Smart Traffic Management System

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Abstract-

Abstract-In today's fast-moving, highly competitive industrial world for smart cites. The Technology and media are very important in our life. Internet of things (IOT) is the network of vehicles, physical devices, home appliances, and other items embedded with sensors, actuators, electronics, software, and connectivity which enable these things to collect and exchange data after connected to each other. Most modern cities compete to be smart cities. IOT Technology is one component of The Fourth Industrial Revolution (4IR). This work is showing traffic management using Internet of Things. We designed a work to monitor the streets independently without need for people to controlling them. And the Result will appear in LCD Screen as well as SMS message will send to ROP .

Keywords: IoT, Traffic, modern cities.

I. INTRODUCTION

This section introduces you to the term Traffic management system an overview of the work plan is given. The experimental setup, hardware and software requirements are also included. In today's fast-moving, highly competitive industrial world .The Technology and media are very important in our life. Automatic system is the use of control systems and information technologies to reduce the need for human work. Traffic Management is where our system monitors the traffic by sensors and send SMS message to ROP also display it in LCD for drivers who use the road. No need for police to go to each road and monitor the traffic. This system Will make their work easier. Also for drivers, some time they want to go to their work early without any impediments. Our system provides effort for police in an easy way to identify the location of the traffic and then go to that place and solve the problem, also drivers can also know where is the traffic then can change the road. In this work, we present the design and implementation of Internet based Traffic management system. The communication between the devices is Internet.

1.1 Background of the Work

The system is designed to be flexible with the increasing variety of devices to be controlled. This system is a measure of the distance between vehicles and gives an alert when vehicles stop along the way, which reflects the presence of traffic congestion. In this control system, the sensors will measure the distance and compare the value. If it's more than value which we configured that is mean no traffic crowded, and if the value less than distance value which we decided so that is mean there is traffic crowd because the distance between cars is short. We programmed our system in Arduino software and we use node MCU (ESP8266) and Ultrasonic sensors.

1.2 General Objectives

The main objective of our work is to implement a low cost, scalable and reliable Traffic

management system that can be used to monitor traffic by easy way.

1.3 Specific Objectives

The general objective of our work will be achieved by the implementation of the following specific objectives:

- Doing a system to remotely monitor the traffic. We used one website and programmed this website which we use it to send message automatically with Arduino and get sensor data and compare it and send SMS on ROP phone or email if there is any traffic.

- Using microcontroller Node MCU with ultrasonic sensors to monitor the Traffic an effective way. The NodeMCU is microcontroller programed according for different instructions. You can read information from sensors.

1.4 Significance of the work

The importance of our work in smart cities is to make the road more safely by using IOT. And this work for help ROP to manage the road and we believe that drivers are the biggest beneficiaries of this work. In future we will make also the Application for driver to know what if there is traffic or not to avoid it by change to other road.

1.5 Scope and Delimitation

Traffic management can be implemented by different application and software like ESPLORER (LUA Language) and different sensor like PIR and leaser but our work is limited to using NodeMCU-ESP8266 and ultra-sonic sensor (HC-SR04).

II. RELATED LITERATURE

Internet of things nowadays is turning information into action that creates new capabilities and richer experience. It is bringing together people, processes, data, and things in a more valuable network connection. Traffic management system is one example of this technology revolution where the ROP can get easier way to monitor the traffic. With traffic management system, ROP monitor the Roads and give them alert when any traffic is happen. This section presents a detailed background about automation concept and specifically Traffic management system. Background about Arduino software and NodeMCU is added under this section as well. Various research whitepapers, conference papers, books, journals' articles, and websites are used in presenting this background. You can refer to these sources of data in the references list for in depth details.

