are responsible for collecting and processing ambient information inorder to upgrade legacy city infrastructure, the so-called Smart Cities (SCs). The focus of the project is monitoring and management of Garbage. The efficient management of waste has a significant impact on the quality of life of citizens. The reason is that waste disposal has a clear connection with negative impacts in the environment and thus on citizen's health. The model is about the waste management which provides a set of services on top of an IoT infrastructure in a Smart Cities.

A definition of the concept of SC is provided in [5]: "A Smart City is a city well performing in a forward-looking way in the following fundamental components (i.e., Smart Economy, Smart Mobility, Smart Environment, Smart People, Smart Living, and Smart Governance), built on the smart combination of endowments and activities of self-decisive, independent and aware citizens". The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

2. METHODOLOGY

The proposed method for the management of wastes is efficient and time saving process. This automation of waste also reduces the human effort and consequently the cost of the whole process. This system can be implemented at any place with ease and within reasonable amount of time and reliable with long distance coverage.

2a. WIRELESS TECHNOLOGY

Wireless is the term which describes any computer network without any physical wired connection between sender and receiver. The actual meaning of wireless is to provide network connection through radio waves or microwaves to maintain communication.

Wireless technology provides the network connection over long distances without the help of long cable wires. This type of communication is also made possible by Radio Frequency (RF) waves and Infrared(IR) waves. This is used increasingly for data transmission.

Advantages

The user can easily connect to the network resources at any location(Convenient to use).Users can access the internet even outside their normal working environment (Mobility).The wireless network can expand the network and can handle more number of users (Expandability).

2b. IoT Technique

The Internet of Things (IoT) is the network of devices embedded with electronics, software, sensors, actuators to connect and exchange data. Each device has unique identifiers in order to transfer data over a network. It create opportunities for more direct integration of the physical world into computer based system which results in improved efficiency, accuracy and economic benefit as well as reduced human intervention. It encompasses technologies such as Smart Homes, Smart Cities and Intelligent transportation. These devices collect useful data with the

help of various existing technologies and then autonomously flow the data between other devices.

3. PROPOSED MODEL DIAGRAM:

3.1INPUT DIAGRAM

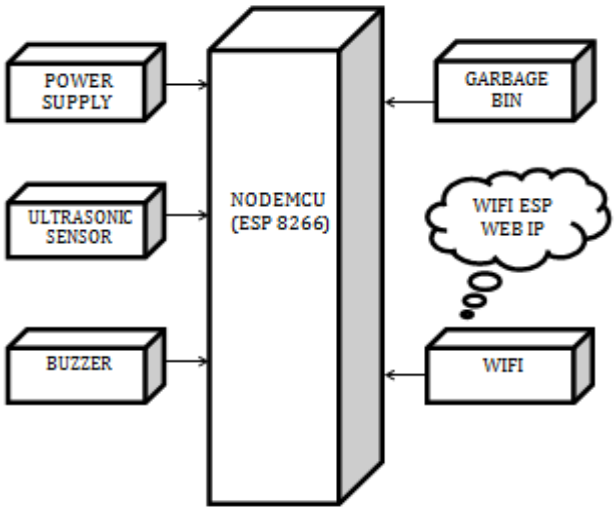

Figure 3.1 Input to Microcontroller

The initial work is to fix an ultrasonic sensor on the lid of the dustbin to detect the depth of the dustbin. Then a microcontroller is also placed on the lid to store the collected information and the collected information from the microcontroller is transferred to the SQL DATABASE with the help of WIFI (Refer Figure 3.1).

The information will be retrieved from SQL (Structured Query Language) DATABASE using a specific host IP address(URL) and create a webpage in order to view the retrieved information.

