Project Report for Microprocessors and Microcontrollers Lab

B.Sc Electrical Engineering

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Title:

Android Controlled RC Car with Obstacle's Distance Measurement

Android Controlled RC Car with Obstacle's Distance Measurement

Objective:

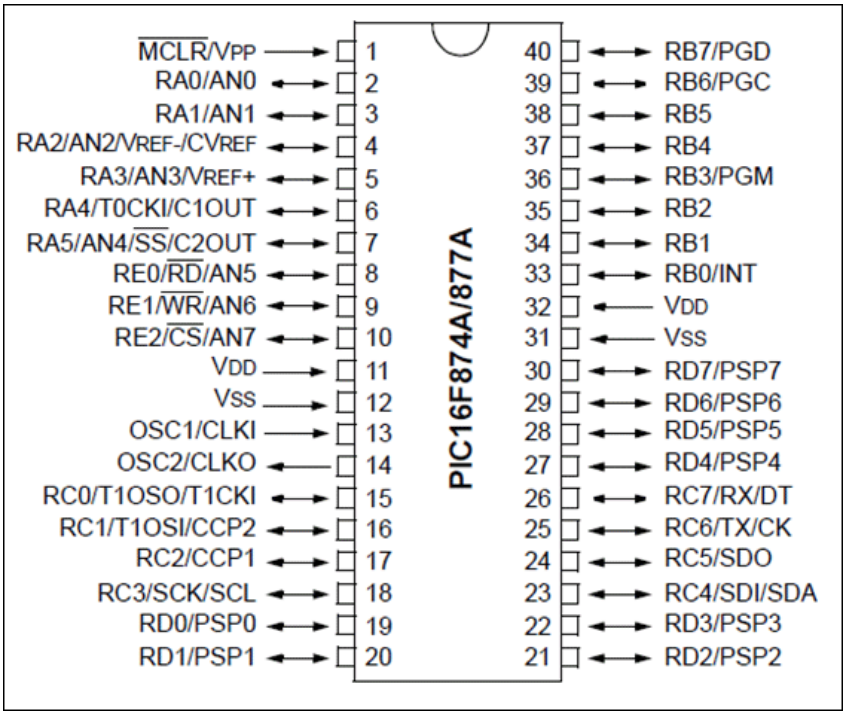
Our Objective is to Control Toy Car using Bluetooth Communication and to measure distance of an obstacle from Car.

Components Required:

- PIC16F877A
- Capacitor (22pF)
- Crystal Oscillator (8MHz)
- Resistors
- L298N
- HC-06
- SR-04
- LCD Display (2x16)
- Transistor (2N2222)
- 12V Battery
- LED Lights
- Buzzer
- Gear Motors
- Potentiometer
- Voltage Regulator (5V)
- Car Chassis
- Vero Boards

Theoretical Background:

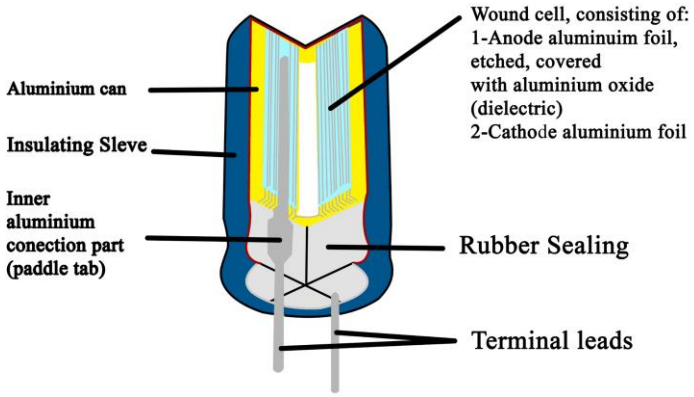
The PIC microcontroller PIC16F877a is one of the most renowned microcontrollers in the industry. It has a total number of 40 pins and there are 33 pins for input and output. It has a smaller 35 instructions set. It can operate up to 20MHz frequency. The operating voltage is between 4.2 volts to 5.5 volts. If you provide it voltage more than 5.5 volts, it may get damaged permanently. The maximum current each PORT can sink or source is around 100mA. Therefore, the current limit for each GPIO pin of PIC16F877A is 10 mili ampere. It does not have an internal oscillator. The coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it uses FLASH memory technology. An EEPROM is also featured in it which makes it possible to store some of the information permanently like transmitter codes and receiver frequencies and some other related data. This microcontroller is normally used in Embedded Projects like Home Automation System, in remote sensors, security and safety devices etc.



