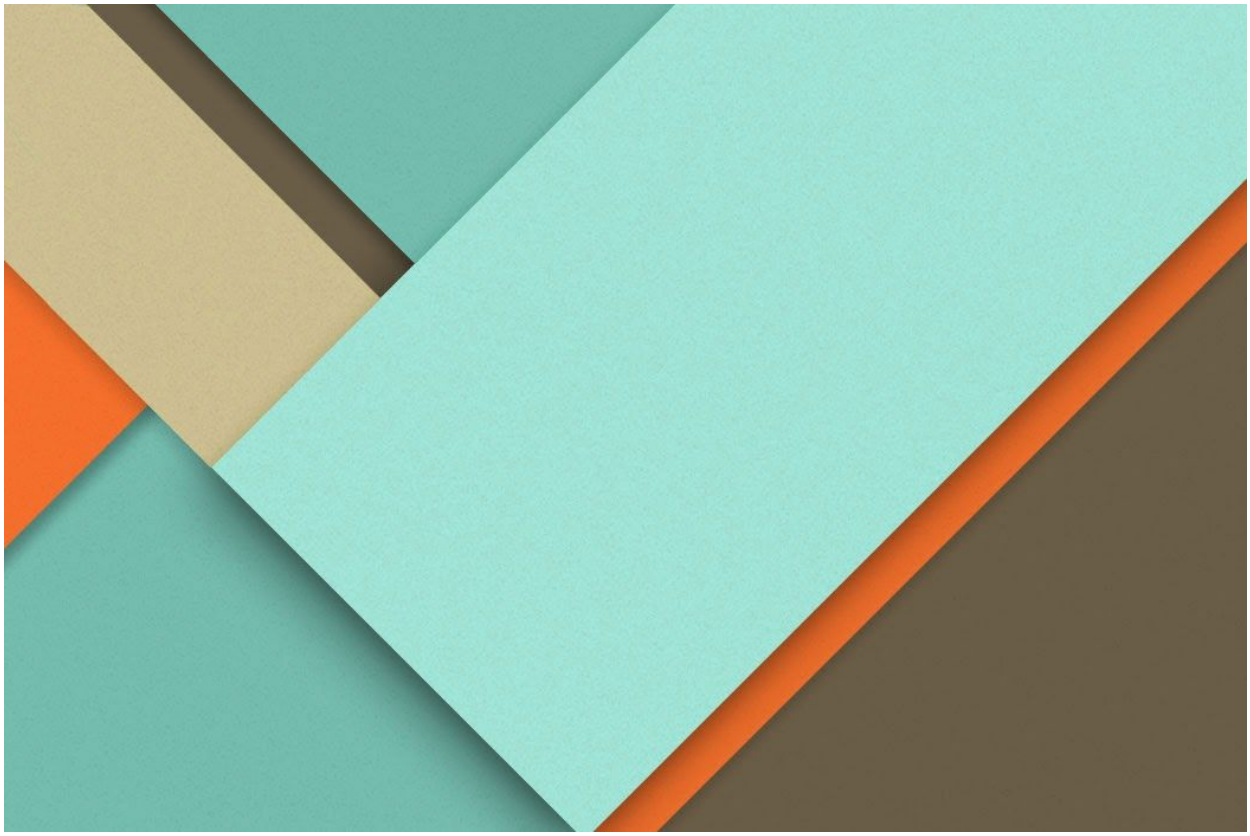

Embedded Systems Project Report

Line Follower Robot

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Overview

This report contains the details of the content that was taught during the Embedded systems course and the design of a line follower robot. It includes the theoretical and practical design of the robot.

