Microprocessors Course Project Report
2nd Year Computer Engineering

Project Title: Robotika

Team Members

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1. Project Objective

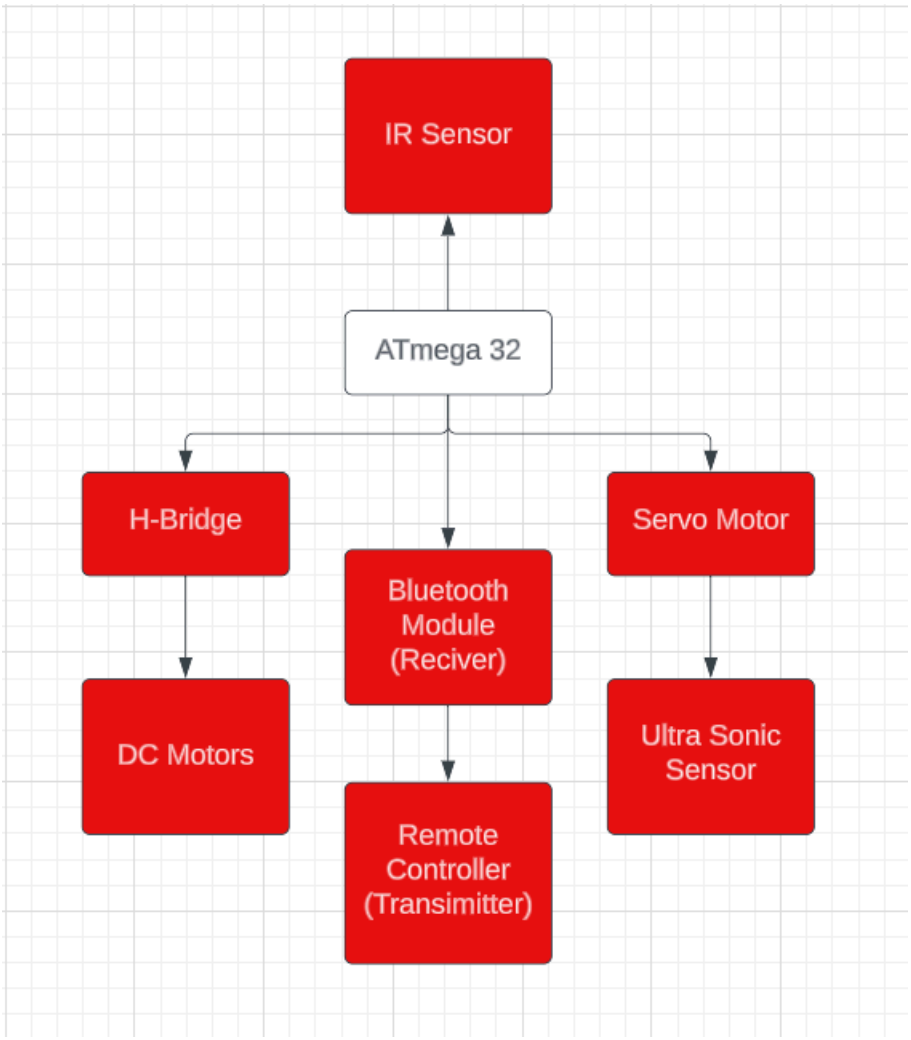
The objective of this project is to design and build an RC car using an Atmega32 microcontroller, H-bridge motor driver, servo motor, ultrasonic sensor, and Bluetooth module. The project aims to practical application using embedded systems and microcontrollers in creating a smart device.