Components Description:

Capacitor:

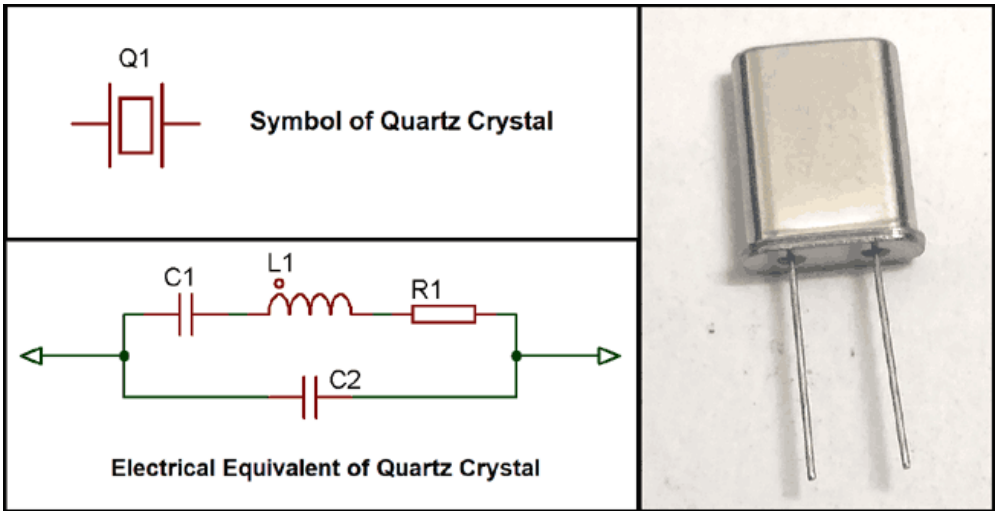
A capacitor is created out of two metal plates and an insulating material called a dielectric. The metal plates are placed very close to each other, in parallel, but the dielectric sits between them to make sure they don't touch.



Your standard capacitor sandwich: two metal plates separated by an insulating dielectric.

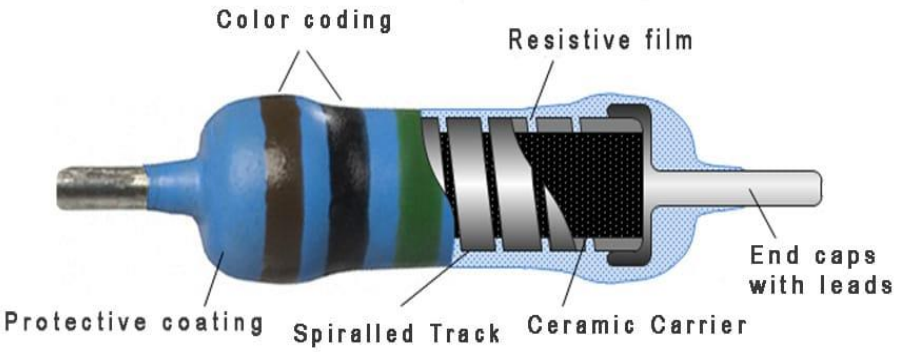
Crystal Oscillator:

A crystal oscillator is an electric oscillator type circuit that uses a piezoelectric resonator, a crystal, as its frequency -determining element. Crystal is the common term used in electronics for the frequency-determining component, a wafer of quartz crystal or ceramic with electrodes connected to it.



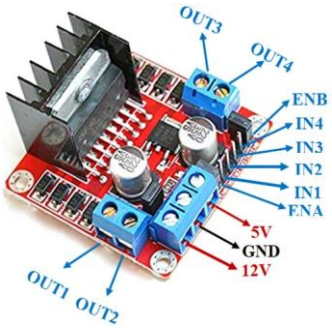
Resistor:

The resistive element in carbon composition resistors is made from a mixture of finely powdered carbon and an insulating material, usually ceramic. A resin holds the mixture together. The resistance is determined by the ratio of the fill material (the powdered ceramic) to the carbon.



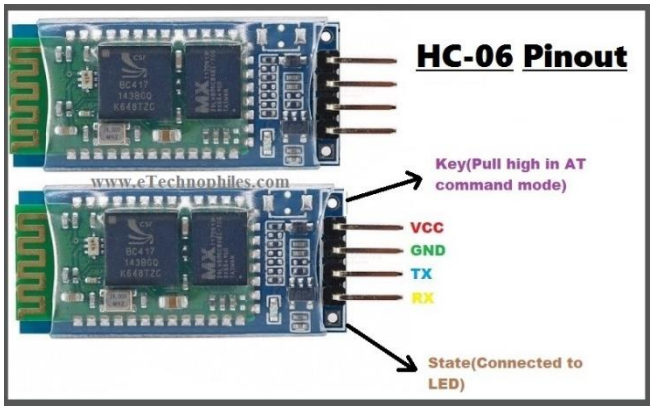
L298N:

The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A.



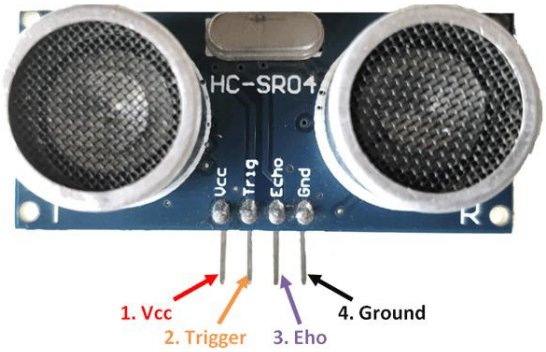
HC-06:

The HC-06 Bluetooth module is a slave Bluetooth module designed for wireless serial communication. It is a slave module meaning that it can receive serial data when serial data is sent out from a master Bluetooth device (Device able to send serial data through the air: smart phones, PC).



