FEYZİYE SCHOOLS FOUNDATION

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Technologies

Line Following Car

by

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PARTS

- Arduino Uno
- 6V 250 RPM DC Motor and Wheel Set
- L298N Motor Driven
- TCRT 5000 Sensor
- Sensor Shield v5.0
- Battery Holder (x6)
- 9V Battery
- Mini On/Off Switch
- Jumper Cable

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Line Following Car

Abstract

This project aims to design a line-following robot using an Arduino microcontroller and the TCRT 500 sensor. The robot is capable of detecting and following a predefined path marked on the ground. The system employs infrared sensors to detect the line and adjust the robot's movements accordingly, ensuring accurate and consistent tracking. The goal is to explore the applications of autonomous robots in various fields and improve the precision and reliability of line-following mechanisms. This report details the design, development, testing, and evaluation phases of the project.

INTRODUCTION

With the rapid advancement of technology, autonomous systems are being developed for different applications. Line-following robots represent an important step in this field. This project aims to develop an Arduino based line following car. By using the TCRT 500 sensor, the vehicle will be ensured to follow the line. This report will provide detailed information about the techniques and components used in the project.

OVERVIEW AND OBJECTIVES

The main purpose of this project is to examine autonomous vehicle technologies by developing a line-following car. In the project, the vehicle will be able to follow the line using the TCRT 500 sensor. The movement of the wheels will be controlled using the Arduino microcontroller and motor driver board. This system ensures that the car steers and moves accurately by following the specified line. In this way, the reliability and accuracy of autonomous line tracking systems will be increased.

