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Web Controlled Car with Autonomous Parking System

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Abstract

This embedded systems project presents the design and implementation of a web-controlled car with an autonomous parking system. The system utilizes two PIC16F877A microcontrollers to control the car's movement and parking capabilities. The car uses IR sensors to follow lines on the ground. The web interface allows for remote control of the car, while the autonomous parking system uses sensor input to navigate and park the car without human intervention. The project demonstrates the integration of various technologies such as web development, microcontroller programming, sensor interfacing and IR sensor technology to create a functional and user-friendly system.
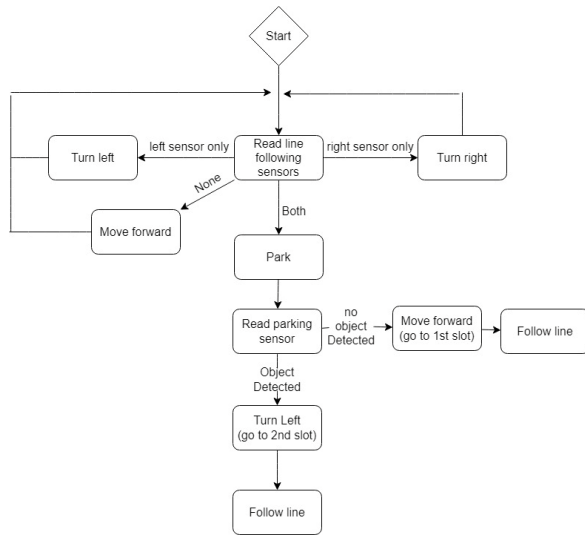
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Introduction

Embedded systems have become an integral part of modern technology, with a wide range of applications in various industries such as automotive, healthcare, and industrial automation. The integration of embedded systems with the Internet has opened up new possibilities for remote control and monitoring of various devices. In this project, we propose to design and implement a web-controlled car with an autonomous parking system. The system utilizes two PIC16F877A microcontrollers, which are powerful and versatile microcontroller units, to control the car's movement and parking capabilities. The car uses infrared sensors to follow lines on the ground, which allows for precise navigation and control. The web interface is designed to provide a user-friendly interface for remote control of the car, while the autonomous parking system uses sensor input to park the car without human intervention.

The main goal of this project is to demonstrate the integration of various technologies such as web development, microcontroller programming, sensor interfacing and IR sensor technology to create a functional and user-friendly system. The end result is a car that can be controlled remotely and can park itself with the help of the IR sensors. This project can serve as a proof of concept for future developments in the field of autonomous vehicles, where the integration of embedded systems and web technologies can play a crucial role in the advancement of self-driving cars. It also showcases the potential of IR sensors in providing precise navigation and control in embedded systems applications. This project aims to demonstrate the power of embedded systems in creating innovative and functional devices that can simplify human lives and make it more efficient.
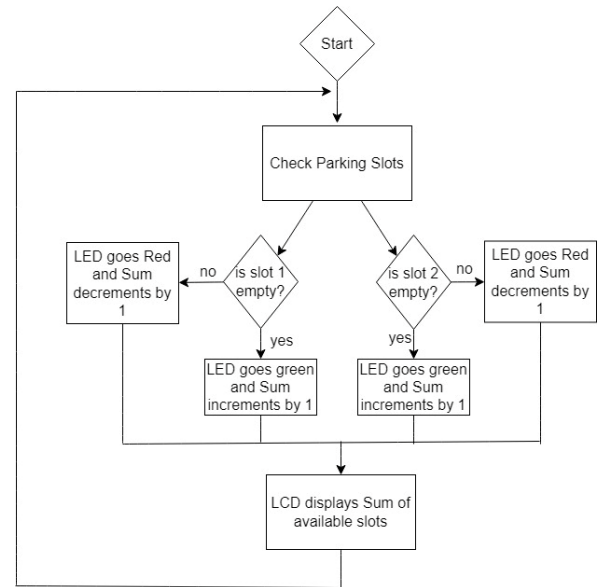
Design

The design of this embedded system project, which is a web-controlled car with autonomous parking system using 2 PIC16F877A microcontrollers and IR sensors to follow the lines, is a complex and ambitious project that combines several different technologies and concepts. The use of microcontrollers, IR sensors, and web-based control interfaces, as well as the integration of autonomous parking functionality, all add to the complexity of the project.
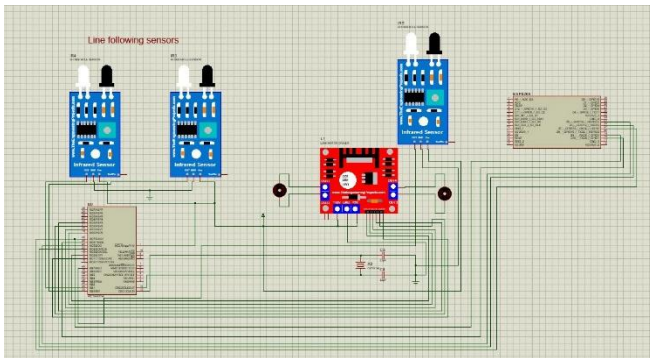
The project also uses ESP8266 as a bridge between the web and the PIC16F877A microcontrollers, which is a good design choice as ESP8266 is a low-cost microcontroller with built-in Wi-Fi capabilities, which allows it to easily connect to the internet and receive commands from a web-based interface. The car uses a switch to turn on and off the battery.
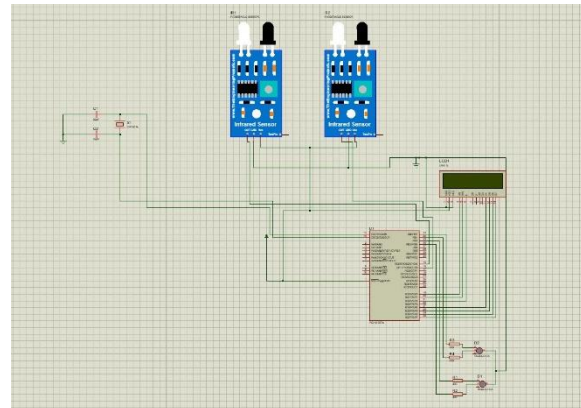
Figure 1. Car's Program Flowchart