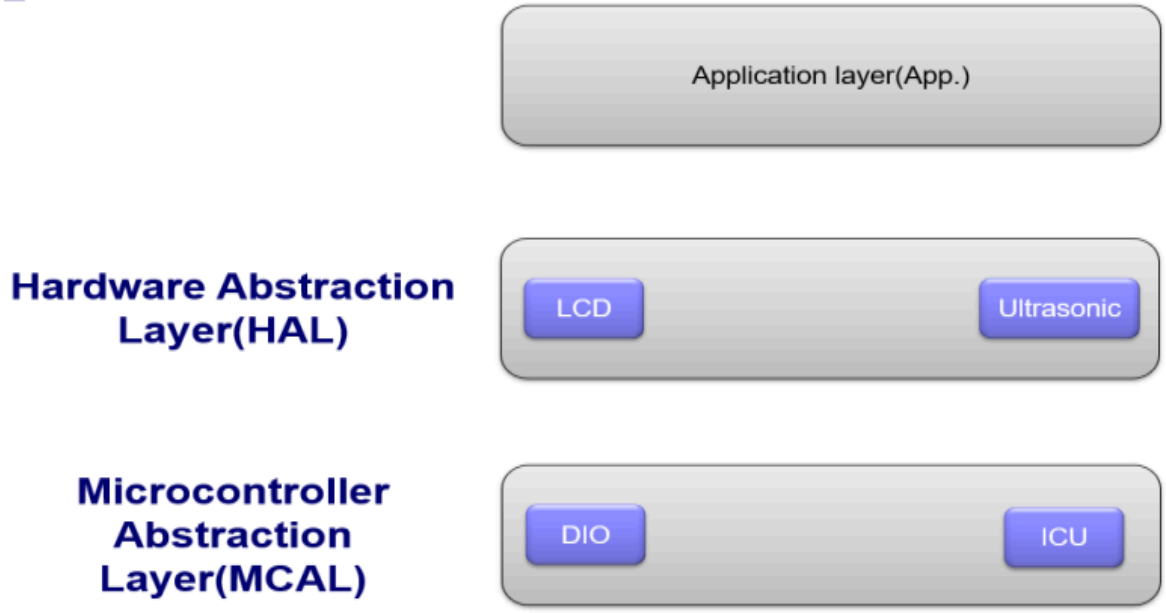
The car is controlled by a smartphone through Bluetooth and can move in all four directions (right, left, forward, and backward). The user can switch between remote controlling and line-following modes.

To ensure safety and avoid collisions, the car can avoid obstacles using the ultrasonic sensor mounted on the servo motor. The ultrasonic sensor will detect obstacles in the car's path and instruct the car to turn or change direction to avoid hitting it.

2. System Block Diagram

2.1. Block Diagram





2.2. Block Diagram Description

The first photo:

The project makes use of an ATmega32 microcontroller to control various components of the RC car. The microcontroller is connected to an H-bridge, which in turn is connected to the DC motors that provide the car's movement. Additionally, the microcontroller is connected to a Bluetooth module that receives commands through UART and is connected to the remote controller.

A servo motor is also used in the project, which is attached to an ultrasonic sensor. The ultrasonic sensor is mounted on the servo motor, allowing it to look in different directions. Additionally, an infrared sensor is incorporated into the design.