3.2 OUTPUT DIAGRAM

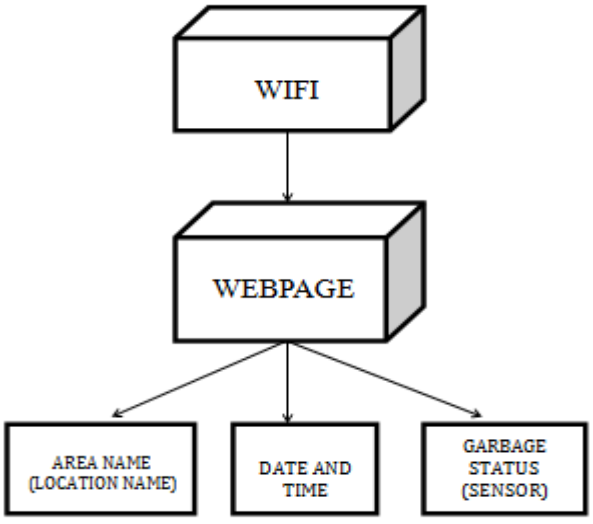

Figure 3.2 Webpage Display

The webpage displays the area name(location name), garbage status(sensor status) and date and time of any particular Street. The readings can also be downloaded for future use. Finally the user can logout from the webpage. A Graphical Interchange Format(GIF) of the dustbin will be displayed on the webpage(Refer Figure3.2).

4. MODULE DESCRIPTION

4.1 SENSING DATA

Ultrasonic sensor transmits the ultrasonic waves from its sensor head and again receives the ultrasonic waves reflected from an obstacle(object).The ultrasonic sensor emits the short and high frequency signal. These propagate in the air at the velocity of sound(Refer Figure 4.1).

It detects the depth(level) of the garbage present in the dustbin. This sensor transmits the ultrasonic waves within the range of 100cm. If they hit any object, then they reflect back echo signal to the sensor. The ultrasonic sensor consists of a multi vibrator, fixed to the base. The multivibrator is combination of a resonator and vibrator. The resonator delivers Ultrasonic wave generated by the vibration.

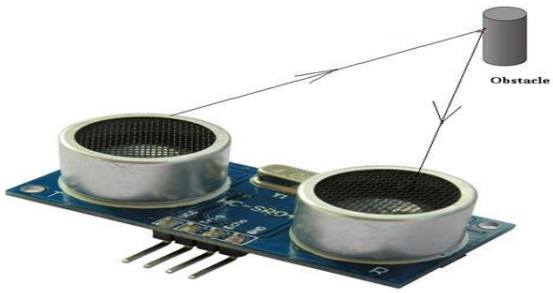

Figure 4.1 Ultrasonic Sensor

4.2 ANALOG TO DIGITAL CONVERSION(ADC)

NodeMCU is a complete environment of hardware and software for IoT prototyping which consists of the following items such as Controller board consisting of a ESP8266 module, Micro USB Port to power (5 volts) and programming, 10 digital inputs GPIOs operating at 3.3v an analog input General-Purpose Input/Output(GPIO) to 1.8 V and Development kit based on the Lua language. NodeMCU Amica is a ESP8266 WiFi Module (Refer Figure 4.2a)based development board. It has got Micro USB slot that can be directly connected to the computer or other USB host devices.

It has got 15X2 Header pins and a Micro USB slot, so that the headers can be mounted on breadboard. The micro USB slot is used to connect USB host device which may be a computer. It also has got CP2102 USB to serial converter.

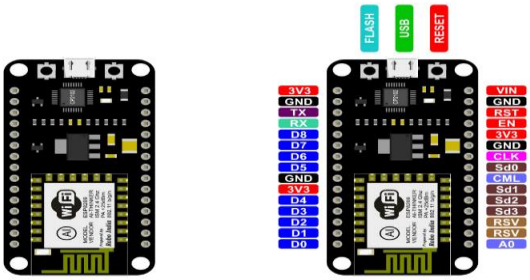

Figure 4.2a NodeMCU(ESP8266)

The microcontroller used is NodeMCU(ESP 8266). The ESP8266 module is a IoT device consisting of a 32-bit ARM microprocessor with support of WIFI network and built-in flash memory. The input given to the microcontroller is power supply(i.e.,+5V DC).Initially 230 volt AC is converted into 12 volt AC using Stepdown Transformer(Refer Figure 4.2b).Then the 12 volt AC is converted to 9 volt DC using Rectifier(Diode).Finally, the 9 volt DC is converted to +5volt DC using Regulator 7805 which will be the input to the NodeMCU(ESP 8266) microcontroller. The data which have been retrieved from the sensor will be stored in microcontroller.

