IOT Technology for smart life and sustainable development

A capstone project submitted to faculty of Industry and Energy Technology, New Cairo Technological University, In partial fulfillment of the requirements for the Degree of Higher Diploma

Information and Communications Technology

Submitted by

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STUDENT DECLARATION

Student declaration

I certify that the assignment submission is entirely my own work and I fully understand the consequences of plagiarism. I understand that making a false declaration is a form of malpractice.

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<u>Approval Sheet</u>

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This capstone project has been approved by the examining committee:

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DEDICATION

This project is dedicated to our parents who have never failed to give us financial and moral support, for giving all our needs during the time we developed our system and for teaching us that even the largest task can be accomplished if it is done one step as a time.
We dedicate this Project to all the people who have worked hard to help us complete this project.

ACKNOWLEDGMENT

First of all, I thank my *" God "* for helping me to achieve this work and giving me the ability to finish this thesis in that satisfactory form.

I would like to express my sincere appreciation to my supervisors: **Eng. Shereen and Eng. Maha**. I am very grateful for their strong effort, continuous support, and encouragement during the research study in this capstone project. They really influenced my way of thinking and developing the research ideas adopted in this thesis. Really, I can't find the appropriate words to thank them. I am very grateful for their strong effort, continuous support, and encouragement during the research study in this capstone project.

I can't forget my dearest **Prof. Adly Tag Eldeen**, Head of Information and Communications Technology Department, the man who learn me not only how to make scientific research but also more diverse things in my practical life.

I would like also to express my deepest thanks *all the members* of my colleges for their cooperation during the period I spend with them
to prepare this work.

I am extremely grateful to *my family especially my father, mother*.

Capstone Project Team

v

ABSTRACT

What is a the target of of the project?

- The possibility of implementing and practical

- application on all academic subjects during the past two years The project can serve the

- community Possibility for future development

The solution of this problem is

Using IOT technology and Arduino to make a robot car that can be go in the dangerous area Filled with natural gas Filled with natural gas, measuring the amount of gas and sending it if it is dangerous or not to the human being while he is far away,and can control his by GUI app and any user can by or learn how can make the robot from tutorial web site

THIS PROJECT WILL DIVIDED INTO MAIN 3 PART

1. Hardware part : Bult the car body and connecting the sensors
2. GUI application : To control and detect the car and show the results of sensors
3. Website : Tutorial website and can buy the product

With robot car Which helps to protect humans in the event of a gas leak in the place without risking the presence of a worker, and the ability to remotely control it using the GUI and locate the gas leakage via GPS, send sensors readings to relief workers if necessary

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CHAPTER I

INTRODUCTION

CHAPTER 1
INTRODUCTION

1. 1 Overview

IOT in these days very important because it's lowest the cost of workers and can remotely controlled from long distance and take action, in our case we use IOT for keeping people from danger in the event of a gas leak or high temperature due to a fire, for example

And knowing the location of the damage through the GPS, which is by measuring the temperature using a sensor and the leakage of gases by using a gas sensor

The car can be controlled by the application of the GUI, and it also displays measurements and location coordinates using the GUI application.

1. 2 Problem Statement

- Human can't go in the dangerous area Filled with natural gas Filled with natural gas (Robot Car)
- measuring the amount of gas requires sensors (Gas Sensor)
- sending reads requires connection (Bluetooth)

- Detection from where gas leaked GPS

1. 3 Capstone Project Objective

- Safety if gas leaked

- Car remote control by using GUI

- Detection car place by using GPS

- Measuring the amount of gas and sending it if It's dangerous or not

- Buy Product by using Website

1. 4 Capstone Project Methodology

The methodology of this research is summarized as follows:

- Robot Car :
    - Arduino Mega
    - gas sensor (MQ-5)
    - temperature sensor (LM35)
    - Ultra-Sonic Sensor (HC-SR04)
    - Bluetooth Module (HC-05)
    - GPS Module (Ublox Neo-7n)
    - Motor driver (L298N)
    - Servo motor
    - 4 Dc motors
    - 4 Wheels
    - Jumper Wires
    - BreadBoard
    - Rechargeable batteries (appropriate capacity)
    - Battery holder

- GUI
    - C#
- Website (VS Code)
    - HTML
    - CSS
    - JAVASCRIPT
    - PHP

1. 5 Significance of Proposed Capstone Project

With robot car Which helps to protect humans in the event of a gas leak in the place without risking the presence of a worker, and the ability to remotely control it using the GUI and locate the gas leakage via GPS, send sensors readings to relief workers if necessary and you can buy the product from website and see how we build the project.

CHAPTER 2

Hardware

CHAPTER 2

Hardware

1. 1 Introduction

The project aims is to design an remotely controlled car, Arduino car contains Arduino microcontroller with basic mobility features. Arduino programs contains instructions mediating between android controller and Arduino car. GUI controller uses different sensors to supervise motion. An appropriate program in the Arduino microprocessor to interact with the GUI controller has to be created. The program has been successfully complied through Arduino IDE to the Arduino microprocessor & loaded in to it after proper checking of logic to decrease any loss/damage of hardware. We have to create an android application that will provide user an interface to interact with the Arduino powered car. The interface is easy to use and provide feedback from the Arduino microprocessor through the Bluetooth after giving instruction to Arduino for various actions through interface via Bluetooth module. The android application is to create with the help of android studio that provide us with more capability & stability. After doing all of this we have test this project thoroughly and find the maximum no. of error & wrong logic in the microprocessor program. After doing this only we can say that we have been able to create as per our goal described

2. 2 Components

- Arduino Mega

- gas sensor MQ-5

- temperature sensor

- Ultra-Sonic Sensor

- Bluetooth Module (hc-05)

- GPS Module

- Rechargeable batteries (appropriate capacity)

- 4 dc motors

- 4 wheels

- Jumpier wires

- Motor driver

- Servo motor

- Bread Board

- Battery holder

1. 3 Specifications, how they work

1. Arduino Mega

The **Arduino Mega 2560** is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), 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 Mega 2560 board is compatible with most shields designed for the Uno and the former boards.

2. gas sensor MQ-5

- **Overview**
- **Sensitive for LPG, natural gas, coal gas**
- **Output voltage boosts along with the concentration of the measured gases increases**
- **Fast response and recovery**
- **Adjustable sensitivity**
- **Signal output indicator**

- **Specifications**
- Power: 2.5V ~ 5.0V

- Dimension: 40.0mm * 21.0mm
- Mounting holes size: 2.0mm
- **Applications**
- Gas leakage detector
- **How to Use**
- In the case of working with a MCU:
- VCC ↔ 2.5V ~ 5.0V
- GND ↔ power supply ground
- AOUT ↔ MCU.IO (analog output)
- DOUT ↔ MCU.IO (digital output)

3. temperature sensor

- LM35 is a temperature measuring device having an analog output voltage proportional to the temperature.
- It provides output voltage in Centigrade (Celsius). It does not require any external calibration circuitry.
- The sensitivity of LM35 is 10 mV/degree Celsius. As temperature increases, output voltage also increases.
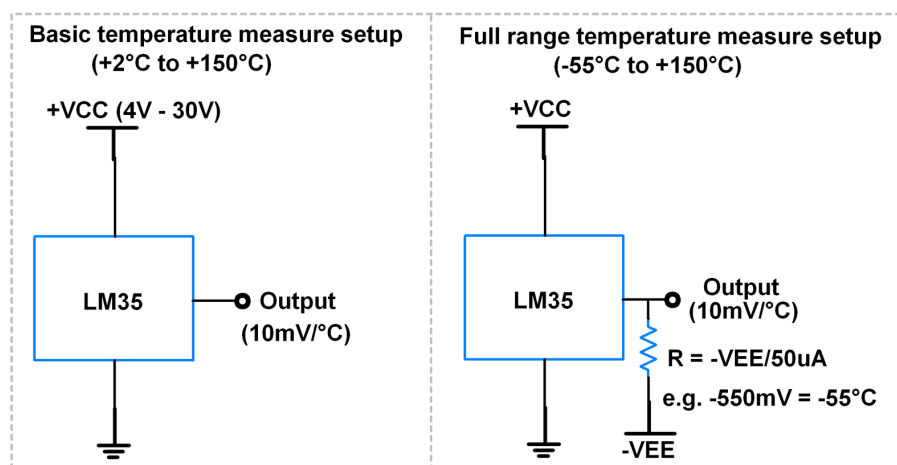