Robot's Mechanical Structure

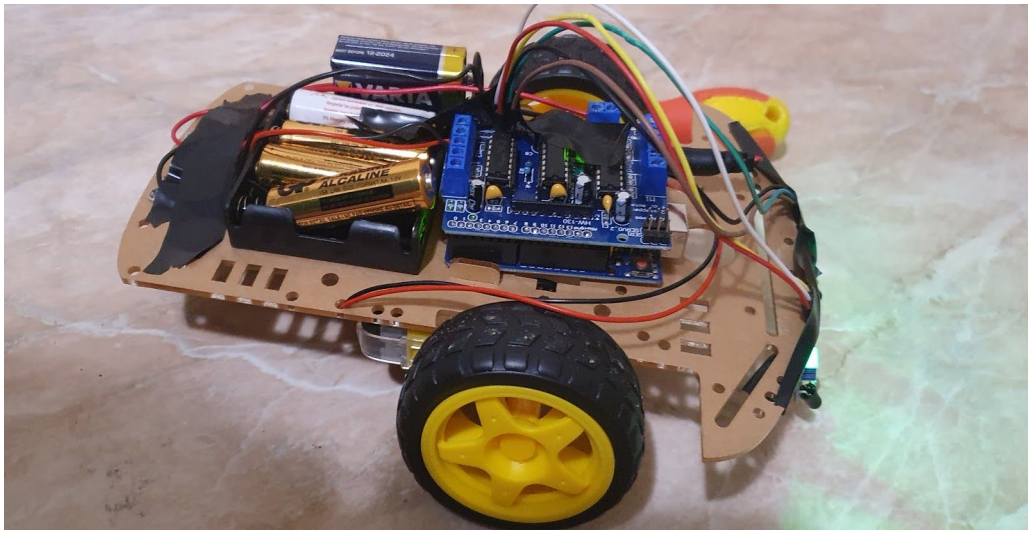
The robot consists of 3 wheels, 2 wheels for movement, driven by motors and 1 for balance, 2 infrared sensors both at the front of the robot, all mounted on a chassis.

Components of the Robot

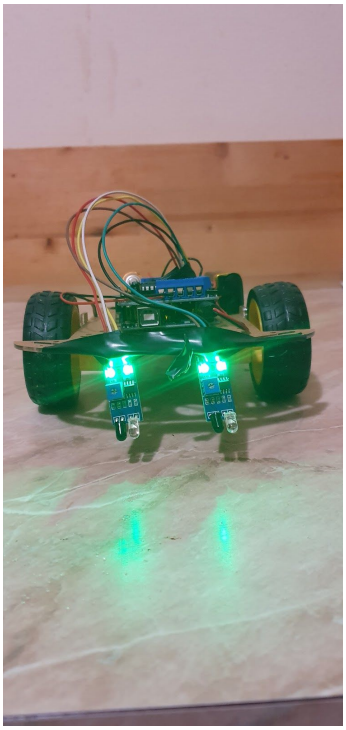
1. Microcontroller: ARDUINO R3
2. Two Infrared sensors
3. 9V battery
4. Two DC motors
5. L293D motor shield
6. Smart robot Car kit ordered from Amazon(https://www.amazon.de/-/en/gp/product/B07DNX1DX9/ref=ppx_yo_dt_b_asin_title_o01_s00?ie=UTF8&psc=1)