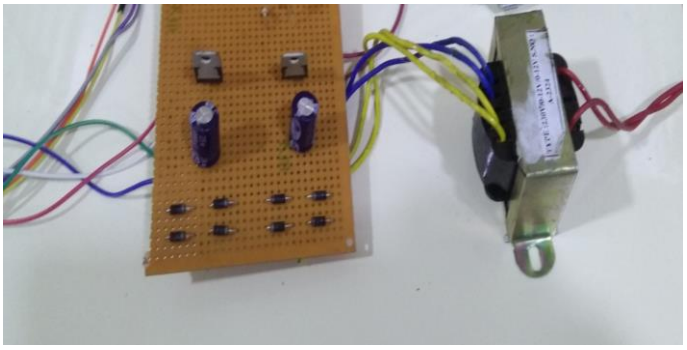

Figure 4.2b AC to DC Conversion

The Microcontroller ESP8266 is interfaced withultrasonic sensor(Refer Figure 4.2c).The Integration process is performed using Embedded C coding.

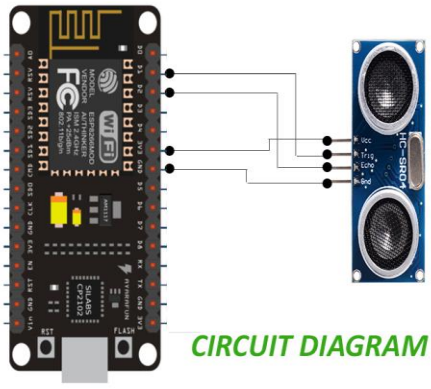

Figure 4.2c Microcontroller interfaced with Ultrasonic Sensor

4.3 STORING DATA

The data stored in the microcontroller is transferred to the SQL Database through WiFi. The WiFi is utilized with the help of inbuilt WiFi in the microcontroller.

Relational Database Management System (RDBMS) is the basis for SQL. MySQL is a popular open source relational database management system (RDBMS) for web-based applications. MySQL helps in optimizing and maintaining databases .For accessing database from MY SQL using Cloud Server (Refer Figure 4.3)

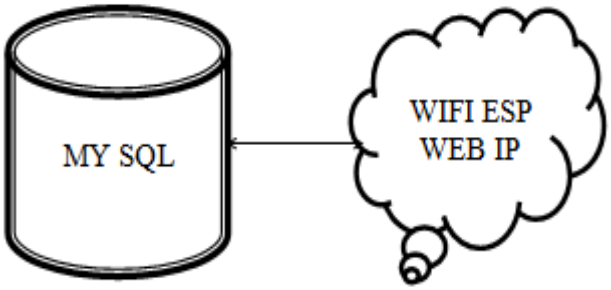

Figure 4.3 Connections between SQL Database and Cloud Server

4.4 WEB APPLICATION DEVELOPMENT

The use of scripting language is required for webpage development. It should be implemented both at the server end and client end. A scripting language known as PHP(Hypertext Preprocessor) is used because of its ability to interact with database systems. The most commonly used scripting language is Hypertext Preprocessor(PHP).The webpage displays the Area name(Location name),date and time and garbage status(Sensor Readings) of any particular Street.

5. DISPLAYING THE OUTPUT SCREENSHOTS

By giving the IP Address (URL), a login page will be displayed for security purpose.(Refer Figure 5.1).