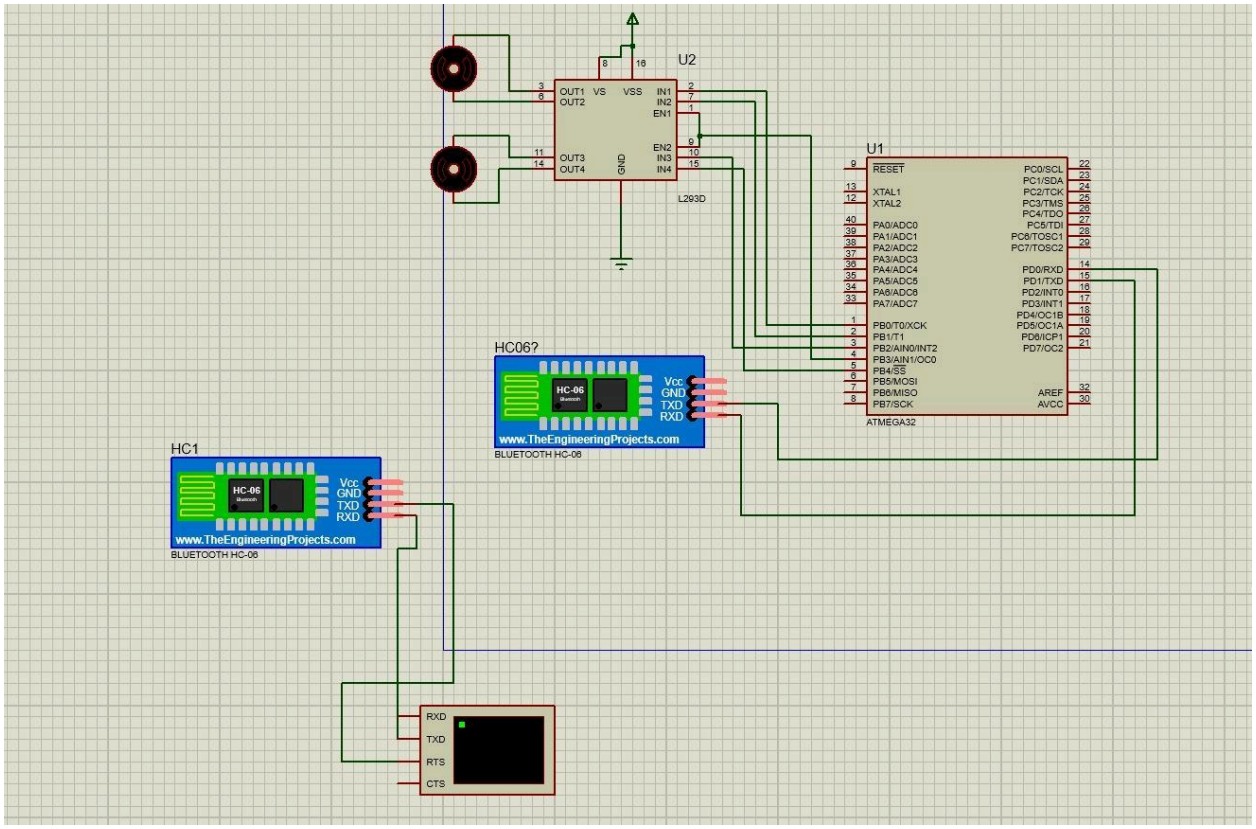
The Second Photo:

Abstraction layer:
•Timer
•UART
•GPIO
•ADC
•ICU

Hardware Layer:
•Ultrasonic sensor
•Bluetooth
•Buzzer
•DC Motor
•Motor Driver
•Servo