2.1 History of Traffic

When cars became popular, local governments established traffic laws to limit collisions with horse-drawn wagons and ensure safety. The mandatory registration of automobiles was one of the first traffic regulations in the United States. New York became the role model in 1901 by being the first state to require that automobile owners register their vehicles. Traffic laws now make up a major part . Their main purpose is to improve unsafe driving and to provide education to bad drivers. Research shows that most people will obey the traffic laws, even when they hit a red light at 3 a.m. and there is not another car in sight. There is, however, a group of people who constantly get caught for ignoring the laws [1] . Our work which is smart Traffic management system is one example where the ROP can get easier way to monitor the traffic. With traffic management system, ROP monitor the Roads and give them alert when any traffic is happen.

2.2 Types of smart Traffic management system

Traffic management control Systems: These are good for existing roads as there is no need for ROP to go to monitor each road and also drivers can know where more traffic is.

2.3 Applications

For any control system you should have application to control it. Our System will send message for ROP and also will display it for drivers in LCD. We will use one website for sending the message. In future we can develop one Application for drivers also.

2.4 Advantages

Traffic management has many advantages in our work. The first advantage it is easy for ROP to manage and control the traffic. The traffic will reduce. Also the road will be more safety because if there any traffic the ROP will go and solve the problem so the road will be saves.

2.5 Disadvantages

In any work there are many disadvantages, in our work the first disadvantage is about how long of vehicle, there is some vehicle is too long so the sensor will not take the results clearly. Also, if there is no connections network in our system it will not work. Because of that cannot send message for ROP easily. It depends of signals of network it is strong or slow.

2.6 Difference between present Traffic management system and previous Traffic management system

In present system The ROP can monitor all Roads from the ROP center, and if there any Crowding they will go to that place, else no need to go. Also the drivers will know how the traffic will be. On the other hand, in previous system the ROP have to go and monitor the traffic and it will take time. The drivers may be they want to go fast to their work so they will dos not know if there is traffic or not.

III. METHODS USED IN DEVELOPING THE WORK

For any work to reach the release stage, you first need to understand the process by which the work is analyzed, developed and maintained. This process is known as software development lifecycle (SDLC) which we have used for developing our work. SDLC is a software development process used in describing the stages involved in system implementation and setup. Phases here are listed from the initial study and planning through maintenance of the completed application. There are function and process under every phase of our work. Five phases are involved: planning, analysis, design, implementation, testing and Maintenance as shown in Fig1:

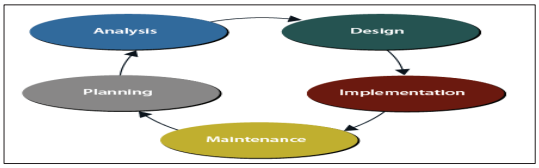


Fig1: phases of SDLC

1.6 Phase1: Planning

This is the first stage of any SDLC model. The work objective is determined during this stage. As we know our streets today are increasing, as a result, congestion is increasing in some streets. We started searching the solutions presented in this field to solve this problem easy by ROP. Presenting this work will help them to reduce the effort in their work. This work presents the design and implementation of Internet (IOT) based Traffic management. The communication between the devices - our system, ROP phones and LCD- is internet. The system is designed to be low cost and flexible with the increasing variety of devices to be controlled. In this Smart traffic management system, the traffic is adjusted using an Arduino board. Using microcontroller

Arduino with NodeMCU and ultrasonic sensor to monitor the traffic management in an effective way for remotely monitor the roads. The Arduino is microcontroller which is a circuit board having a chip to be programed according for different instructions.

1.7 Phase2: Analyze

The second phase in SDLC model is analysis. We start to plan the implementation of our work; collecting information about Traffic management and the various options of applications for designing IOT solutions, selecting Arduino system for implementation and buying the components to be used. Then, we moved to Analyzing the required services to be provided by the proposed system.

1.8 Phase3: Design

In this phase we prepared the design of smart management system using NodeMCU microcontroller. We searched sample work of home automation design by NodeMCU microcontroller in Arduino software.