Robot's View

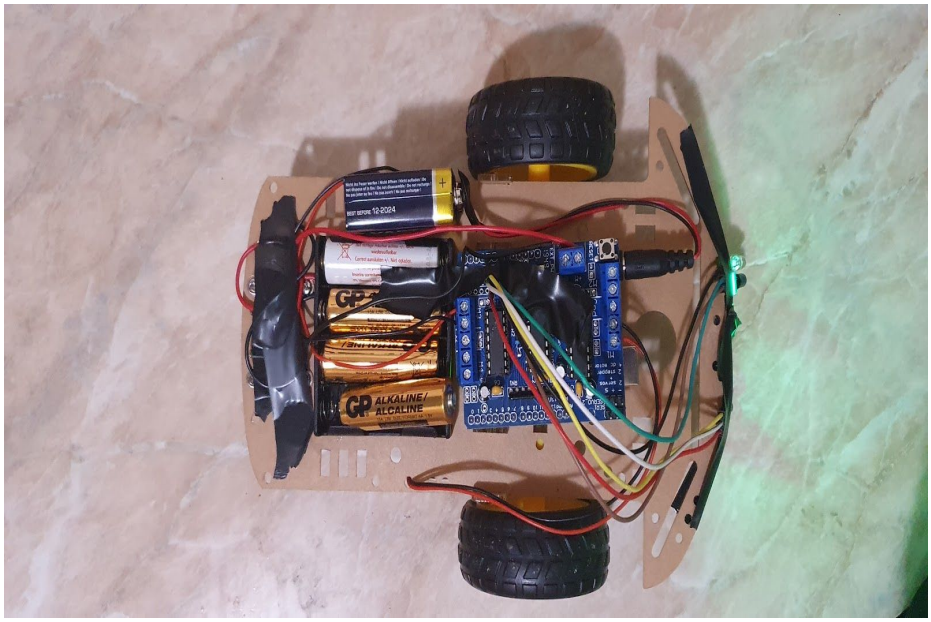
Side View



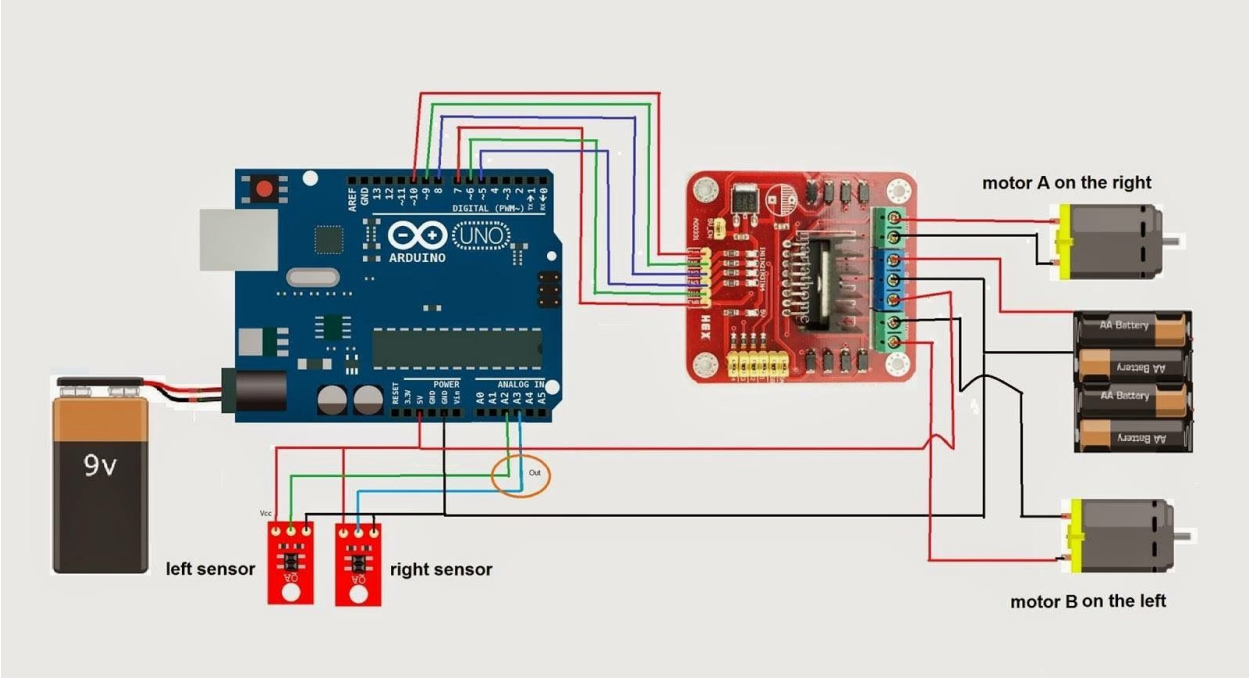
Front View



Top View



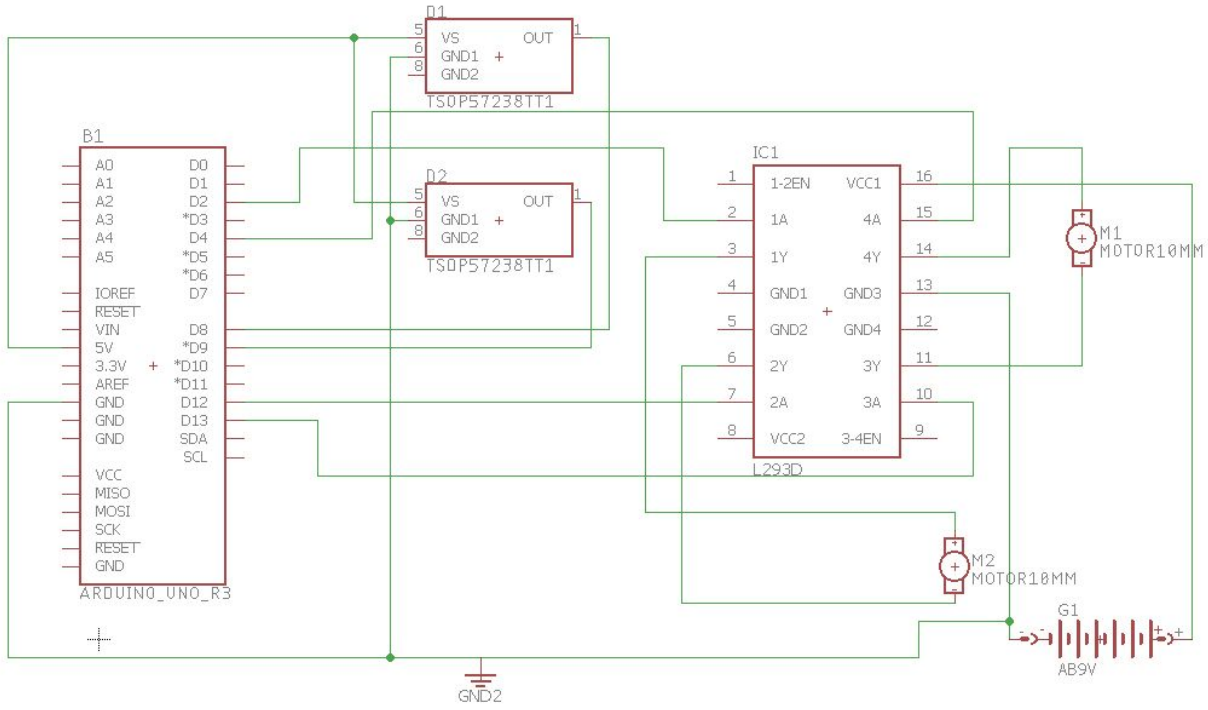
Basic Working Scheme



The whole robot is powered by a 9V battery that is connected to the Arduino which transfers some of the voltage to the motor shield. Due to the fact that the DC motors can't be connected directly to the microcontroller, there is a need for a motor shield to power

the DCmotors. The two infrared sensors are mounted on the front of the robot facing with the diodes facing towards Earth.
When the robot is placed on the fixed path, it follows the path by detecting the line. The robot's direction of motion depends on the two sensor outputs. When the two sensors are on the line of path, the robot moves forward. If the left sensor moves away from the line, the robot moves towards right. Similarly, if the right sensor moves away from the path, the robot moves towards its left. Whenever the robot moves away from its path it is detected by the IR sensor.

Schematic Design of the Robot



Use of Important Components

1. Infrared Obstruction sensors

   An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. The IR sensor consists of individual IR LEDs and IR photodiodes. The IR light emitted by the LED strikes the surface and is reflected back to the IR photodiode. The photodiode then gives an output voltage proportional to the reflectance of the surface (high value for a light surface and low for a black or dark surface). This tells the robot the right places to go.

2. Motor Shield

   The motor shield helps in powering up the DC motors, the DC motors can't be connected directly to the microcontroller so instead a motor shield is used to connect the DC motors to the microcontroller.

3. Microcontroller(Arduino)

   Arduino is an open source microcontroller, it is used for real time projects. The controller controls all the objects. The IR sensor senses black line and then sends the signal to the arduino. Then arduino drives the motor according to sensors' output.