LM35

1 4-20V
2 OUT
3 GND
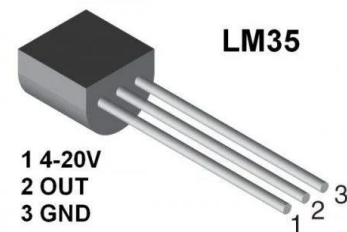
- It is a 3-terminal sensor used to measure surrounding temperature ranging from -55 °C to 150 °C.
- LM35 gives temperature output which is more precise than thermistor output.
- **Pin description**
  - **VCC:** Supply Voltage (4V – 30V)
  - **Out:** It gives analog output voltage which is proportional to the temperature (in degree Celsius).
  - **GND:** Ground

Basic temperature measure setup (+2°C to +150°C)

+VCC (4V - 30V)

LM35 → Output (10mV/°C)

Full range temperature measure setup (-55°C to +150°C)

+VCC

LM35 → Output (10mV/°C)

R = -VEE/50uA

e.g. -550mV = -55°C

-VEE

4. Ultra-Sonic Sensor

Ultrasonic Sensor HC-SR04 is a sensor that can measure **distance**. It emits an **ultrasound** at **40 000 Hz (40kHz)** which travels through the air and if there is an object or obstacle on its path It will bounce back to the module. Considering the travel time and the speed of the sound you can calculate the distance.
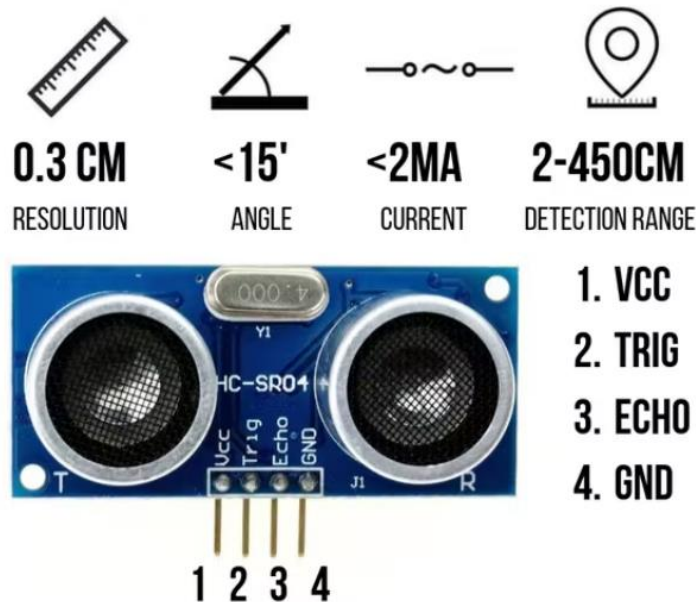
In order to generate the ultrasound we need to set the Trigger Pin on a High State for 10 μs. That will send out an 8 cycle sonic burst which will travel at the speed sound and it will be received in the Echo Pin. The Echo Pin will output the time in microseconds the sound wave traveled.

Ultrasonic HC-SR04 moduleTiming Diagram
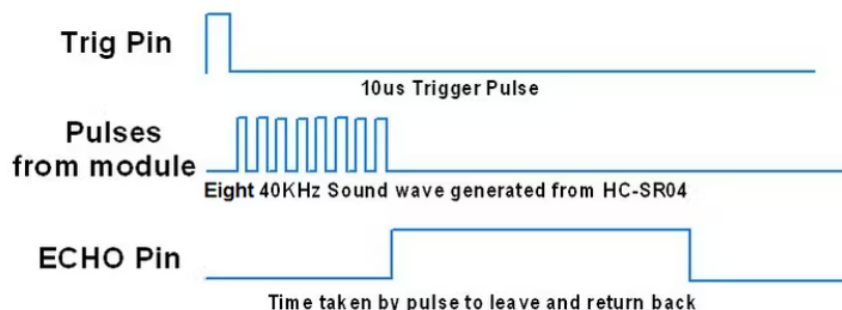
Ultrasonic HC-SR04 timing diagram

5. Bluetooth Module (hc-05)

- It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard and many more consumer applications.
- It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions.
- It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN). It uses frequency-hopping spread spectrum (FHSS) radio technology to send data over air.
- It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART).

- ## Pin Description
- Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth.
- It has 6 pins,
- 1. **Key/EN:** It is used to bring Bluetooth module in AT commands mode. If Key/EN pin is set to high, then this module will work in command mode. Otherwise by default it is in data mode. The default baud rate of HC-05 in command mode is 38400bps and 9600 in data mode.
- HC-05 module has two modes,
- 1. **Data mode:** Exchange of data between devices.
- 2. **Command mode:** It uses AT commands which are used to change setting of HC-05. To send these commands to module serial (USART) port is used.
- 2. **VCC:** Connect 5 V or 3.3 V to this Pin.
- 3. **GND:** Ground Pin of module.
- 4. **TXD:** Transmit Serial data (wirelessly received data by Bluetooth module transmitted out serially on TXD pin)
- 5. **RXD:** Receive data serially (received data will be transmitted wirelessly by Bluetooth module).
- 6. **State:** It tells whether module is connected or not.

6. GPS Module

Ublox Neo-7N. Utilising high-tech Ublox hardware and exceptional software, this sensor can connect to multiple satellites in order to locate where you are currently at. I would really recommend using an external antenna with this module as it can increase its range and signal strength. Also, a wide open space is required for this project to work and the module to collect data as a direct line is required to establish a stable connection to satellites.
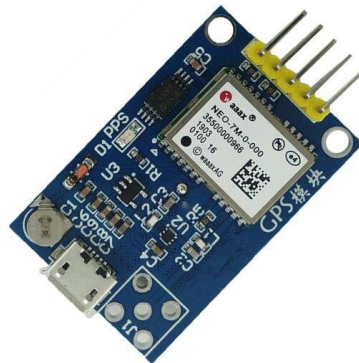
7. Motor driver

This L298N Motor Driver Module is a high power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control.
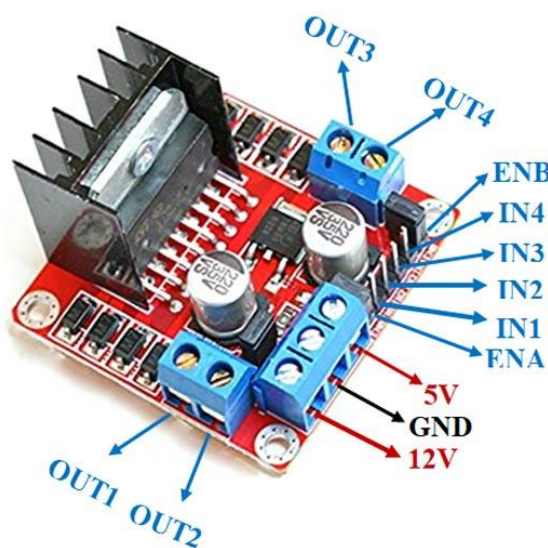
The L298N Motor Driver module consists of an L298 Motor Driver IC, 78M05 Voltage Regulator, resistors, capacitor, Power LED, 5V jumper in an integrated circuit.

78M05 Voltage regulator will be enabled only when the jumper is placed. When the power supply is less than or equal to 12V, then the internal circuitry will be powered by the voltage regulator and the 5V pin can be used as an output pin to power the microcontroller. The jumper should not be placed when the power supply is greater than 12V and separate 5V should be given through 5V terminal to power the internal circuitry.

ENA & ENB pins are speed control pins for Motor A and Motor B while IN1& IN2 and IN3 & IN4 are direction control pins for Motor A and Motor B.

8. Servo motor

Servos, are electronic devices and rotary or linear actuators that rotate and push parts of a machine with precision. Servos are mainly used on angular or linear position and for specific velocity, and acceleration.

## Servo Motor Working Mechanism

It consists of three parts:

1. Controlled device

2. Output sensor

3. Feedback system

It is a closed-loop system where it uses a positive feedback system to control motion and the final position of the shaft. Here the device is controlled by a feedback signal generated by comparing output signal and reference input signal.