SR-04:

SR-04 Ultrasonic Sensor Module is a 4-pin module, pin names are Vcc, Trigger, Echo and Ground respectively. Distance = Speed × Time.
The one acts as a transmitter which converts electrical signal into 40 KHz ultrasonic sound pulses. The receiver listens for the transmitted pulses. If it receives them, it produces an output pulse whose width can be used to determine the distance the pulse travelled.

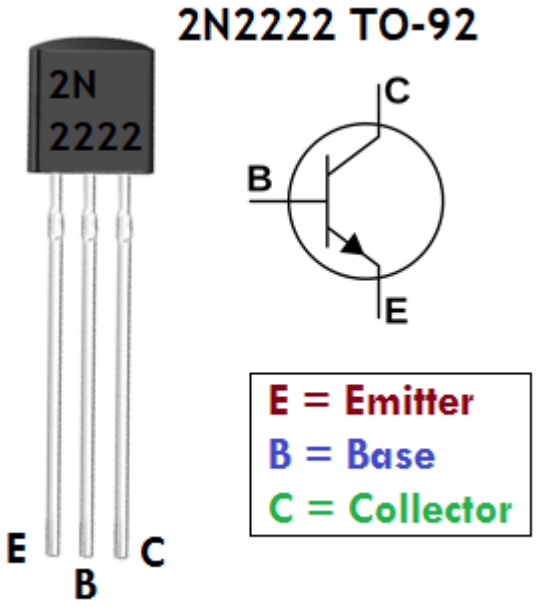


LCD Display:

An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines.

Transistor:

The 2N2222 is a common NPN bipolar junction transistor (BJT) used for general purpose low-power amplifying or switching applications. It is designed for low to medium current, low power, medium voltage, and can operate at moderately high speeds. It was originally made in the TO-18 metal.



Battery:

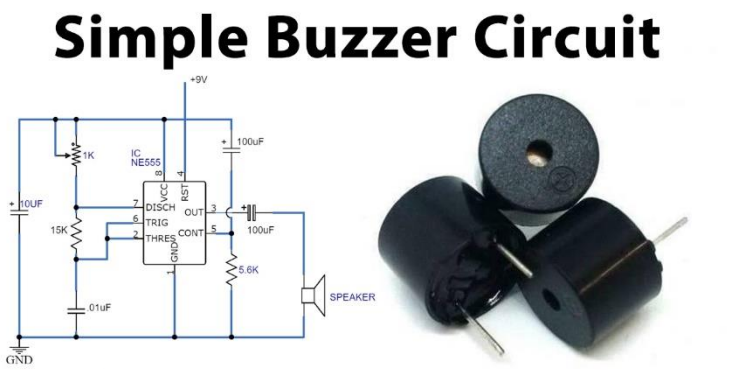
DC stands for 'direct current' which means the current only flows in one direction. Batteries and electronic devices like TVs, computers and DVD players use DC electricity - once an AC current enters a device, it's converted to DC. A typical battery supplies around 1.5 volts of DC.

LED Lights:

LED stands for light emitting diode. LED lighting products produce light up to 90% more efficiently than incandescent light bulbs. How do they work? An electrical current pass through a microchip, which illuminates the tiny light sources we call LEDs, and the result is visible light.

Buzzer:

The buzzer is a sounding device that can convert audio signals into sound signals. It is usually powered by DC voltage. It is widely used in alarms, computers, printers and other electronic products as sound devices.

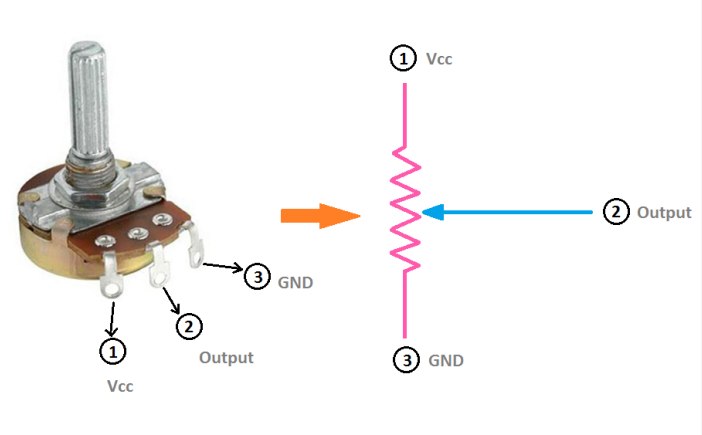


Gear Motor:

A gearmotor (or geared motor) is a small electric motor (AC induction, permanent magnet DC, or brushless DC) designed with an integral (non-separable) gear reducer (gearhead) attached. The end shield on the drive end of the motor (light blue, below) is designed to provide a dual function.