MATERİALS AND TECHNIQUES USED

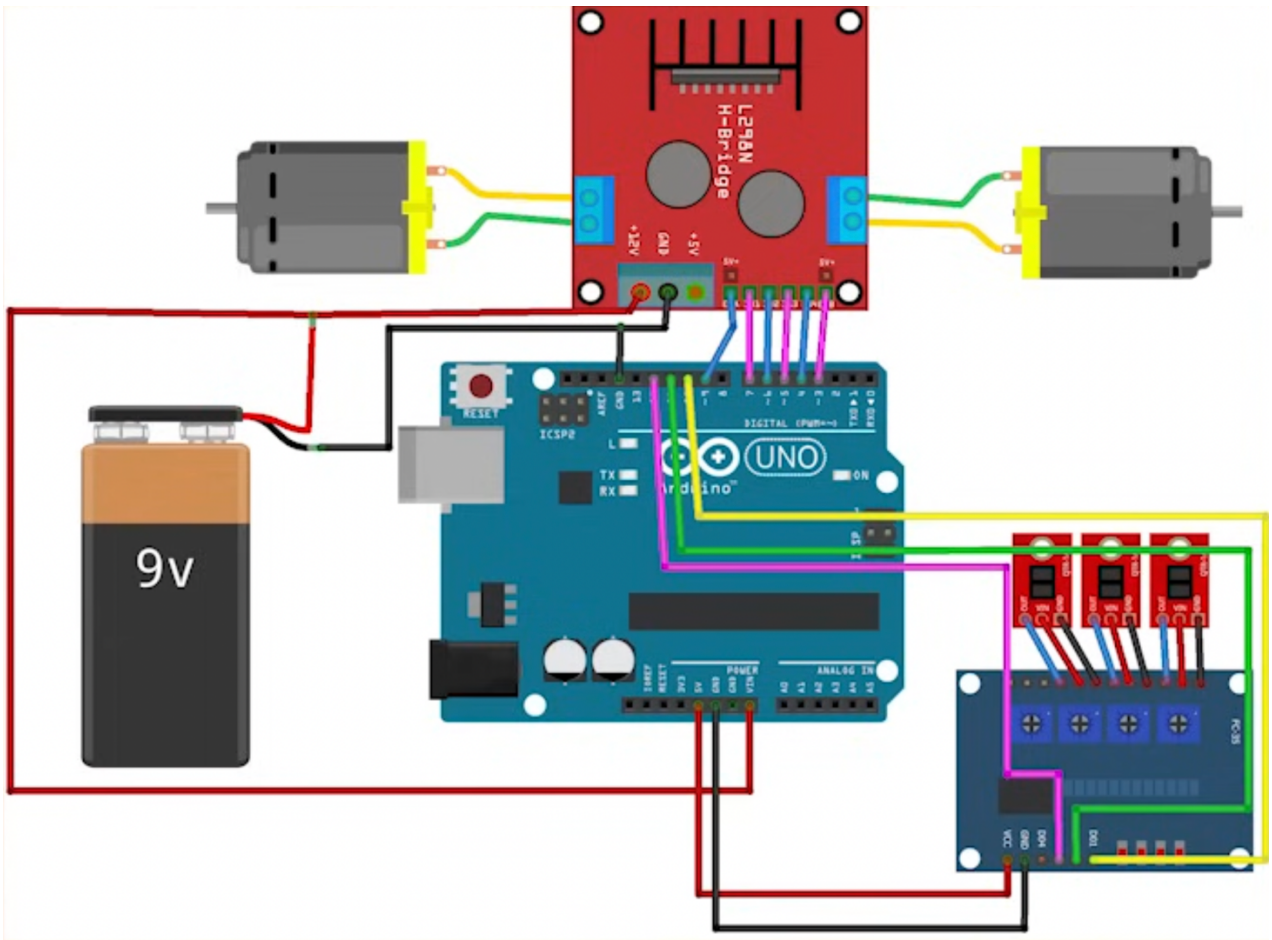
Materials and Techniques Used

The main materials and techniques used in this project are:

- Arduino Uno: Microcontroller used to control the system.
- 6V 250 RPM DC Motor and Wheel Set: Used to provide movement of the vehicle.
- L298N Motor Driver Card: Used to control motors.
- TCRT 5000 Sensor: Used for line tracking.
- Sensor Shield v5.0: Used to easily connect sensors and other components.
- Battery Slot (x6): Used to meet the energy needs of the system.
- 9V Battery: Used to power the system.
- Mini On/Off Switch: Used to turn the system on and off.
- Jumper Cables: Used to establish connections between components.

These components are combined to ensure that the line following car operates accurately and effectively.

DESIGN AND IMPLEMENTATION



Explanation of the Code

The code is designed to control a car following the line with the TCRT 5000 sensor. The car adjusts its direction using data from sensors as it follows the line. The system uses the L298N motor driver board to control the motors and operates with a switch for on/off operations when necessary.

```
int mod = 0;

#define sol_sensor 4
#define orta_sensor 3
#define sag_sensor 2

int sol;
int orta;
int sag;

int siyah = 0;
int beyaz = 1;
// beyaz üstü siyah

int yol = siyah;
int cizgi = beyaz;

// MOTOR SÜRÜCÜ PİNLERİ
#define sol_motor_ileri 9
#define sol_motor_geri 10
#define sag_motor_ileri 6
#define sag_motor_geri 5

void setup() {
  pinMode(sol_sensor, INPUT);
  pinMode(orta_sensor, INPUT);
  pinMode(sag_sensor, INPUT);

  pinMode(sol_motor_ileri, OUTPUT);
```

```
  pinMode(sol_motor_geri, OUTPUT);
  pinMode(sag_motor_ileri, OUTPUT);
  pinMode(sag_motor_geri, OUTPUT);

  Serial.begin(9600);
}

void loop() {
  while (mod == 0) { // çizgi izleyen modu
    sol = digitalRead(sol_sensor);
    orta = digitalRead(orta_sensor);
    sag = digitalRead(sag_sensor);

    Serial.print(sol); Serial.print(orta); Serial.println(sag);

    if (sol == yol && orta == cizgi && sag == yol) {
      digitalWrite(sol_motor_ileri, 1);
      digitalWrite(sag_motor_ileri, 1);
    }
    else if (sol == cizgi && orta == yol && sag == yol) {
      digitalWrite(sol_motor_ileri, 0);
      digitalWrite(sag_motor_ileri, 1);
    }
    else if (sol == yol && orta == yol && sag == cizgi) {
      digitalWrite(sol_motor_ileri, 1);
      digitalWrite(sag_motor_ileri, 0);
    }
  }
}
```

TESTING AND RESULTS

The TCRT 5000 IR sensor reliably detected the difference between black and white surfaces and provided accurate and stable readings across multiple measurements. The L298N motor driver effectively controls the 6V 250 RPM DC motors, ensuring smooth and precise movement of the vehicle. The sensor successfully maintained the vehicle's route while following the line, and in case of any deviation, it instantly sent a signal to the engines, ensuring that it remained on the right track.

Overall, the system performed reliably in a variety of terrain and light conditions and demonstrated its effectiveness in improving user safety and vehicle mobility.

CONCLUSION AND FUTURE WORK

The Arduino-based line-following car system has been successfully designed by integrating line detection, motor control and user warning mechanisms with the TCRT 5000 sensor. As a result of extensive tests, the system followed the line reliably, ensured precise control of the motors in the correct direction, and achieved the goals of the system by warning users in time in case of deviation from the line. This system has been an important step in increasing the security of users by allowing them to move independently in their environment.

Future improvements include improving sensor calibration to increase line-following performance, making algorithm optimizations to ensure more reliable operation in various ground and lighting conditions, and adding additional functions that will increase the vehicle's maneuverability to enrich the user experience. These improvements will significantly increase the performance and usability of the line-following car system.