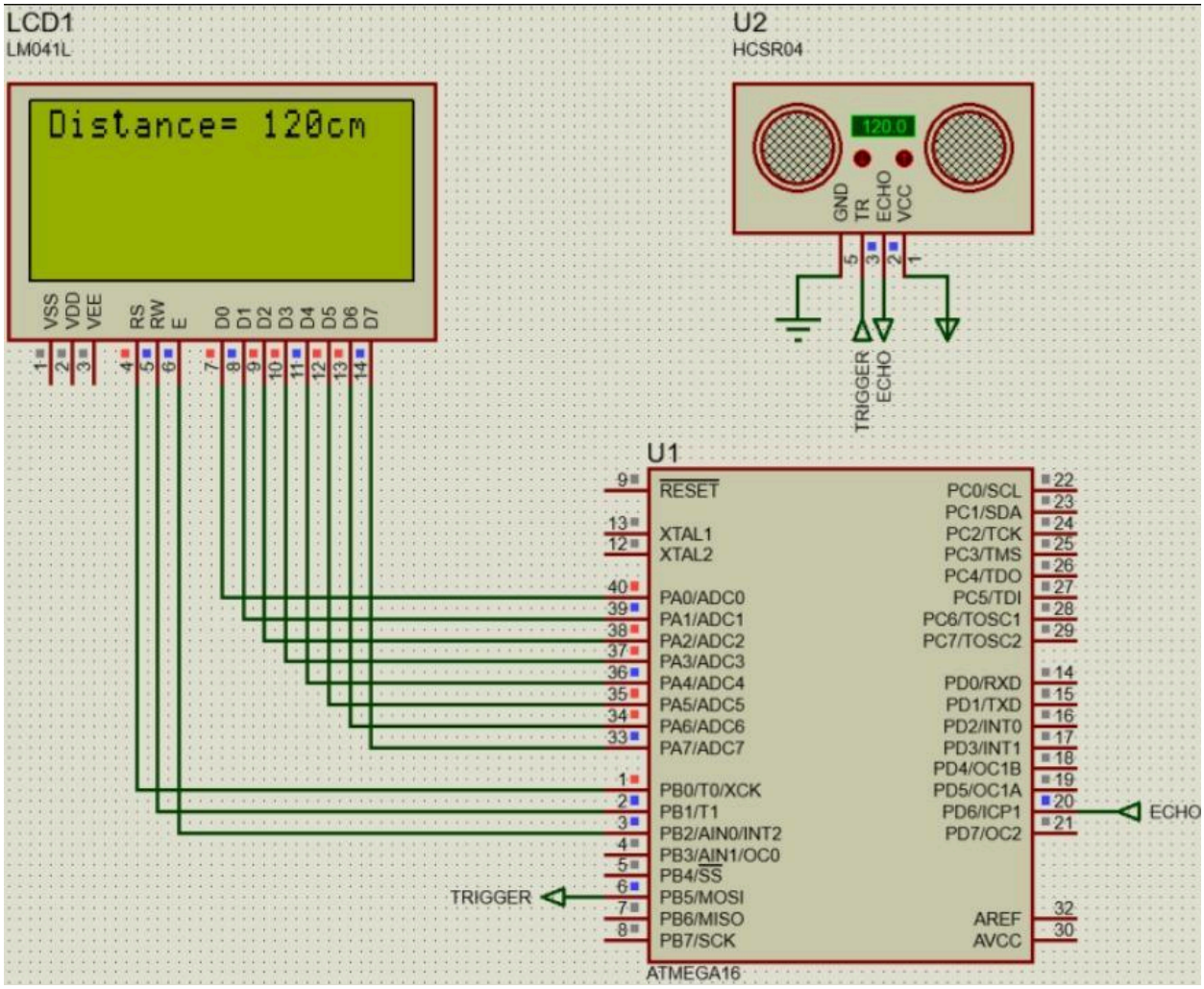
3. Schematic Diagram (Circuit Diagram)

Circuit 1:



One Bluetooth module is used to receive commands from the smartphone, while the other represents the smartphone itself. The simulation allows the user to control the car's movement through the smartphone, which sends commands to the Bluetooth module. These commands are then processed by the microcontroller, which controls the DC motors through the H-bridge to move the car in the desired direction.

Circuit 2:



The simulation includes an ultrasonic sensor that is used to detect the distance between the RC car and an obstacle. The sensor sends a signal, which bounces off the obstacle and returns. The time it takes for the sound waves to return to the sensor is used to calculate the distance between the car and the obstacle.