Potentiometer:

A potentiometer is a manually adjustable variable resistor with 3 terminals. Two of the terminals are connected to the opposite ends of a resistive element, and the third terminal connects to a sliding contact, called a wiper, moving over the resistive element.



Working Procedure:

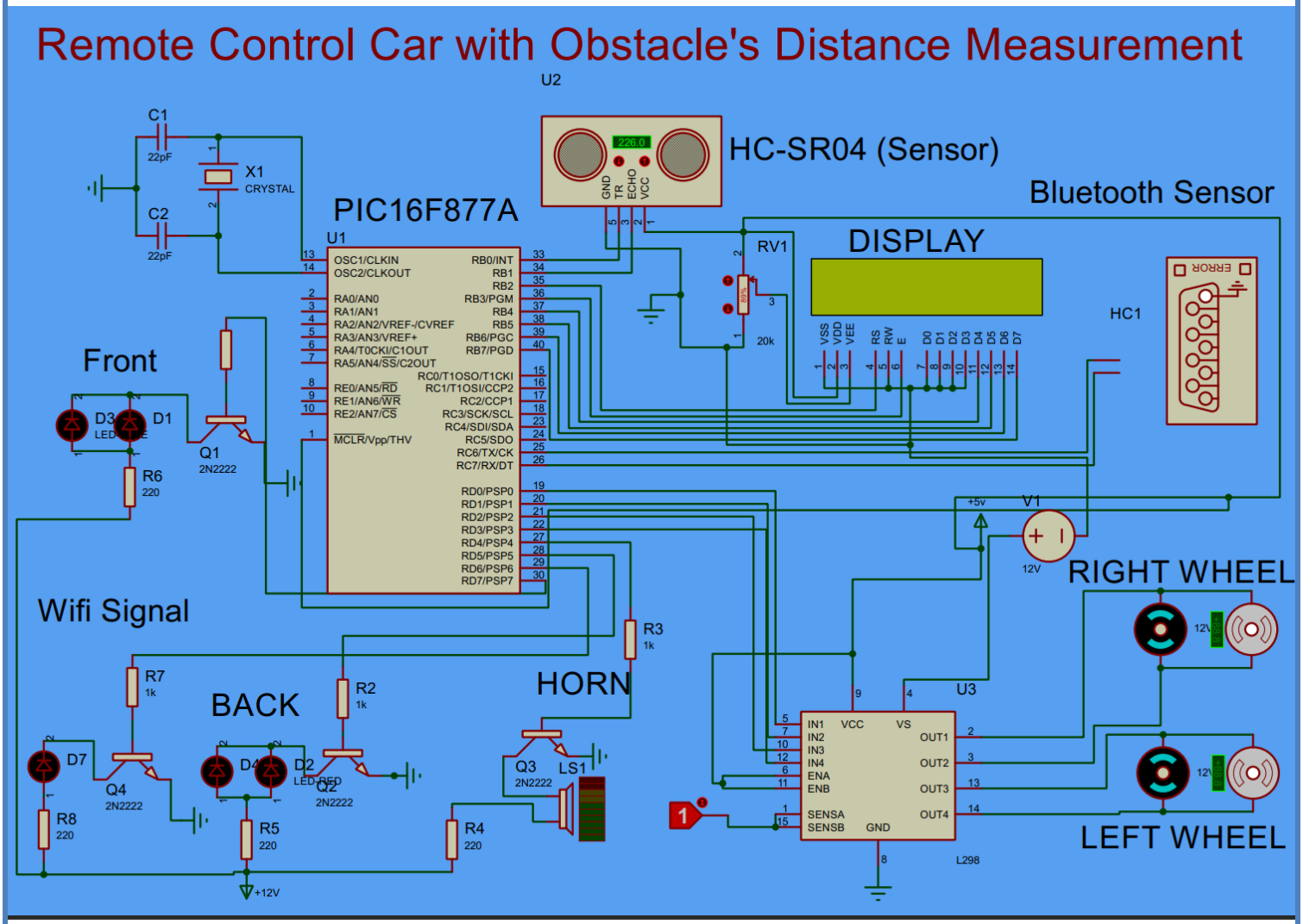
- PIC16F877A is controlling this complete circuit.
- Circuit for this project was made on Proteus.
- First 2 pins of Port B (B0,B1) is connected with Tr and Echo Pin of SR-04.
- Next 6 pins of Port B (B2,B3,B4,B5,B6,B7) are connected with LCD (2x16).
- RX and TX pins of Port C are connected with HC-06.
- D0,D1,D2,D3 pins of Port D are connected with Motor Drive (L298N).
- D4,D5,D6,D7 of Port D are connected with Buzzer, Backlight, Signal Light and Front Light respectively.
- Code for this project is compiled using MikroC for PIC.
- Distance can be measured easily by using Time Delay of Echo of SR-04, and then converting it into

distance.

