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OPTIMIZED PATH FOR WASTE MANAGEMENT USING IOT

Prof.Indu Anoop[1] , Ayush Jain[2], Shweta Pathak[3], Gauri Yadav[4]

[1]*Asisstant Professor , Department of Information Technology, Vidyalankar Institute of Technology,Mumbai.*

[2,3,4] *Student, Department of Information Technology , Vidyalankar Institute of Technology, Mumbai.*

Abstract— Garbage and Waste Management is a tedious job for all the civic bodies in the country. Most of the times, it has been observed that the garbage bins are overloaded with waste which is not collected at proper intervals. This condition not only creates unhygienic conditions for people but also contaminates the surrounding. The environment is filled with bad odor which can lead to pollution as well.

To avoid all the above mentioned situations, the team is implementing a project called 'IOT Based Smart Garbage and Waste Collection Bins'. These dustbins are interfaced with Arduino based system having Ultrasonic sensor along with central system showing status of garbage and on mobile web application with Android app. The status would thus be reflected on the app. Major part of the project depends upon the working of the Wi-Fi module; essential for its implementation. The main aim of this project is to redu ce human resources and efforts along with the enhancement of a smart city vision.

Keywords—IOT, Arduino, Ultrasonic sensor, Wifi Module, Dip Switch.

I. INTRODUCTION

Internet and its applications have become an integral part of today's human lifestyle. It has become an essential tool in every aspect. Due to the tremendous demand and necessity, researchers went beyond connecting just computers into the web. These researches led to the birth of a sensational gizmo, Internet of Things (IOT). Communication over the internet has grown from user - user interaction to device – device interactions these days. The IOT concepts were proposed years back, but still it is in the initial stage of commercial deployment. Home automation industry and transportation industries are seeing rapid growth with IOT. The technology can be simply explained as a connection between human computers-things. Most processes are done with the help of sensors in IOT.

Sensors are deployed everywhere and these sensors convert raw physical data into digital signals and transmit them to its control centre. This system's architecture would be based on context of operations and processes in real-time scenarios. Smart collection bin works in the similar manner with the ultrasonic sensor that indicates the depth of garbage in the bin. The ultrasonic sensor will show the various levels of garbage collected in the dustbins and send its output ahead when its threshold level is crossed. These details are further given to the Arduino and it gives the details to the transmitter module (Wi-Fi module). At the receiver section a mobile handset is needed to be connected to the Wi-Fi module so the details of the garbage bin are displayed onto the Android Application of our mobile handset. Once the details are collected, the optimized path for the garbage truck is calculated and displayed.

II. SYSTEM DESCRIPTION

A. Ultrasonic sensor

BLOCK: Input

Type: HC-SR04

ANALOG/DIGITAL: Digital

PINS FOR INTERFACE: 4Pins **PHOTO/CIRCUIT SYMBOL:**

Fig 1: Ultrasonic sensor

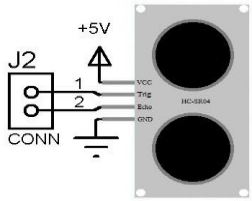


Fig 2: Ultrasonic sensor circuit

Description:

Ultrasonic sensors work on a principle similar to sonar which evaluate distance of a target by interpreting the echoes from ultrasonic[3] sound waves.

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

(1) Using IO trigger for at least 10us high level signal, (2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.

(3) IF the signal back, through high level, time of high output IO duration is the time from sending ultrasonic to returning.

Test distance = (high level time×velocity of sound (340M/S) / 2

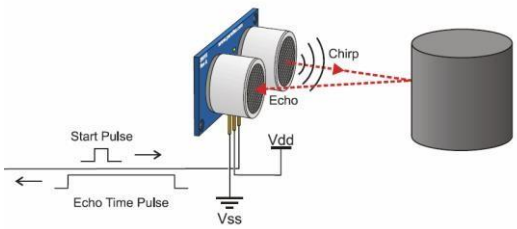


Fig 3: Working of Ultrasonic sensor

B. Arduino

What is Arduino?

Arduino[2] is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.

Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can communicate with software running on your computer (e.g. Flash, Processing, MaxMSP.) The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free.

The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

Why Arduino?

There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Netmedia's BX-24, Phidgets, MIT's Handyboard, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

- Inexpensive - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the preassembled Arduino modules cost less than $50
- Cross-platform - The Arduino software runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.
- Simple, clear programming environment - The Arduino programming environment is easy-touse for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with the look and feel of Arduino
- Open source and extensible software- The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.
- Open source and extensible hardware - The Arduino is based on Atmel's ATMEGA8 and ATMEGA168 microcontrollers. The plans for the modules are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.