Here reference input signal is compared to the reference output signal and the third signal is produced by the feedback system. And this third signal acts as an input signal to the control the device. This signal is present as long as the feedback signal is generated or there is a difference between the reference input signal and reference output signal. So the main task of servomechanism is to maintain the output of a system at the desired value at presence of noises.

9. Bread Board

It is self-adhesive and compatible with the Arduino Proto Shield.
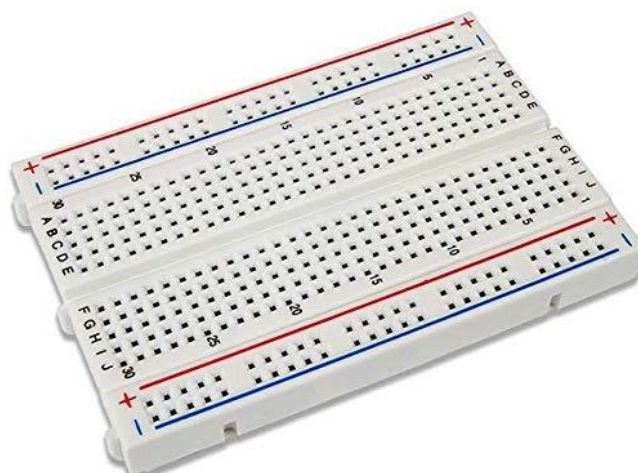
- **Car**

10. **4 dc motors**

11. **4 wheels**

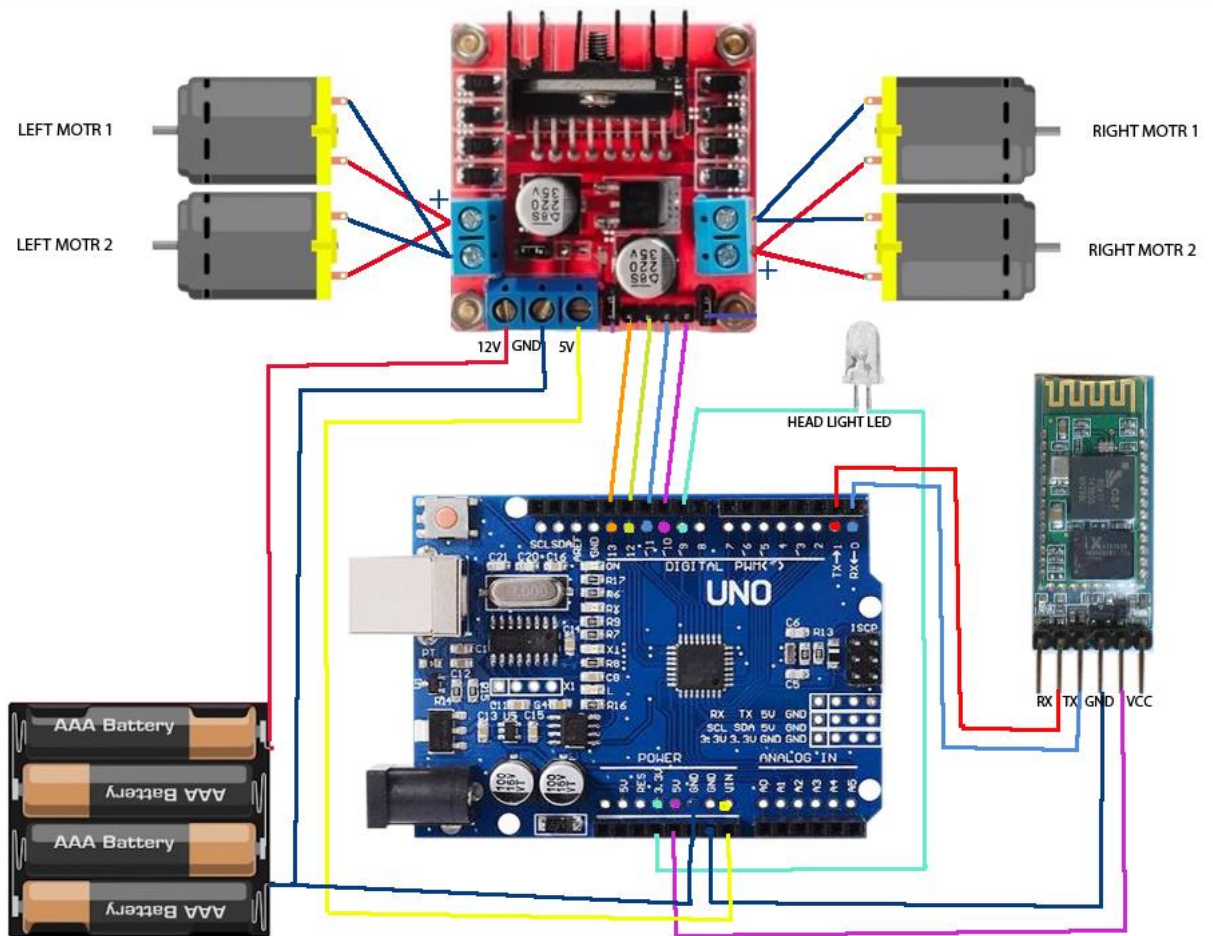12. **Jumper wires**

13. **Rechargeable batteries (appropriate capacity)**

14. **Battery holder**

2. 4 Connections

- Robot Car with Bluetooth

Resultant Analysis

Here we work on common mode and when we want to change settings of HC-05 Bluetooth module like change password for connection, baud rate, Bluetooth device's name etc. To do this, HC-05 has AT commands. To use HC-05 Bluetooth module in AT command mode, connect ―Key‖ pin to High (VCC). Default Baud rate of HC05 in command mode is 38400bps. Following are some AT command generally used to change setting of Bluetooth module. To send these commands, we have to connect HC-05 Bluetooth module to the PC via serial to USB converter and transmit these command through serial terminal of PC.

| Command	Description	Response
AT	Checking communication	OK
AT+PSWD=XXXX AT+NAME=XXXX	Set Password e.g. AT+PSWD=4567 Set Bluetooth Device Name e.g. AT+NAME=MyHC-05	OK OK
AT+UART=Baud rate, stop bit, parity bit	Change Baud rate e.g. AT+UART=9600,1,0	OK
Change Baud rate e.g. AT+UART=9600,1,0	Respond version no. of Bluetooth module	+Version: XX OK e.g. +Version: 2.0 20130107 OK
AT+ORGL	Send detail of setting done by manufacturer	Parameters: device type, module mode, serial parameter, passkey, etc.

We have created functions for different directions of car. There are five conditions for this Bluetooth controlled car which are used to give the directions:

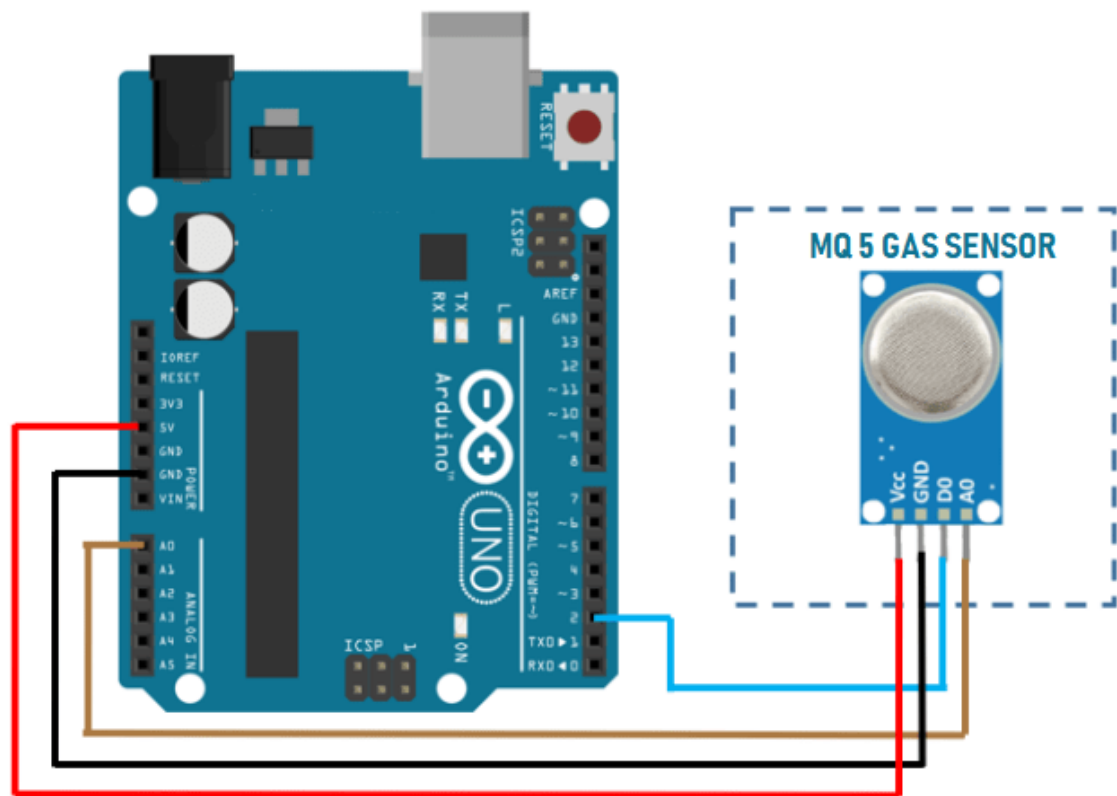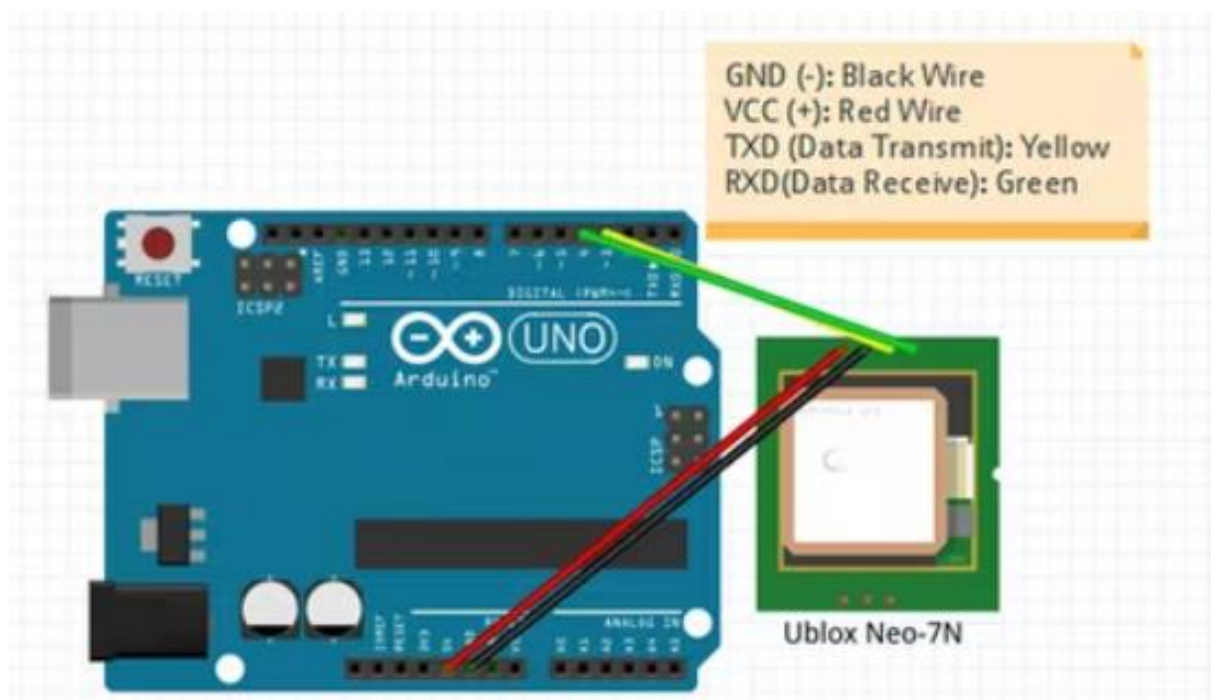| Touched button in Bluetooth controller app	Output for front side motor to give direction		Output for rear side motor to move forward or reverse direction		
Button	M11	M12	M21	M22	Direction
Stop	0	0	0	0	Stop
Forward	0	0	0	1	Forward
Backward	0	0	1	0	Backward
Right	1	0	0	1	Right
Left	0	1	0	1	Left

- Ultrasonic Sensor , Servo motor
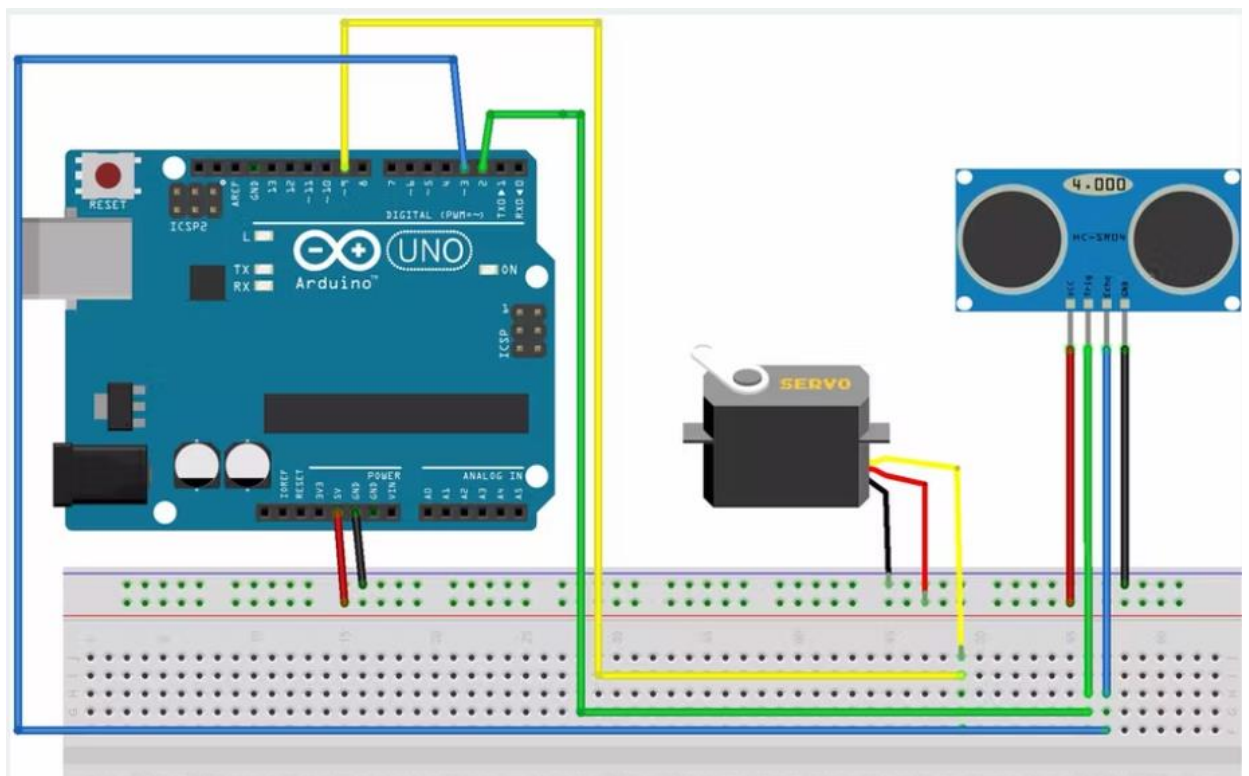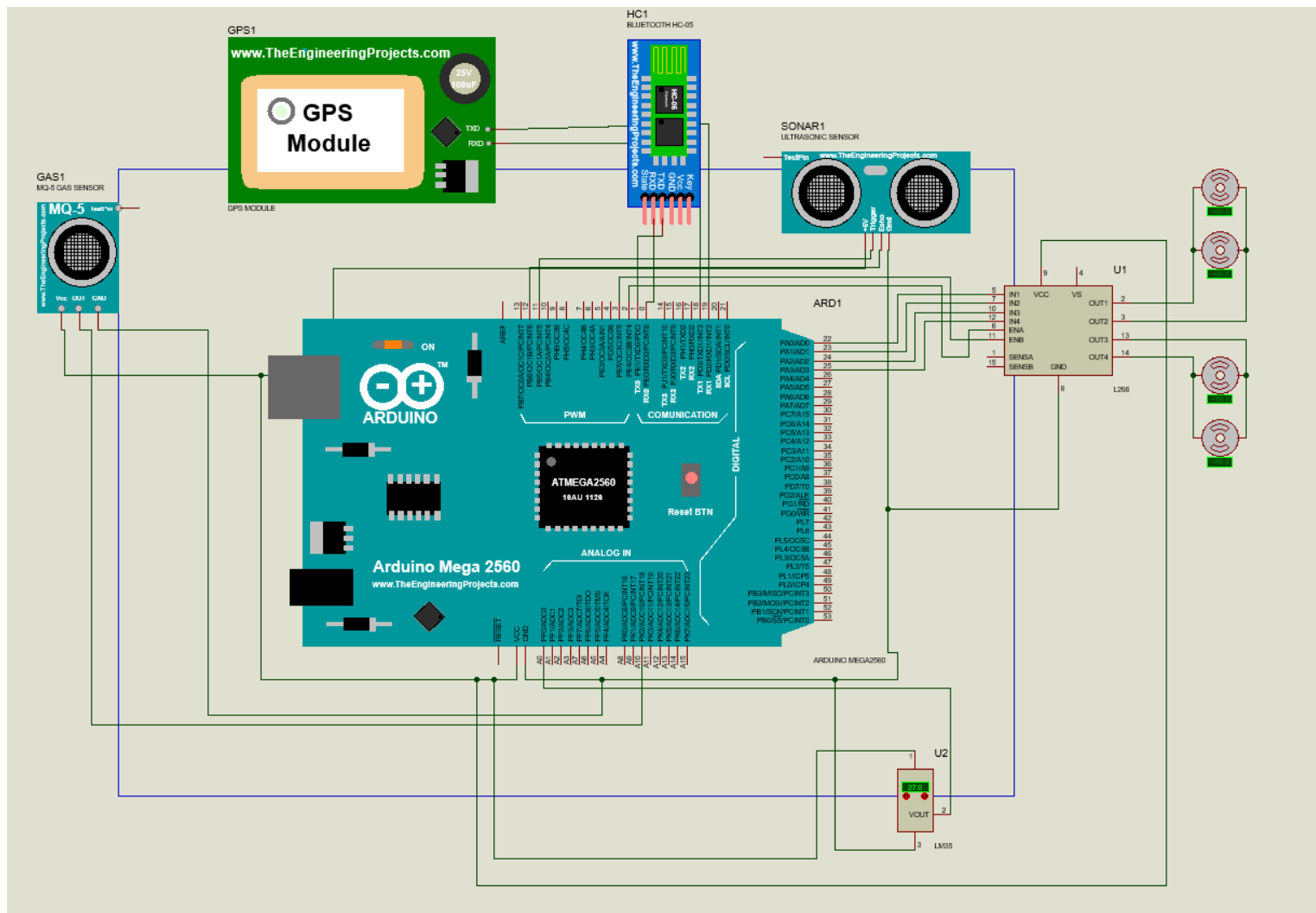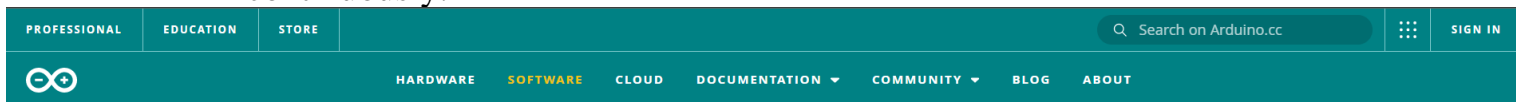

- Temperature Sensor
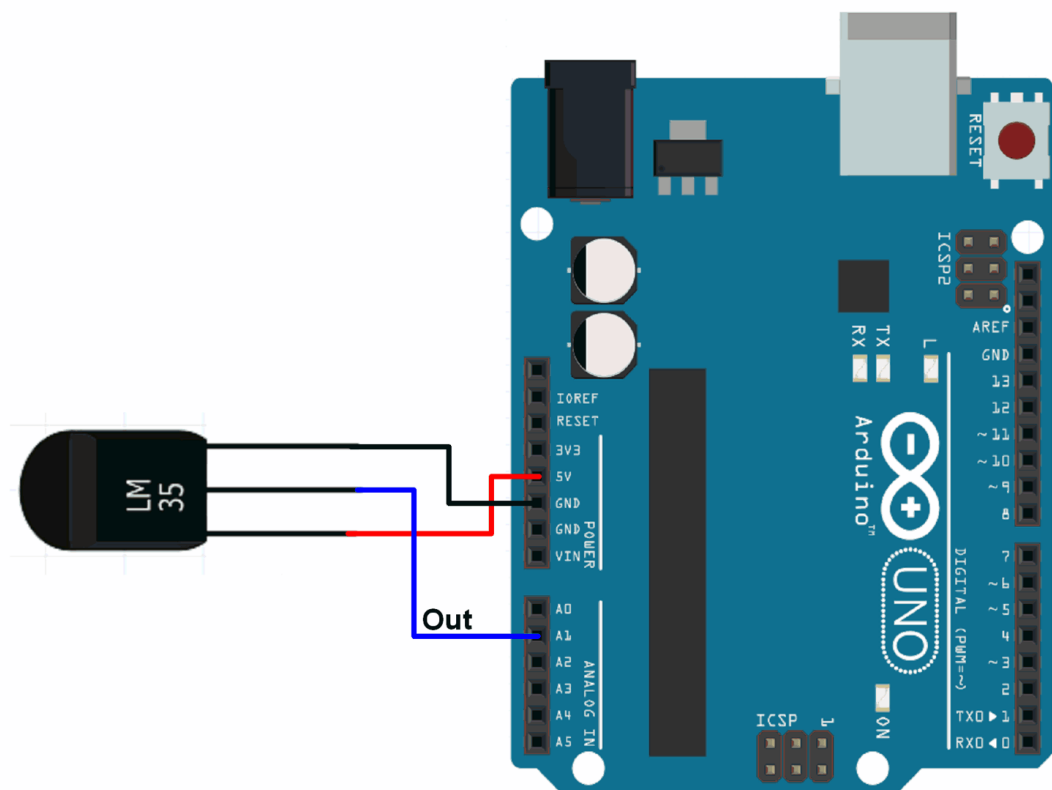
- Gas Sensor

- GPS

- Final

2. 5 Arduino IDE programming language

Arduino software is used to put the instruction of whole functions of this system to the microcontroller. Here we

language. The program is burnt in the microcontroller using burner software. The program is stored in the

EEPROM of the microcontroller, which is present in the NodeMCU ESP8266. By this software we put the data

and instruction for forward, backward, left, right operation of this system. In android application when we press

a button, a corresponding signal is sent through the Bluetooth to Bluetooth module (HC-05) which is connected

with the NodeMCUESP8266 . Similarly an android application is been built for Wi-Fi module and when the

buttons been pressed through the application the corresponding signal is been sent through the NodeMCU

ESP8266 and the motor driver drives the wireless car. When signal data arrives the NodeMCU ESP8266 the pin

which corresponds to the particular input is set to high. Now that pin gives the output to the motor driver

section. Motor driver switches accordingly the data bit, if the data bit is low then the corresponding pin of the

motor driver doesn't work else high bit then the corresponding pin of the motor driver is on. We have used

Arduino IDE version 1.8.1 for writing program. There are two steps of the programming. First set up section

where we define all the variables. Second loop part where the program runs continuously.