- Using serial communication, we can send data to PIC16F877A using HC-06 from Android App.

- Tx and Rx pins of HC-06 are used for serial communication. It is slave Bluetooth module used for receiving data from Master Device as Android
- ENA and ENB pins of L298N are used to grant control of Out1 and Out 2 to IN1 and IN2, Out3 and Out4 To IN3 and IN4
- Potentiometer is used to control Brightness of LCD
- Trig (Trigger) pin is used to trigger the ultrasonic sound pulses. Echo pin produces a pulse when the reflected signal is received. The length of the pulse is proportional to the time it took for the transmitted signal to be detected.

Proteus Circuit Diagram:



MikroC Code:

```
//Muhammad Umer Mujahid (20-EE-21)
//Faizan Nusrat (20-EE-149)
//Muhammad Shehroz Tariq (20-EE-189)
//Muhammad Abdullah (20-EE-117)
// LCD module connections
sbit LCD_RS at RB2_bit;
sbit LCD_EN at RB3_bit;
sbit LCD_D4 at RB4_bit;
sbit LCD_D5 at RB5_bit;
sbit LCD_D6 at RB6_bit;
sbit LCD_D7 at RB7_bit;

sbit LCD_RS_Direction at TRISB2_bit;
sbit LCD_EN_Direction at TRISB3_bit;
sbit LCD_D4_Direction at TRISB4_bit;
sbit LCD_D5_Direction at TRISB5_bit;
sbit LCD_D6_Direction at TRISB6_bit;
sbit LCD_D7_Direction at TRISB7_bit;
// End LCD module connections
```

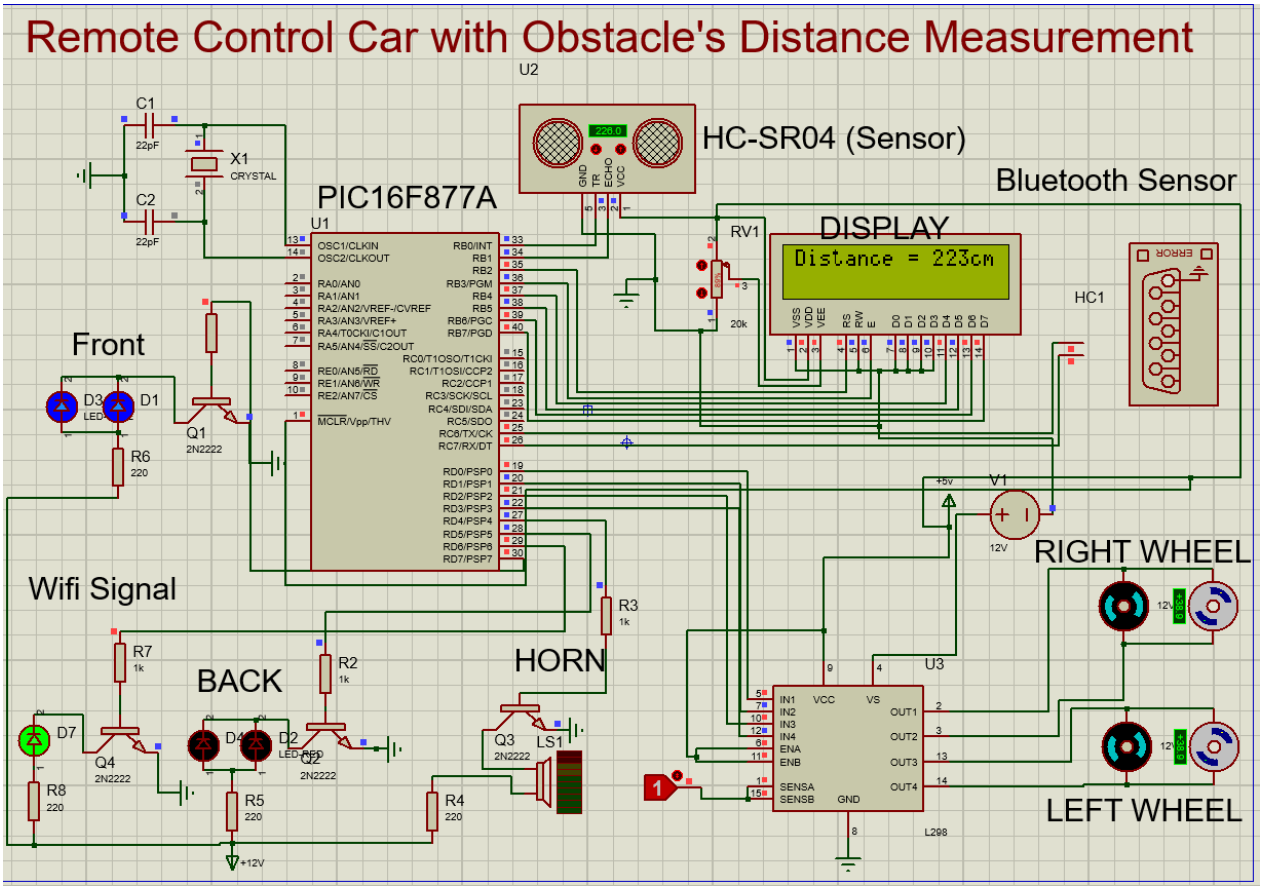
```
void main()
{

int a;
char IncData;
char txt[7];
TRISD=0X00;
TRISB = 0x02;           //RB1 as Input PIN (ECHO)
PORTD=0X00;
TRISC.F7 = 1;


Lcd_Init();
Lcd_Cmd(_LCD_CLEAR);          // Clear display
Lcd_Cmd(_LCD_CURSOR_OFF);     // Cursor off