Arduino UNO Rev3

Fig 4: Arduino Uno

The Arduino Uno R3 is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything

needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Additional features coming with the R3 version are:

- ATmega16U2 instead 8U2 as USB-to-Serial converter.
- 1.0 pinout: added SDA and SCL pins for TWI communication placed near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board and the second one is a not connected pin, that is reserved for future purposes.
- stronger RESET circuit.

"Uno" means "One" in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform.

C. Wifi Module

Fig 5: Wifi Module

The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existance interfaces, it contains a selfcalibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

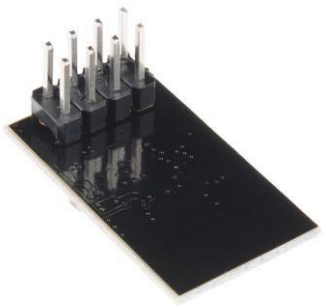


Fig 6:ESP8266 Wifi Module

Features:

- 802.11 b/g/n
- Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA.

D. Dip Switch

A Dip switch is a manual electric switch that is packaged with others in a group in a standard dual inline package (DIP). The term may refer to each individual switch, or to the unit as a whole. This type of switch is designed to be used on a printed circuit board along with other electronic components and is commonly used to customize the behavior of an electronic device for specific situations.

DIP switches are an alternative to jumper blocks. Their main advantages are that they are quicker to change and there are no parts to lose.

Types: There are many different kinds of DIP switches. Some of the most common are the rotary, slide, and rocker types.

Rotary DIP switches contain multiple electrical contacts, one of which is selected by rotating the switch to align it with a number printed on the package.

The slide and rocker types, which are very common, are arrays of simple single pole, single throw (SPST) contacts, which can be either on or off. This allows each switch to select a one-bit binary value. The values of all switches in the package can also be interpreted as one number. For example, seven switches offer 128 combinations, allowing them to select a standard ASCII character. Eight switches offer 256 combinations, which is equivalent to one byte.

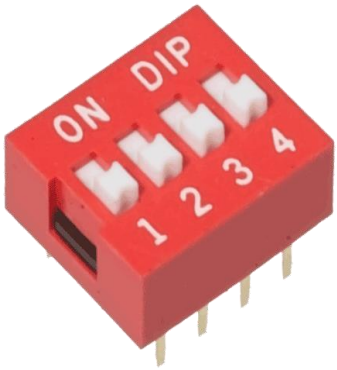


Fig 7: DIP Switch

Applications: DIP switches were also often used on arcade games in the 1980s and early 1990s to enter game settings such as difficulty or the number of credits per coin. DIP switches were very commonly used to set security codes on garage door openers as well as on some early cordless phones. Current garage door openers use rolling code systems for better security.

These type of switches were used on early video cards for early computers to facilitate compatibility with other video standards. For example, CGA cards allowed for MDA compatibility.

II. IMPLEMENTATION

A) Arduino is used over which the ultrasonic sensor, Dip switch and Wifi Module are connected to the board.
The Ultrasonic sensors are used to sense the level of the garbage in the dustbin. The dip switch is used for the location of the bins and the wifi module is used to send the data wirelessly to the server side.

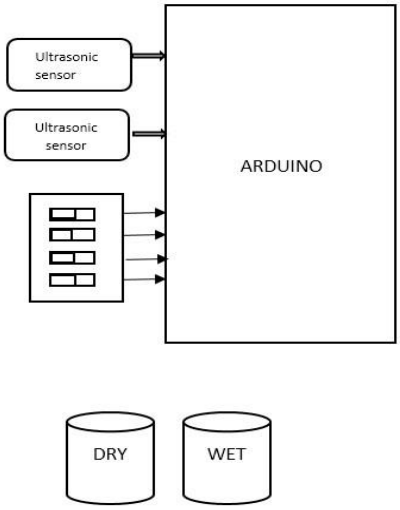


Fig 8: Hardware setup

B) In this the wifi module sends the data to the server. The values are then updated on the visual Basic GUI.

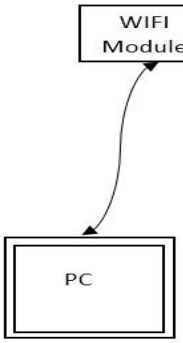


Fig 9: Server Side

C) The android application displays the values and the route for the truck driver to collect the garbage on the basis of the threshold of the garbage in the bins.

Fig 10: Android Application

III. TEST CASES

The hardware of our project consists of Arduino, Wifi Module, Dip Switch and Two Ultrasonic Sensors.

Fig 11: Live Hardware

The server on the Pc sides consists of Graphical User Interface for displaying the values of the garbage in different bins. This GUI is made using Visual Basic Software.