3. 6 Code

```
int ledPin= 13;
#define trig 11
#define echo 12
int distance=0,t=0;
int input = A0;
int reading ;
int temp ;
#define IN1 22

#define IN2 23

#define IN3 24
#define IN4 25

#define ena 2
#define enb 3

//Connect with pin 18 and 19
#include <TinyGPS.h>
//long    lat,lon; // create variable for latitude and longitude object
float lat,lon;
TinyGPS gps; // create gps object


char c;

int i=1; //counter for change speed
void setup()
{

  Serial.begin(57600); // connect serial
  Serial.println("The GPS Received Signal:");
  Serial1.begin(9600); // connect gps sensor


  pinMode(input , INPUT) ;
  pinMode(ledPin, OUTPUT);
  pinMode(IN1,OUTPUT);
  pinMode(IN2,OUTPUT);
  pinMode(IN3,OUTPUT);
  pinMode(IN4,OUTPUT);
  pinMode(ena,OUTPUT);
  pinMode(enb,OUTPUT);
  pinMode(trig,OUTPUT);
  pinMode(echo,INPUT);
}
```

```
void loop()
{
   char c = Serial.read();
// bool ultra()=false ;
/////////////////////////////
 // ultraread();
 // tem();
if(distance > 20 && c != 'o')
{
    if( c == 'w')
    {
      forward();
      ultra();
    }
    else if ( c == 'd')
    {
      Tright();
            ultra();
    }
    else if ( c == 'a')
    {
      Tleft();
            ultra();
    }
    else if ( c == 's')
    {
      reverse();
       ultra();

    }

    else if ( c == 'o')
    {
      off();
          ultra();
    }

}
else
{
  off();
}
/////////////////////////////
if(c =='t')
{
  tem();

}
else if(c =='l'){
ultraread();
}
else if(c == 'g'){
 gps1();
}
}
```

```
void forward()
{
  digitalWrite(IN1,LOW);
  digitalWrite(IN2,HIGH);
  digitalWrite(IN3,HIGH);
  digitalWrite(IN4,LOW);
    analogWrite(ena,100);
    analogWrite(enb,100);
}

void reverse()
{

  digitalWrite(IN1,HIGH);
  digitalWrite(IN2,LOW);
  digitalWrite(IN3,LOW);
  digitalWrite(IN4,HIGH);
    analogWrite(ena,100);
    analogWrite(enb,100);
}

void Tleft()
{
    digitalWrite(IN1, HIGH);
    digitalWrite(IN2, LOW);
    digitalWrite(IN3, HIGH);
    digitalWrite(IN4, LOW);
    analogWrite(ena,100);
    analogWrite(enb,100);
}

void Tright()
{
    digitalWrite(IN1,LOW);
    digitalWrite(IN2,HIGH);
    digitalWrite(IN3,LOW);
    digitalWrite(IN4,HIGH);
    analogWrite(ena,100);
    analogWrite(enb,100);
}

void off()
{
  digitalWrite(IN1,LOW);
  digitalWrite(IN2,LOW);
  digitalWrite(IN3,LOW);
  digitalWrite(IN4,LOW);
  analogWrite(ena,100);
  analogWrite(enb,100);
 }
```

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```
void ultra()
{
 digitalWrite(trig,LOW);
 delayMicroseconds(5);
 digitalWrite(trig,HIGH);
 delayMicroseconds(10);
 digitalWrite(trig,LOW);
 t=pulseIn(echo,HIGH);
 distance=t/57;//Distance = (Speed of Sound * Time/2) = t/(1/((350*0.0001)/2))

}

void ultraread()
{

 digitalWrite(trig,LOW);
 delayMicroseconds(5);
 digitalWrite(trig,HIGH);
 delayMicroseconds(10);
 digitalWrite(trig,LOW);
 t=pulseIn(echo,HIGH);
 distance=t/57;//Distance = (Speed of Sound * Time/2) = t/(1/((350*0.0001)/2))

 Serial.println(distance);
}




void tem()
{
  reading  = analogRead(input);
  temp = (reading * (5.0/1024))*100 - 2.5 ;
  Serial.println(temp);
}

void gps1()
{
  while(Serial1.available()){ // check for gps data
    if(gps.encode(Serial1.read()))// encode gps data
    {
    gps.f_get_position(&lat,&lon); // get latitude and longitude

    Serial.print("Position: ");

    //Latitude
    Serial.print("Latitude: ");
    Serial.print(lat,6);

    Serial.print(",");

    //Longitude
    Serial.print("Longitude: ");
    Serial.println(lon,6);