UART1_Init(9615); // Initialize UART module at 9600 bps
Delay_ms(100); // Wait for UART module to stabilize

Lcd_Out(1,5,"M&M Lab");
Lcd_Out(2,3,"Final Project");

Delay_ms(3000);
Lcd_Cmd(_LCD_CLEAR);



T1CON = 0x10;                //Initialize Timer Module


while(1)
{
TMR1H = 0;                  //Sets the Initial Value of Timer
TMR1L = 0;                  //Sets the Initial Value of Timer

PORTB.F0 = 1;               //TRIGGER HIGH
Delay_us(10);               //10uS Delay
PORTB.F0 = 0;               //TRIGGER LOW

while(!PORTB.F1);           //Waiting for Echo
T1CON.F0 = 1;               //Timer Starts
while(PORTB.F1);            //Waiting for Echo goes LOW
T1CON.F0 = 0;               //Timer Stops

a = (TMR1L | (TMR1H<<8));   //Reads Timer Value
a = a/58.82;                //Converts Time to Distance
a = a + 1;                  //Distance Calibration
if(a>=2 && a<=400)          //Check whether the result is valid or not
{
IntToStr(a,txt);
Ltrim(txt);
Lcd_Cmd(_LCD_CLEAR);
Lcd_Out(1,1,"Distance = ");
Lcd_Out(1,12,txt);
Lcd_Out(1,15,"cm");




}
else
{
Lcd_Cmd(_LCD_CLEAR);
Lcd_Out(1,1,"Out of Range");
```

```
}
Delay_ms(400);

(!UART1_Data_Ready());
if (UART1_Data_Ready())
{
IncData = UART1_Read();



if ( IncData == 'F')
//Forward//
PORTD = 0XC5;



if ( IncData == 'B')
//Backward//
PORTD = 0X6A;



if ( IncData == 'L')
//Left//
PORTD = 0X59;



if ( IncData == 'G')
//ForwardLeft//
PORTD = 0XD1;



 if ( IncData == 'H')
//BackwardLeft//
PORTD = 0X72;



if ( IncData == 'R')
 //Right//
 PORTD = 0X56;



if ( IncData == 'I')
//ForwardRight//
PORTD = 0XD4;
```