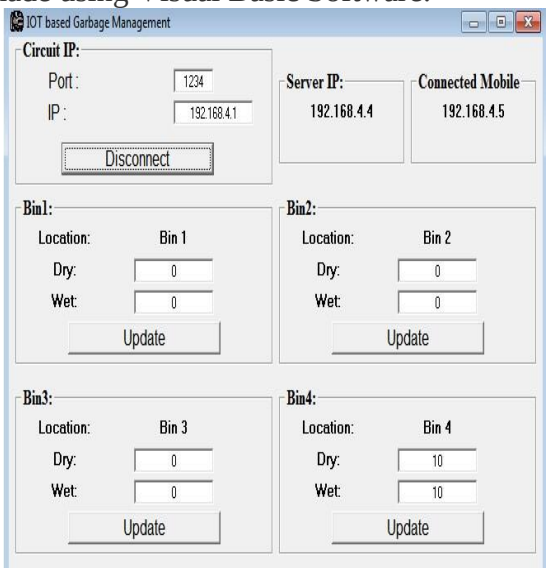


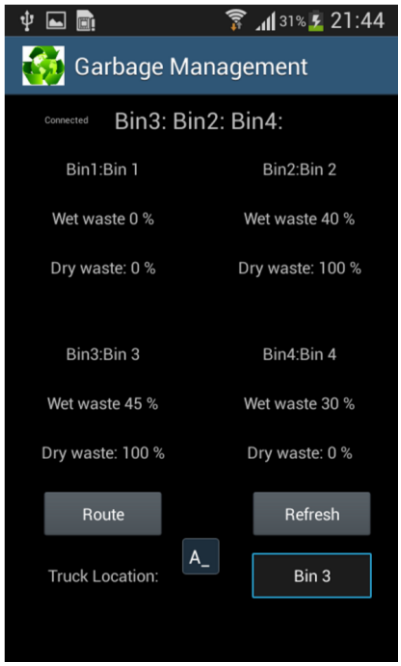
Fig 12: Visual Basic GUI

The android application is used for depicting the values of the garbage in the bin and also provide a route for the truck to collect the garbage based on the levels of garbage in the bin. The bin with highest WET garbage is provided the priority to be collected and then the bin with the highest DRY waste is collected. The threshold for WET bin is set at 20% and dry bin is set 80%. The optimized path is displayed by calculating the shortest distance between the bins using the Djikstra's algorithm[1]. The algorithm takes into account the weight of each bin. The weight of each bin acts as the nodes of the Djikstra's algorithm working.

V. CONCLUSION

This project work is the implementation of smart garbage management system using Ultra sonic sensor, Arduino and Wi-Fi module. This system assures the cleaning of dustbins as soon as the garbage level reaches its threshold. This reduces the total number of trips of garbage collection vehicle and hence reduces the overall expenditure associated with the garbage collection. It ultimately helps to keep cleanliness in the society. Therefore, the smart garbage management system makes the garbage collection more efficient.

Smart dustbin helps us to reduce pollution.This project ensures waste collection on time which in turn ensures less contamination of environment, no spread of disease and a cleaner surrounding.



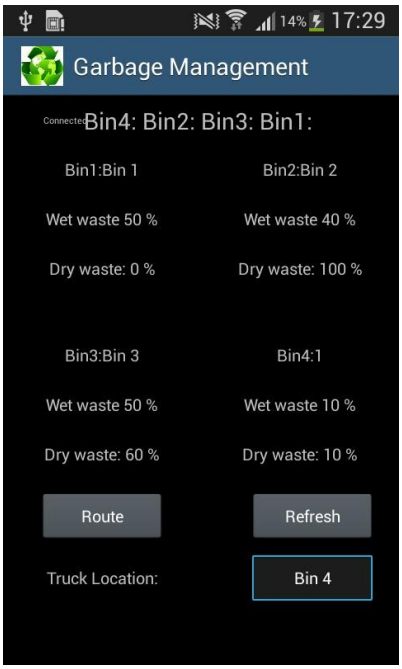


Fig 13: Optimized Route-Bin 3:Bin 2:Bin 4 ***Fig 14: Optimized Route-Bin 4:Bin 2:Bin 3:Bin 1***

VI. REFERENCES

1. A Review And Evaluations Of Shortest Path Algorithms by Kairanbay Magzhan, Hajar Mat Jani.
2. Establishing the Connection between Control Theory Education and Application: An Arduino Based Rapid Control Prototyping Approach by Hongtai Cheng, Lina Hao, Zhong Luo, and Fei Wang.
3. An ultrasonic sensor for distance measurement in automotive applications by Alessio Carullo and Marco Parvis.