4. DC motors

   The robot is driven by DC motors to control the movements of the wheels. The line follower robot is designed to be able to follow a black line on the ground without getting off the line too much.

Arduino Programming Code

```
#include <AFMotor.h>


AF_DCMotor motorA(1); //this is the left motor
AF_DCMotor motorB(3); //this is the right motor



void setup() {
  Serial.begin(9600);          // set up Serial library at 9600 bps
  Serial.println("Line Follower Rover");
  delay(500);


  pinMode(A0, INPUT); // declare A0 as input pin for left sensor
  pinMode(A1, INPUT); // declare A1 as input pin for right sensor
  motorA.setSpeed(180); // turn on motor1
  motorA.run(RELEASE);
  motorB.setSpeed(180); // turn on motor2
```

```
  motorB.run(RELEASE);
}


void loop() {

  int sensor1 = digitalRead(A1);
  int sensor2 = digitalRead(A0);

  //Reading the values of the sensors on the serial monitor
  Serial.print(sensor1);
  Serial.print("    ");
  Serial.println(sensor2);
  delay(50);
  //value of 0 means no black line, value of 1 means black line detected.

  //Move forward if both sensors zero (no black line).

  if ((sensor1 == 1) && (sensor2 == 1))
  {
    motorA.setSpeed(200); // turn on motor1
    motorB.setSpeed(200);
    motorA.run(FORWARD);
    motorB.run(BACKWARD);
  }
  //Turn left if left sensor (sensor 1) detects black line
  else if ((sensor1 == 0) && (sensor2 == 1))
    //motor1 is left motor, motor 2 is right motor
  {
```

```
    motorA.setSpeed(200); // turn on motor1
    motorA.run(FORWARD);
    motorB.setSpeed(50);
    motorB.run(BACKWARD);

  }
  //Turn right if right sensor detects black line
  else if ((sensor2 == 0) && (sensor1 == 1))
    //motor1 is left motor, motor 2 is right motor
  {
    motorA.setSpeed(50); // turn on motor1
    motorA.run(FORWARD);
    motorB.setSpeed(200);
    motorB.run(BACKWARD);
  }
}
```