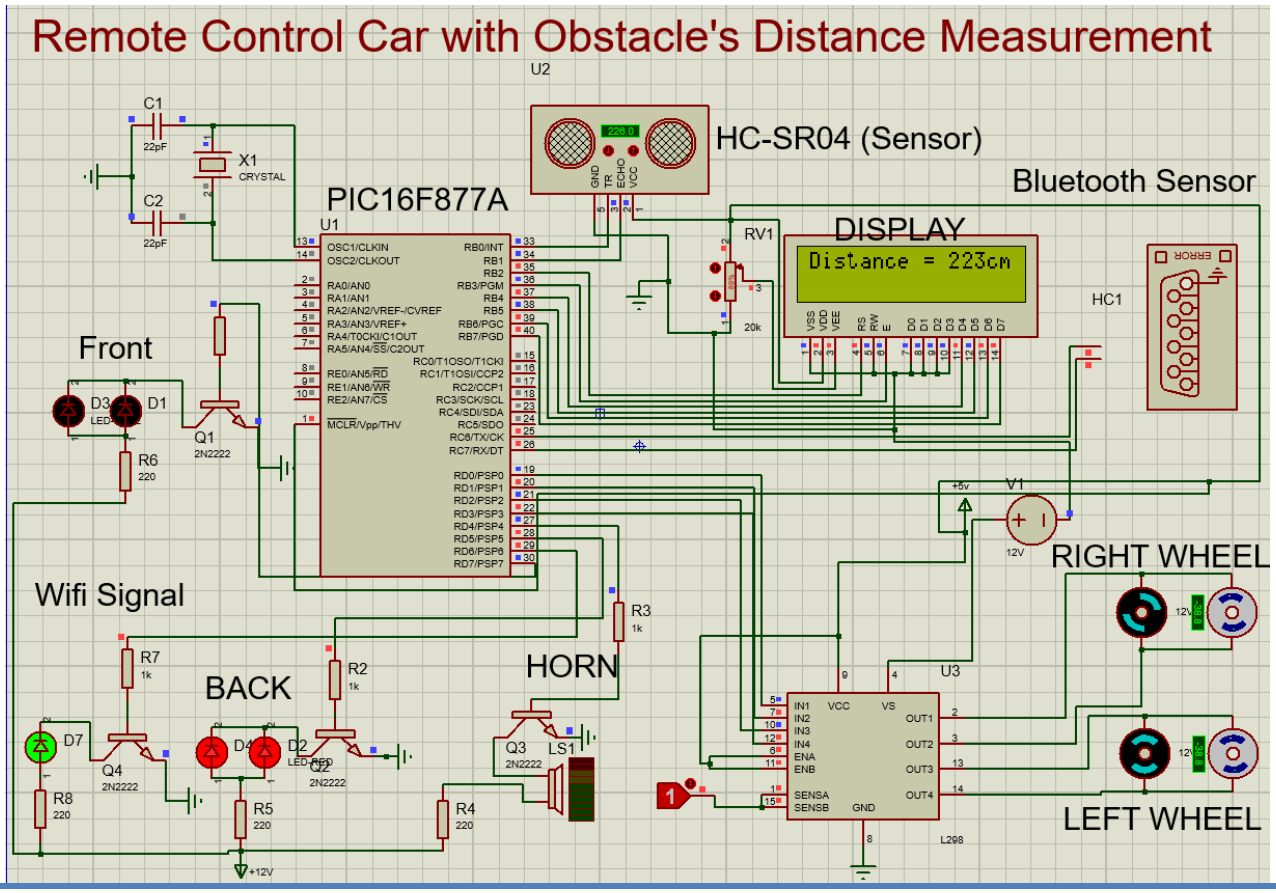
```
if ( IncData == 'J')
//BackwardRight//
PORTD = 0X78;




 if ( IncData == 'S')
 PORTD = 0X40;




 if ( IncData == 'W')
 PORTD = 0X50;



if ( IncData == 'w')
PORTD = 0X00;


if ( IncData == 'U')
PORTD = 0X60;



if ( IncData == 'u')
PORTD = 0X00;



if ( IncData == 'V')
PORTD = 0X50;


if ( IncData == 'v')
PORTD = 0X00;


if ( IncData == 'X')
PORTD = 0XA0;

if ( IncData == 'x')
PORTD = 0X00;

if ( IncData == 'D')
PORTD = 0X00;







}

}
}
```