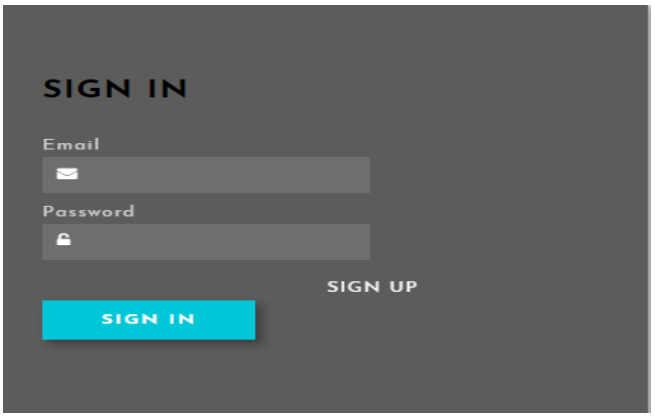

Figure 5.1 Login page

After signing in to the webpage, the home page will be displayed (Refer Figure 5.2). It indicates the level in 3 ways with 3 different colors. The colors used are Red, Blue, Green colors (ie., RGB). The green color represents low (ie., 25%). The blue color represents moderate (ie., 50%). The red colour represents high (ie., 100%).

Figure 5.2 Home Page

The home page will display the ultrasonic sensor readings of the garbage bin(Refer Figure 5.3)

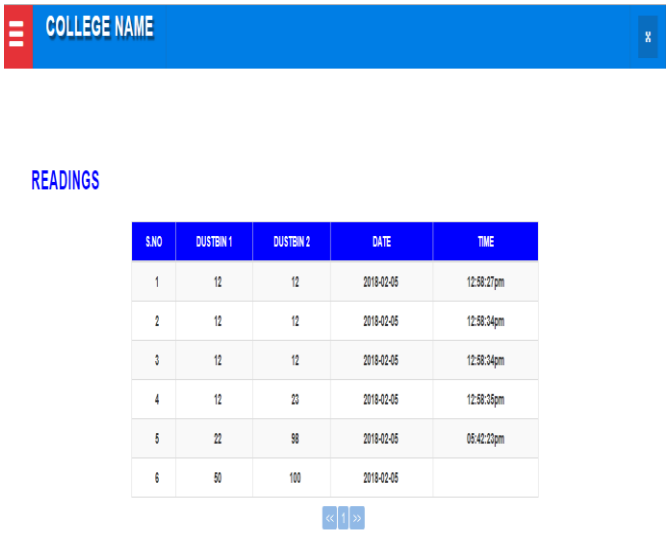

Figure 5.3 Displaying the Readings Page

There will be a download option in the home page which is used to view the particular time period data (Readings) of the dustbin. There will be 2 options indicating the Start Date and End Date and 1 button(Download) to view the old history details(particular time period). The readings can also be downloaded for future use(Refer Figure 5.4). Finally the user can logout from the webpage.

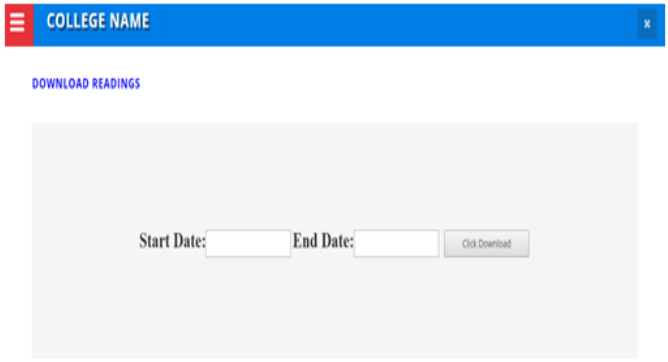

Figure 5.4 Download Readings Page

6. CONCLUSION AND FUTURE ENHANCEMENTS

This survey's focus is on more energy-efficient Internet of Things (IoT) as an enabler of various applications including waste management. The work presents the efforts for the intelligent transportation within the context of Internet of Things (IoT) and Smart Cities for waste collection. In real time, this setup can be implemented in the environment. This set up can also be implemented in Industry based areas The future work may be implemented by interfacing the devices with google maps to find the optimal(shortest) path. The collected waste can also be recycled for future use.

7. REFERENCES

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