Start → Read line following sensors

- left sensor only → Turn left
- right sensor only → Turn right
- None → Move forward
- Both → Park

Park → Read parking sensor

- no object Detected → Move forward (go to 1st slot) → Follow line
- Object Detected → Turn Left (go to 2nd slot) → Follow line

Figure 1. Car's Program Flowchart

Figure 2. Parking Program Flowchart

Start → Check Parking Slots

- is slot 1 empty?
  - no → LED goes Red and Sum decrements by 1
  - yes → LED goes green and Sum increments by 1
- is slot 2 empty?
  - no → LED goes Red and Sum decrements by 1
  - yes → LED goes green and Sum increments by 1

→ LCD displays Sum of available slots

Figure 2. Parking Program Flowchart

Figure 3 Proteus Implementation of the Car

Figure 4 Proteus Implementation of the Garage

Results

The car successfully parked in the Garage, also the garage decremented and incremented whenever the car leaves or enters the garage. Also the car follows the line and enters the parking lot as needed.
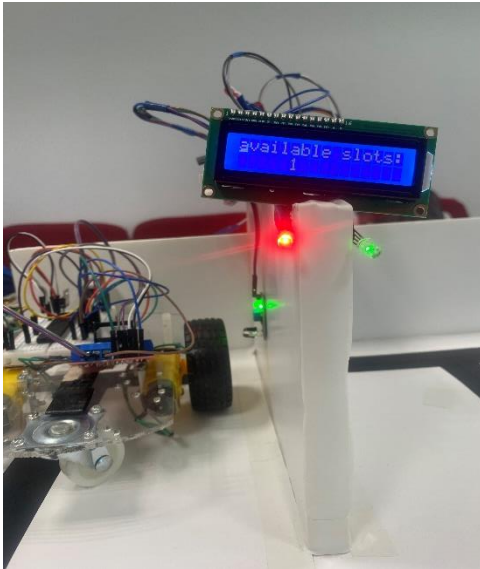
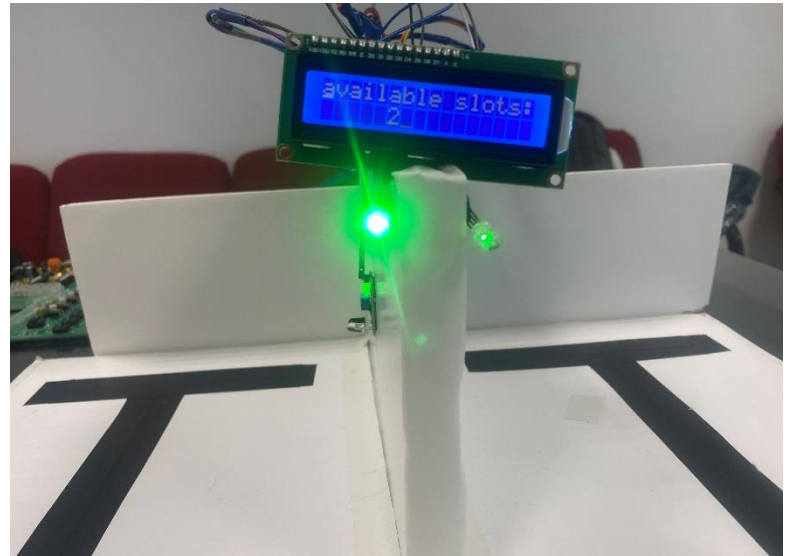**Figure 5. Garage LCD Decrements when Car enters the garage.**

Figure 6. Garage LCD Decrements when Car enters the garage.

Problems and Recommendations

We have faced a problem that the ESP-8266 was buffering the data it receives from the web, the option was to upgrade it to ESP-32, but the cost was high, we have also faced problems of continuously burning sensors that are available in the university. Also, we faced a problem with the programing board which causes the PIC to give faulty readings and commands.

Conclusion

In conclusion, this embedded system project is a complex and ambitious project that combines several different technologies and concepts to create a web-controlled car with an autonomous parking system using 2 PIC16F877A microcontrollers and IR sensors to follow the lines. The use of microcontrollers, IR sensors, and web-based control interfaces, as well as the integration of autonomous parking functionality, all add to the complexity of the project.

In summary, the embedded system project is well thought out, it includes several advanced features and technologies, and it makes good use of existing technologies such as PIC16F877A and ESP8266 to create a powerful and useful system. The use of IR sensors for navigation and the integration of autonomous parking functionality are also noteworthy features that add value to the project. Overall, this project shows a high level of skill and expertise in embedded systems development and IoT.