Proteus Simulation:

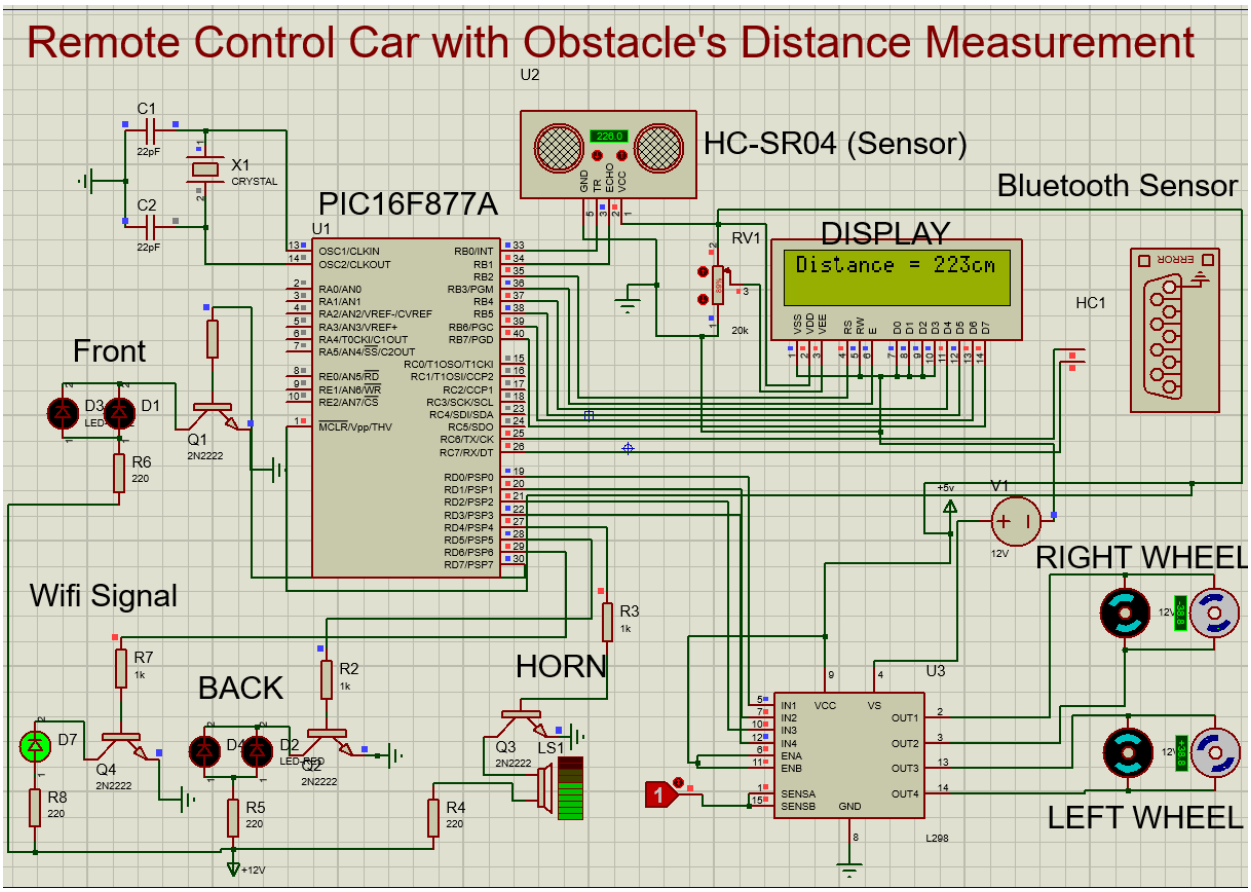
Moving Forward



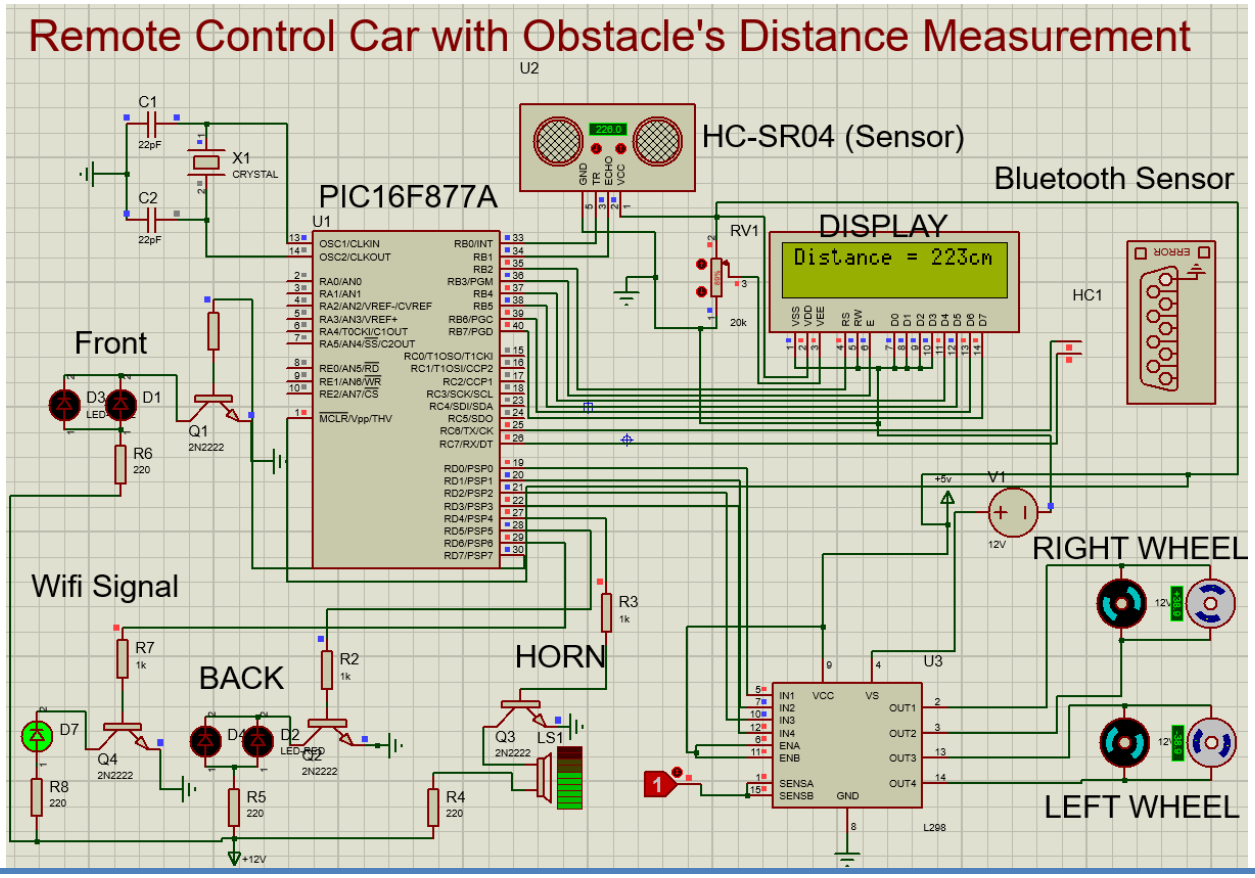
Moving Backward



Turning Right



Turning Left



Applications:

- Remote-control vehicles are used in law enforcement and military engagements.
- Its is also used for entertainment purpose of kids.
- It is used to get access at places where humans feel danger to go.

References:

- https://www.microchip.com/en-us/product/PIC16F877A
- https://www.labcenter.com/
- https://www.mikroe.com/mikroc-pic
- https://www.theengineeringprojects.com/