As you see in figure (2), the system has two main parts: the hardware part microcontroller by NodeMCU (ESP8266) plus the ultrasonic sensor and the second parts is the www.ubidots.com website coding with Arduino software. With our system and necessary sensors .The ROP can monitor the traffic anytime and from anywhere by using our system.

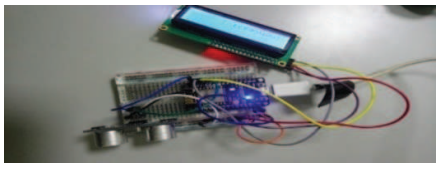


Fig1: Design of Smart traffic management system

NodeMCU is an open source Lua based firmware for the ESP8266 WiFi SOC from Espressif and uses an on-module flash-based SPIFFS file system.

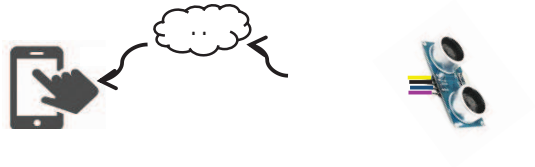


Fig2: Hardware requirements - traffic management system

1.8.1 Implementation

Implementation phase was applying the design proposed in the previous stage. We first connected the hardware (NodeMCU ESP8266 microcontroller, ultrasonic sensor, jumper wires and LCD) .Next; we programmed the instructions to be given for NodeMCU (ESP8266) by Arduino software. Then we code the website with software.

1.8.2 Testing

This stage tests and integrates individual units or program (codes/output) to have communicated signal between the software, hardware elements, the ultrasonic sensor , ROP phone and LCD. The ultrasonic sensor then passes the signal to the Arduino software to get take action. The main challenge in this phase was the source of Internet connection .The NodeMCU microcontroller needs good single to respond.

1.8.3 Maintenance

The last phase was Maintenance. Since all parts were communicating and responding to each other, the system can be used for the purpose it was planned for. It's recommended to use the ubidots website between the phone SMS and the

NodeMCU microcontroller rather than using cellular connection. Movement sensor can be added to this system, when car is near of Movement sensor for much time so, there is traffic.

1.9 Gathering Instruments

3.2.1 Observation

Sometimes traffic congestion can cause a lot of delay for drivers and they may have no choice but to wait, causing congestion, so the police should go to solve the problem.In some cites, there is a lot of traffic in the streets,

From this point, the work idea was generated to provide a solution for remotely monitoring for police, and also for drivers.

IV.REQUIREMENT SPECIFICATION

4.1.1 Hardware Requirement

- NodeMCU ESP8266 microcontroller with board LCD Wires
- Ultrasonic sensor

4.1.2 Specifications

➢ Requirement name: NodeMCU ESP8266.

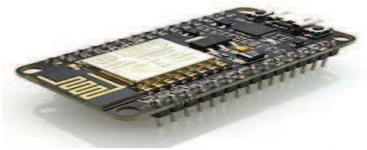
- Module Type: ESP8266.
- Price: O.R 3.800.
- Function: NodeMCU is an open source IOT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

Features:

NodeMCU provides access to the GPIO (General Purpose Input/Output) and for developing purposes below pin mapping table from the API documentation should be referenced.

IO index	ESP8266 pin
0 [*]	GPIO16
1	GPIO5
2	GPIO4
3	GPIO0
4	GPIO2
5	GPIO14
6	GPIO12
7	GPIO13
8	GPIO15
9	GPIO3
10	GPIO1
11	GPIO9
12	GPIO10

Table1: Pins of NodeMCU



➢ Requirement name: Ultrasonic sensor.

- Module Type: Ultrasonic sensor module HC-SR04.
- Price: O.R 0.800
- Function: The sonic waves emitted by the transducer are reflected by an object and received back in the transducer. After having emitted the sound waves, the ultrasonic sensor will switch to receive mode. The time elapsed between emitting and receiving is proportional to the distance of the object from the sensor. Shown picture as fig4.

Fig4: Ultrasonic sensor module HC-SR04.

Features :

1. Transparent object detectable
   - Since ultrasonic waves can reflect off a glass or liquid surface and return to the sensor head, even transparent targets can be detected
2. Resistant to mist and dirt
   - Detection is not affected by accumulation of dust or dirt.

➢ Requirement name: wires.

- Module Type: Jumper Wires.
- Price: O.R 0.900/20cm.
- Function: used for carrying electric current. They have the flexibility of stranded wire but will fit directly into breadboards . Shown picture of wires as fig5.

Fig5: wires

Requirement name: LCD.

- Module Type: 4-Pin I2C LCD
- Price: O.R 1.00
- Function: display the information

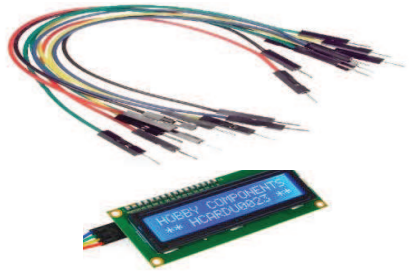


Fig6: LCD 4-pin 12C

4.1.3 Software Specification

- Ubidots WEBSITE :

Ubidots is an Internet of Things (IoT) application builder with data analytics and visualization.

Ubidots offers a platform for developers that enables them to easily capture sensor data and turn it into useful information. Use the Ubidots platform to send data to the cloud from any Internet-enabled device. You can then Configure actions and alerts based on your real-time data and unlock the value of your data through visual tools. Ubidots offers a REST API that allows you to read and write data to the resources available: data sources, variables, values, events and insights. The API supports both HTTP and HTTPS and an API Key is required.

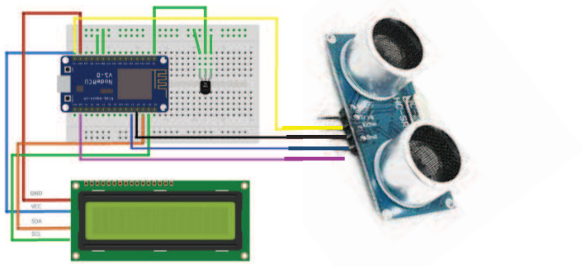
- Arduino software :

The Arduino software is one good application to programming the system . The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and hardware to upload programs and communicate with them. In our work ,we write the code by this software in Arduino to make control our system .

4.2 Design

The design is important part in our work. In this work, we do the design and implementation of smart traffic management system. The system is designed to be low cost and flexible with the increasing variety of devices to be controlled. This is system is to monitor the traffic remotely. In this smart traffic management system, the ultra-sonic sensor is adjusted using an NodeMCU and Ubidots website where is message will sent to ROP.

The instructions to NodeMCU will be programmed via Arduino software. Also ,we made Small design of Smart traffic management system as shown fig 8.



Fig(7) design of smart traffic management hardware

V. NETWORK DEVELOPMENT AND IMPLEMENTATION

The implementation of the previous design scheme will be implemented in a sample test pad. The process is divided into 4 phases. The first phase install Arduino software in laptop and create account in Ubidots website. Phase 2 connecting wires in NodeMCU with breadboard and ultrasonic sensor. Phase 3, write the codes in software, in phase4. Test the system by send SMS to ROP phone and display it in LCD. The last phase is giving guidance on maintain and testing the experiment.

5.1 Phase 1: Installing Applications

We install Arduino software in laptop from internet. Fig 9 shows the steps of downloading the software.

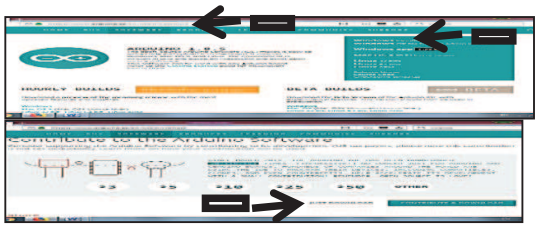


Fig 9. The steps of download the software

5.2 Phase 2: Making Connections

First, we connect the wires from ESP8266 to breadboard. After that we connect the ultra-sonic sensor to breadboard by wires. Third step we connect (LCD) to breadboard by using jumper wires. Shown as fig10 Connection the components.

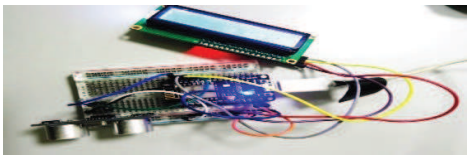


Fig10. Connecting the components

5.3 Phase 3: Programming Arduino

In this phase we download the ultra-sonic library which will use it to write the codes in Arduino software .

we need to download the ultra-sonic library for Arduino. To do that, open the Arduino go to the Sketch menu and open the Library manager. Once opened you can search the library by the ultra-sonic keyword and install it. As shown Fig11 ultra-sonic library.

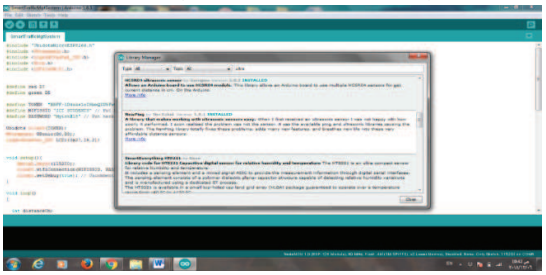


Fig11. Ultra-sonic library

- These are codes which we write in our work:

```
#include "UbidotsMicroESP8266.h"
#include <Ultrasonic.h>
#include <LiquidCrystal_I2C.h>
#include <Wire.h>
#include <ESP8266WiFi.h>
#define red D7
#define green D5
#define TOKEN  "BBFF-
lD4uks1cIHbmQZD5FwCgRNbp1wBnFi"
// Put here your Ubidots TOKEN
#define WIFISSID "ICT STUDENTS" //
Put here your Wi-Fi SSID
#define PASSWORD "Myict@18" // Put
here your Wi-Fi password
Ubidots client(TOKEN);
Ultrasonic USonic(D0,D3);
LiquidCrystal_I2C LCD1(0x27,16,2);


void setup(){
   Serial.begin(115200);
   client.wifiConnection(WIFISSID,
PASSWORD);
   client.setDebug(true);
}

void loop()
{

  int distanceCm;
  int distanceIn;
  distanceCm = USonic.distanceRead();


   Serial.begin(115200);
    Wire.begin(D2,D1);
    LCD1.begin(16,2);
    LCD1.init();
    LCD1.backlight();
    LCD1.setCursor(0,0);

    LCD1.setCursor(1,0);

if ((distanceCm) <= 5) {
  pinMode(red, HIGH);
  digitalWrite(red, HIGH);
  LCD1.print("High Traffic");
  //Serial.println("High Traffic");
  pinMode(green, LOW);

} else  {
  pinMode(green, HIGH);
  digitalWrite(green, HIGH);
  LCD1.print("LOW Traffic");
  //Serial.println("LOW Traffic");
  pinMode(red, LOW);
}
```

VI.CONCLUSION

Traffic Management is where our system monitors the traffic by sensors and send SMS message to ROP also display it in LCD for drivers who use the road. No need for police to go to each road and monitor the traffic. This system Will make their work easier. Also for drivers, some time they want to go to their work early without any impediments. Our system provides effort for police in an easy way to identify the location of the traffic and then go to that place and solve the problem, also drivers can also know where is the traffic then can change the road. In this work, we present the design and implementation of Internet based Traffic management system. The communication between the devices is Internet. The system is designed to be flexible with the increasing variety of devices to be controlled.

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