   }
  }}
```

3. 7 Conclusion

To us the need of internet and the things which are internet based are very much important nowadays. IOT or internet of things is the very important part in both computer and our daily lives. The above model describes how the Arduino programs the car motor module and by IoT we actually rotate the wheels and give direction to the car. IoT gives us the opportunity to work with different platforms and it helps us to create various interesting modules to work on. We also tested the applications used to drive the car. Due to the new concept of Wireless Controlled Car using Bluetooth and IOT, we were able to come up with various possibilities that can take place.

CHAPTER 3
GUI

CHAPTER 3

GUI

3. 1 Introduction

A graphical user interface (GUI) application is one that is designed using graphical features that make the application easy to use. When you compile a GUI application, an executable file with start-up code is created. The executable usually provides the basic functionality of the program, and simple programs often consist of only an executable file.

the interface that allows users to interact with electronic devices, such as computers, laptops, smartphones and tablets, through graphical elements. It's a valuable part of software application programming in regards to human-computer interaction, replacing text-based commands with user-friendly actions. Its goal is to present the user with decision points that are easy to find, understand and use. In other words, GUI lets you control your device with a mouse, pen or even your finger.

GUI was created because text command-line interfaces were complicated and difficult to learn. The GUI process lets you click or point to a small picture, known as an icon or widget, and open a command or function on your devices, such as tabs, buttons, scroll bars, menus, icons, pointers and windows. It is now the standard for user-centered design in software application programming.

Programs that use GUI are known as "GUI programs." The program creates small pictures of tasks or functions and waits for the user to interact with them. The user controls when and how they will be used. To select functions, users can either use a keyboard, pointing device, such as a mouse, touchpad or touchscreen depending on the device.

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Input controls:

Buttons: Buttons are circles that let you make immediate choices and take actions. Radio buttons come in groups where only one button can be selected at a time. Label buttons have text on them. If you want more than one option to be selected, consider using a check box.

Checkboxes: Checkboxes are square boxes in a list of one or more options. When you click the box, it stays selected. They are best presented in a vertical list. A checkbox can be a single box, such as acknowledging a statement, or a list of related items, such as a shopping list.

Date picker: A date picker lets you select a date and/or time. The creator can choose a calendar or a fill-in option. It ensures that a consistent format is used, such as "day, month, year."

Dropdown lists: Dropdown lists lets you select one item at a time. Several items can be included compactly. Consider adding directions, such as "select one" to let the user know what to do. The creator can add or delete items to keep the list up to date.

List boxes: List boxes let you select multiple items from one compact list. Use this GUI feature if you have a long list of options for the user to consider. There are four variations of list boxes: single-line, multiselect, multiselect with checkboxes and multiselect-dual list boxes.

Text boxes: Text boxes are fields that let you enter text. The creator can control how much text is allowed.

Toggles: Toggle buttons let you change a setting typically as off/on states.

Informational components

Message box: A message box is a small window with information such as a policy or disclaimer. It requires you to take action before you proceed.

Notifications: A notification is a message box. Typically, they are used to indicate emergency warnings, error messages or task completion.

Pop-up windows: A pop-up, or modal, window requires you to interact with it before you can return to the system.

Progress bar: A progress bar shows where you are in a series of steps in a process. Typically, progress bars are not clickable. For example, a progress bar might show your pizza order's status in the order, cook and delivery process.

Tool tips: A tool tip offers you more information when you hover over an item. For example, you might receive a definition and usage examples when you hover over a word or phrase.

Interaction elements of a GUI:

Apart from structural elements, a GUI also features interaction elements, such as:

Cursors: A cursor indicates the place where the system will accept input next. It can either be a pointer, which follows the movements of a pointing device—such as a mouse—or a text cursor, which indicates the point of focus in a current text box.

Selections: A selection refers to a list of items to which a user will apply an operation. A user will select a portion of text for cut, copy and paste operations. Image editing applications allow users to select and modify certain areas of an image by using the magic wand selection or lasso selection tools.

Adjustment handles: A handle serves as the indicator of a drag and drop operation. When a user places the pointer on the handle to

initiate the drag process, its shape changes to an icon that represents the drag function.

What are the benefits of a GUI?

GUI uses visual elements to represent those now hidden lines of command. You simply select a button or an icon to call the relevant function. The easy use of GUIs has made it possible for the public in general, regardless of experience or knowledge, to access all kinds of systems for everyday use.

There are many other benefits to using GUI. Here are the most common:

1. Easy to use

Since data is represented by symbols, shapes and icons, users can easily recognize, classify and navigate options. A simple click is all it takes to acquire a function. Because it's so easy to use and understand, GUI has become the preferred interface for computers and mobile devices.

2. Easy to communicate

Visual representation of data is recognized faster than text. Non-programmers find it easy to use GUIs since it requires no experience with computing commands. They don't have to worry about writing or debugging code. As a result, users find GUI an easy-to-learn interface.

3. Attractive

GUI has visually appealing features and is not cluttered with command line codes. Visual images can portray emotions, comments and situations with long lines of computer language. Pictures and such are easy to understand and often carry universal meaning.

4. Provides shortcuts

GUI lets users take advantage of shortcut keys to minimize strokes. A combination of two keys in place of several actions saves the user time and increases productivity. For example, a call-to-action button can pull up a form, a prefilled letter or a list of contact information. That one button saves you from searching for the same information.

5. Allows for multitasking

GUI lets users work and view two or more programs at the same time. For example, you can view a streaming presentation while searching the internet from a web browser. You can watch a video while writing a review of the presentation with a search engine in another tab.

3. 2 Problem Formulation

The user can't deal with the code to reach the information he want to know or to use the car in a proper way so the application help him to:

- Control the moving of the car
- Know the read (value) of each sensor
- Easy to deal with a website that contain all the information about the car

3. 3 The Applied Approach

Design a desktop application to facilitate the using of the car which is simple to user to deal with , as there is a button to drive and know the readings of each sensor and another one to open the web page which contain all the information about the car using c# language and visual studio

3. 4 Code of Capstone Project

CHAPTER 4
Website

CHAPTER 4

1.Intoduction:

At the first, the website presents many features the first one is to display and introduce team members at the home page, and simple brief talking about the project.

The second webpage displaying the specifications and the components of the project that our team members used in designing the project and each component has it's datasheet that you can download and explore, it's not only that, there are other features, you can learn about the programs and technologies used for the project (Arduino IDE and C# for the GUI Application);

Also you can see the code used in programming and developing the project, it's not only that, there are some schematics for designed parts.

There are many webpages used in this website like if the users wants to buy the project we developed webpage to sell it with different versions and we offered more than one way to make it easy for user to buy the project like cash on delivery or by credit card, all the user have to do is enter some data like name, email, phone, and address after that the user choose the way that he would pay with, there are webpage if the user wants to leave comments for team members, it will be stored in the database and being displayed in the admin part, which in it admins or team members see information about who logged in, who left comments, and who bought the project.

At the end of the website there is a webpage that user can log out from our website.

2. Languages and technologies:

The website is divided into two parts. The first part (Front-end) consists of languages and techniques for displaying content, while the second part (back-end) consists of languages and techniques used to make the website dynamic.

Front-end languages and technologies:

Html:

- HTML, or **HyperText Markup Language**, allows web users to create and structure sections, paragraphs, and links using elements, tags, and attributes. However, it's worth noting that HTML is not considered a programming language as it can't create dynamic functionality.

- HTML has a lot of use cases, namely:

    - **Web development**: Developers use HTML code to design how a browser displays web page elements, such as text, hyperlinks, and media files.

    - **Internet navigation**: Users can easily navigate and insert links between related pages and websites as HTML is heavily used to embed hyperlinks.

    - **Web documentation**: HTML makes it possible to organize and format documents, similarly to Microsoft Word.

- It's also worth noting that HTML is now considered an official web standard. The **World Wide Web Consortium (W3C)** maintains and develops HTML specifications, along with providing regular updates.

- This article will go over the basics of HTML, including how it works, its pros and cons, and how it relates to CSS and JavaScript.

CSS:

- Cascading Style Sheets, fondly referred to as CSS, is a simple design language intended to simplify the process of making web pages presentable.

- CSS handles the look and feel part of a web page. Using CSS, you can control the color of the text, the style of fonts, the spacing between paragraphs, how columns are sized and laid out, what background images or colors are used, layout designs,variations in display for different devices and screen sizes as well as a variety of other effects.

- CSS is easy to learn and understand but it provides powerful control over the presentation of an HTML document. Most commonly, CSS is combined with the markup languages HTML or XHTML.

What does CSS do?

- You can add new looks to your old HTML documents.

- You can completely change the look of your website with only a few changes in CSS code.

Javascipt:

- JavaScript is a scripting language that enables you to create dynamically updating content, control multimedia, animate images, and pretty much everything else. (Okay, not everything, but it is amazing what you can achieve with a few lines of JavaScript code.)

- It's a scripting or programming language that allows you to implement complex features on web pages — every time a web page does more than just sit there and display static information for you to look at — displaying timely content updates, interactive maps, animated 2D/3D graphics, scrolling video jukeboxes, etc. — you can bet that JavaScript is probably involved. It is the third layer of the layer cake of standard web technologies, two of which (HTML and CSS) we have covered in much more detail in other parts of the Learning Area.

AJAX:

AJAX stands for Asynchronous JavaScript And XML. In a nutshell, it is the use of the XMLHttpRequest object to communicate with servers. It can send and receive information in various formats, including JSON, XML, HTML, and text files. AJAX's most appealing characteristic is its "asynchronous" nature, which means it can communicate with the server, exchange data, and update the page without having to refresh the page.

The two major features of AJAX allow you to do the following:

- Make requests to the server without reloading the page
- Receive and work with data from the server

JSON:

- JSON (JavaScript Object Notation) is a lightweight data-interchange format. It is easy for humans to read and write. It is easy for machines to parse and generate. It is based on a subset of the JavaScript Programming Language Standard ECMA-262 3rd Edition - December 1999. JSON is a text format that is completely language independent but uses conventions that are familiar to programmers of the C-family of languages, including C, C++, C#, Java, JavaScript, Perl, Python, and many others. These properties make JSON an ideal data-interchange language.

- JSON is built on two structures:

  - A collection of name/value pairs. In various languages, this is realized as an object, record, struct, dictionary, hash table, keyed list, or associative array.

  - An ordered list of values. In most languages, this is realized as an array, vector, list, or sequence.

  - These are universal data structures. Virtually all modern programming languages support them in one form or another. It makes sense that a data format that is interchangeable with programming languages also be based on these structures.

  - In JSON, they take on these forms:

  - An object is an unordered set of name/value pairs. An object begins with {left brace and ends with }right brace. Each name is followed by :colon and the name/value pairs are separated by ,comma.

Back-end languages and technologies:

PHP:

PHP is an open-source server-side scripting language that many devs use for web development. It is also a general-purpose language that you can use to make lots of projects, including Graphical User Interfaces (GUIs).

In this article, I will help you explore the world of PHP so you can learn how it works and its basic features. By the end, you will be able to write your first Hello World program in PHP.

What Does PHP Mean?

- The abbreviation PHP initially stood for Personal Homepage. But now it is a recursive acronym for Hypertext Preprocessor. (It's recursive in the sense that the first word itself is an abbreviation, so the full meaning doesn't follow the abbreviation.)

- The first version of PHP was launched 26 years ago. Now it's on version 8, released in November 2020, but version 7 remains the most widely used.

- PHP runs on the Zend engine, which is the most popular implementation. There are some other implementations as well, like parrot, HPVM (Hip Hop Virtual Machine), and Hip Hop, created by Facebook.

- PHP is mostly used for making web servers. It runs on the browser and is also capable of running in the command line. So, if you don't feel like showing your code output in the browser, you can show it in the terminal.

Advantages of PHP

- PHP has some advantages that have made it so popular, and it's been the go-to language for web servers for more than 15 years now. Here are some of PHP's benefits:

- Cross-Platform: PHP is platform-independent. You don't have to have a particular OS to use it because it runs on every platform, whether it's Mac, Windows, or Linux.

- Open Source: PHP is open source. The original code is made available to everyone who wants to build upon it. This is one of the reasons why one of its frameworks, Laravel, is so popular.

- Easy to learn: PHP is not hard to learn for absolute beginners. You can pick it up pretty if you already have programming knowledge.

- PHP syncs with all Databases: You can easily connect PHP to all Databases, relational and non-relational. So it can connect in no time to MySQL, Postgress, MongoDB, or any other database.

- Supportive Community: PHP has a very supportive online community. The official documentation provides guides on how to use the features and you can easily get your problem fixed while stuck.

Mysql:

MySQL is an open source relational **database management system** (RDBMS) with a client-server model. **RDBMS** is a software or service used to create and manage databases based on a relational model. Now, let's take a closer look at each term:

- **Database**

    - A database is simply a collection of structured data. Think of taking a selfie: you push a button and capture an image of yourself. Your photo is data, and your phone's gallery is the database. A database is a place in which data is stored and organized. The word "relational" means that the data stored in the dataset is organized as tables. Every table relates in some ways. If the software doesn't support the relational data model, just call it DBMS.

- **Open source**

    - Open source means that you're free to use and modify it. Anybody can install the software. You can also learn and customize the source code to better accommodate your needs. However, The GPL (**GNU Public License**) determines what you can do depending on conditions. The commercially licensed version is available if you need more flexible ownership and advanced support.

- **Client-server model**

    - Computers that install and run RDBMS software are called clients. Whenever they need to access data, they connect to the RDBMS server. That's the "client-server" part.

    - MySQL is one of many RDBMS software options. RDBMS and MySQL are often thought to be the same because of MySQL's popularity. A few **big web applications** like Facebook, Twitter, YouTube, Google, and Yahoo! all use MySQL for data storage purposes. Even though it was initially created for limited usage, it is now compatible with many important computing

platforms like Linux, macOS, Microsoft Windows, and Ubuntu.

SQL:

- **[MySQL and SQL are not the same](#)**. Be aware that MySQL is one of the most popular RDBMS software's brand names, which implements a client-server model. So, how do the client and server communicate in an RDBMS environment? They use a domain-specific language – Structured Query Language (SQL). If you ever encounter other names that have SQL in them, like PostgreSQL and Microsoft SQL server, they are most likely brands which also use Structured Query Language syntax. RDBMS software is often written in other programming languages, but always use SQL as their primary language to interact with the database. MySQL itself is written in C and C++.

- Computer scientist Ted Codd developed SQL in the early 1970s with an IBM based relational model. It became more widely used in 1974 and quickly replaced similar, then-outdated languages, ISAM and VISAM. History aside, SQL tells the server what to do with the data. It is similar to your WordPress password or code. You input it into the system to gain access to the dashboard area. In this case, SQL statements can instruct the server to perform certain operations:

- Data query: requesting specific information from the existing database.

- Data manipulation: adding, deleting, changing, sorting, and other operations to modify the data, the values or the visuals.

- Data identity: defining data types, e.g. changing numerical data to integers. This also includes defining a **schema** or the relationship of each table in the database

- Data access control: providing security techniques to protect data, this includes deciding who can view or use any information stored in the database

How Mysql works:

One or more devices (clients) connect to a server through a specific network. Every client can make a request from the graphical user interface (GUI) on their screens, and the server will produce the desired output, as long as both ends understand the instruction. Without getting too technical, the main processes taking place in a MySQL environment are the same, which are:

- MySQL creates a database for storing and manipulating data, defining the relationship of each table.

- Clients can make requests by typing specific SQL statements on MySQL.

- The server application will respond with the requested information and it will appear on the clients' side.

That's pretty much it. From the clients' side, they usually emphasize which MySQL GUI to use. The lighter and more user-friendly the GUI is, the faster and easier their data management activities will be. Some of the **most popular MySQL GUIs** are MySQL WorkBench, SequelPro, DBVisualizer, and the Navicat DB Admin Tool. Some of them are free, while some are commercial, some run exclusively for macOS, and some are compatible with

major operating systems. Clients should choose the GUI depending on their needs. For web database management, **including a WordPress site**, the most obvious go-to is phpMyAdmin.

3.Code:

In this section, we will show parts of the codes used in the designing of the website:

config.php

```php
<?php
session_start();
$host = "localhost";
$username = "root";
$password = "123";
$db = "ecommerce";

$conn = mysqli_connect("$host", "$username",
"$password", "$db");
?>
```

The above block of code display how the website connects with the database to deal with it, and it written by php language.

regist.php

```php
<?php
require 'config.php';
if (!empty($_SESSION["id"])) {
    header("Location: index.php");
}
if (isset($_POST["submit"])) {
    $name = $_POST["name"];
    $username = $_POST["username"];
```

```php
    $email = $_POST["email"];
    $password = $_POST["password"];
    $confirmpassword =
$_POST["confirmpassword"];
    $duplicate = mysqli_query($conn, "SELECT *
FROM user_login WHERE username = '$username' OR
email = '$email'");
    if (mysqli_num_rows($duplicate) > 0) {
        echo
        "<script> alert('Username or Email Has
Already Taken'); </script>";
    } else {
        if ($password == $confirmpassword) {
            $query = "INSERT INTO user_login
VALUES('','$name','$username','$email','$passwor
d')";
            mysqli_query($conn, $query);
            echo
            "<script> alert('Registration
Successful'); </script>";
        } else {
            echo
            "<script> alert('Password Does Not
Match'); </script>";
        }
    }
}
?>
```

This extracted part display how user will signup in the website to deal with it.

contact-us.php

```php
<form class="" action="" method="post"
autocomplete="off">
 <div class="row">
```

```html
<div class="col-md-6">
<div class="form-group">
<label class="label" for="name">Full
Name</label>
<input type="text" class="form-control"
name="name" id="name" required value="">
</div>
</div>
<div class="col-md-6">
<div class="form-group">
<label class="label" for="email">Email
Address</label>
<input type="email" class="form-control"
name="email" id="email" required value="">
</div>
</div>
<div class="col-md-12">
<div class="form-group">
<label class="label"
for="subject">Subject</label>
<input type="text" class="form-control"
name="subject" id="subject"
placeholder="Subject">
</div>
</div>
<div class="col-md-12">
<div class="form-group">
<label class="label"
for="comment">Message</label>
<textarea name="comment" class="form-control"
id="comment" cols="30" rows="4"
placeholder="Message"></textarea>
</div>
</div>
<div class="col-md-12">
<div class="form-group">
 <button type="submit" class="btn btn-primary"
name="submit">Send Message</button>
```

```html
</div>
</div>
</div>
</form>
```

This extracted part of code display the form used in making contact us webpage, and it written by html language.

4. Summary:

This website is mix of displaying information and simple ecommerce website.

The first section is used to display information about team members and to document the specifications, code, and schematics of the project.

The last section is used to sell our IoT project and to interact with the admins such as by leaving comments.

CHAPTER 5
Conclusion and Future Work

CHAPTER 5

CONCLUSION AND FUTURE WORK

7. 1 Conclusions

A remote controlled vehicle is the GUI application controlled it by using Bluetooth , that means is physically not connected with origin external to the machine. These devices are always controlled by humans and take no action autonomously just in one case car stop automatically if there is any obstacle the car will stop by using ultrasonic sensor . The main target in such vehicles would be to safely reach a designated point and measures temperature and indicate if there is gas in the area, maneuver the area and reach back to the point of origin.

GPS will send coordinates of the car to GUI application to know where the gas is leaked and send worker to solve the problem.

In this project we make use of the Bluetooth technology to control our machine car. This machine can be controlled by any human using his GUI application, by connecting it with the Bluetooth module present inside our car. User can perform actions like moving forward, backward, moving left and right by the means of command using his-her GUI app. The task of controlling our car is taken car by the Arduino Mega with micro controller ATMEGA2560, 16 MHz crystal oscillator, 8 KB SRAM (Static Random Accessible Memory) and 256 KB flash memory. Arduino play a major role in the control section and had made it easier to convert digital signals and analogue signals into physical movements. The major reason for using a Bluetooth based tech is that we can change the remote anytime – mobiles

phones, tablets and laptops and physical barriers like wall or doors do not affect the car controls.

A **GUI** is represented actions that can be taken by the user

Include GUI object buttons: that performs an action in a program when pressed. Using these objects, a user can use the computer without having to know commands.

The Website for selling our product , to show the cost of components and how we collect and made the car, The code of Arduino IDE and GUI using C#.

7. 2 Future Works

Add decision making from car by itself example : car moves into the place every 5 minutes by itself (if there any obstacle car will avoid it by ultrasonic sensor) and detect if there any problem and send report by measures of temperate and gas in the air.

Increased distance control by using WIFI instead of Bluetooth for remote control ability if required.

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