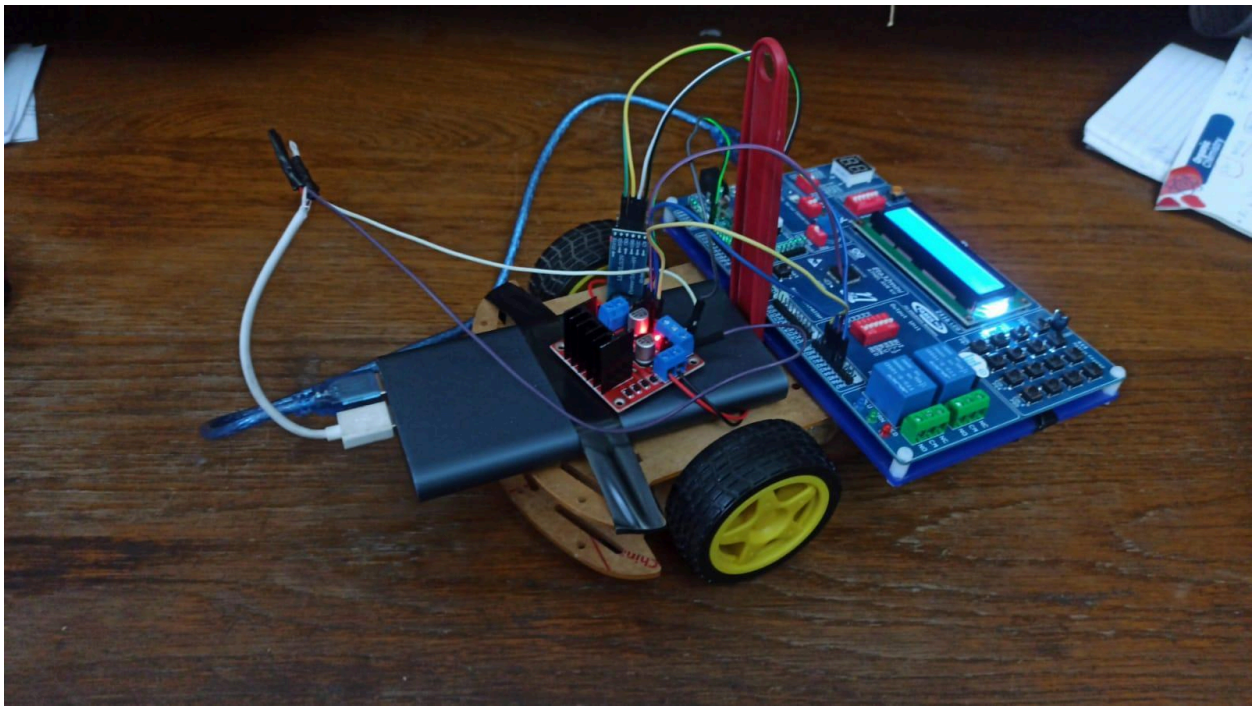
The calculation used to configure the sensor:
Sound velocity = 340.00 m/s = 34000 cm/s
the distance of Object (in cm) = (340000∗Time)/2 = 17000 * Time
Total distance is divided by 2 because the signal travels from HC-SR04 to the object and returns to the module.
Now, here we have selected an internal 16MHz oscillator frequency for ATmega32, with Pre scaler F_CPU/8 for timer frequency.

distance (cm) = 17000 x (TIMER value) x 5 x 10^-7 cm
= 0.0085 x (TIMER value) cm
= (TIMER value) / 117 cm

4. List Of Components

SN	Item Type	Item Code Name	Purpose	Quantity
1	Microcontroller	ATMEGA 32	To process the code	1
2	Motor	DC Motor	To move the car	2
3	Motor	Servo	To move the Ultrasonic Sensor	1
4	Sensor	UltraSonic Sensor	Stop the car from hitting	1
5	H-Bridge	L298N	To Help in controlling the direction of the motor	1
6	IR Sensor		Used in line moving mode	1
7	Bluetooth module	HC-05	Controlling the car through Bluetooth	1

5. Real-Time Hardware Photo



6. Source Code

6.1. Hardware-side source code

Link:
https://github.com/amrhossam9/RC-Car

6.2. PC-side source code

```
Commands/characters sent to the car:

Forward -> F
Back -> B
Left -> L
Right -> R
Forward Left -> G
Forward Right -> I
BackLeft -> H
Back Right -> J
```

The Characters that are sent from the phone

The program used to control the car: