Princess Sumaya University for Technology

جامعة الأميرة سميّة للتكنولوجيا

Smart Car 877A

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Abstract:

The Smart Car 877A is a Bluetooth-controlled vehicle developed using the PIC16F877A microcontroller. It incorporates various sensors and modules to enhance its functionality and responsiveness. Key features include obstacle detection using ultrasonic sensors, flame detection with an alarm system, PWM-controlled servo and DC motors via an H-Bridge, an LDR-based lighting system, and safety controls like interrupt and reset buttons. Communication between the car and user is established through UART and an HC-06 Bluetooth module, enabling remote operation.

Introduction:

The Smart Car 877A is a microcontroller-based project designed to demonstrate the integration of wireless control, sensor feedback, and intelligent automation. Built using the PIC16F877A microcontroller, the car is operated remotely via an HC-06 Bluetooth module, allowing users to control movement and respond to environmental inputs in real time. The system is equipped with front and rear ultrasonic sensors to detect obstacles, a flame sensor for fire detection, and an LDR for ambient light monitoring. The car responds to these inputs by controlling a servo motor that raises a flag upon obstacle detection and activating a buzzer when fire is detected. It also features an H-Bridge circuit to manage the speed and direction of two DC motors using PWM signals. Additional safety features include an interrupt button that halts the car and a Master Clear button to reset the system. This project highlights the practical application of embedded systems and real-time control in a compact, multifunctional design.

Components Used and Purpose:

PIC16F877A Microcontroller – Main controller handling sensor input, motor control, and Bluetooth communication.

- HC-06 Bluetooth Module – Enables wireless control of the car via smartphone.
- 2 Ultrasonic Sensors (Front & Back) – Detect obstacles and prevent collisions.
- Flame Sensor – Detects the presence of fire and activates an alert system.
- Buzzer – Sounds an alarm when a flame is detected.
- Servo Motor – Raises a flag when an obstacle is detected; speed controlled via PWM.
- H-Bridge Motor Driver – Controls direction and speed of DC motors using PWM signals.
- 2 DC Motors – Drive the car forward and backward.
- LDR (Light Dependent Resistor) – Detects ambient light levels.
- LEDs – Turn on in low light conditions and off in bright environments.
- Interrupt Button – Immediately stops the car when pressed.
- Master Clear (Reset) Button – Resets the microcontroller and restarts the system.
- Capacitors (2) – Stabilize voltage to prevent lag during servo operation.

Our Design and Connections:

1. Pins and Connections

h-bridge -> RC[5,4,3,0] (RC1 PWM)

LDR -> RA0

LED -> RA1

Ultrasonic(1) -> RB4,RB5

Ultrasonic(2) -> RB6,RB7

Servo -> RC2

RX -> RC7

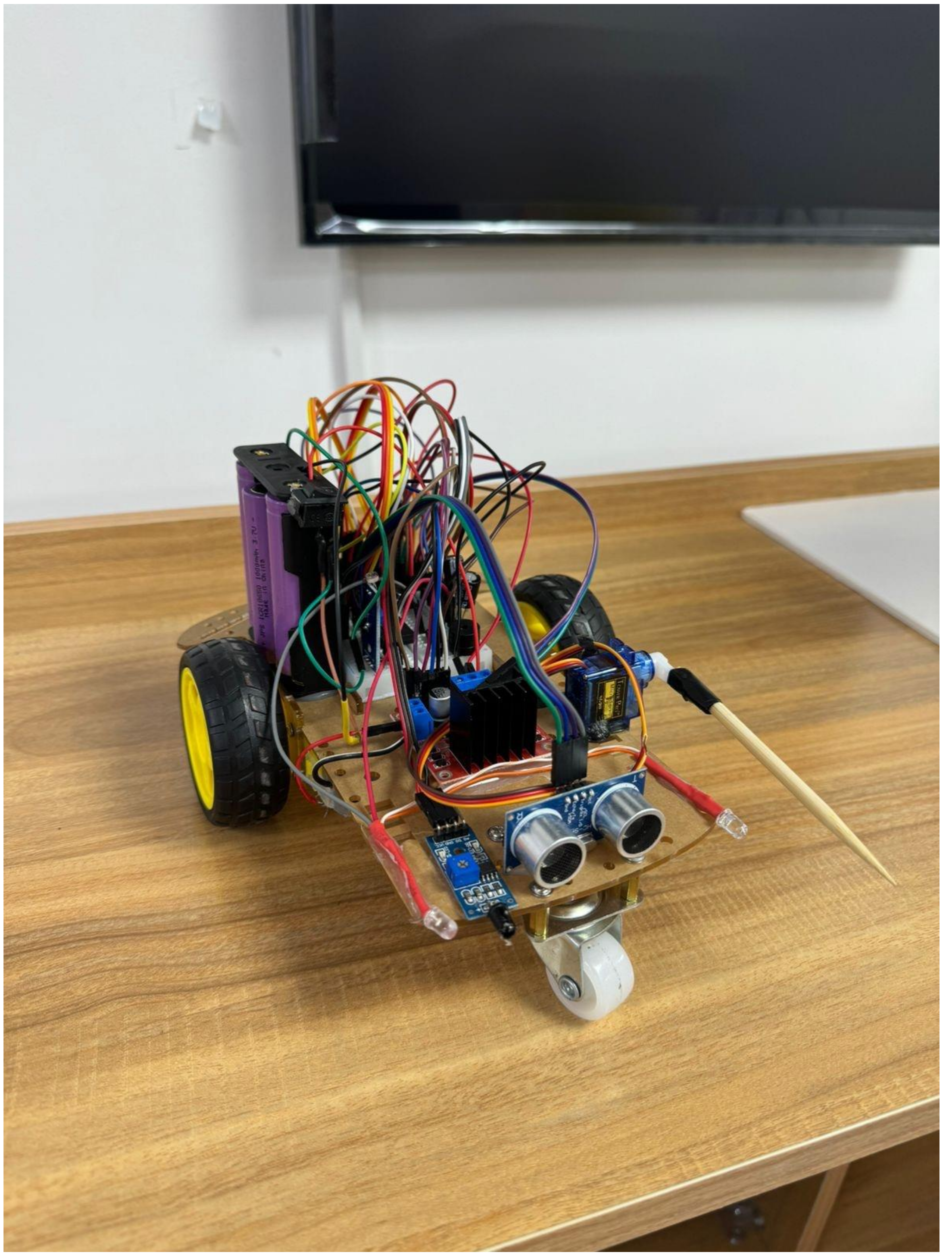
TX -> RC6

Flame Sensor -> RD0

Buzzer -> RD1

Push button -> RB0 (interrupt)

2. Hardware Design:



Problems and Recommendations:

One major issue encountered was lagging during servo operation due to sudden voltage drops; this was mitigated by adding capacitors. Additionally, interference in PWM signals occasionally disrupted motor control, suggesting the need for improved filtering or shielding. The flame sensor showed false positives in bright environments, highlighting the importance of environmental calibration. Bluetooth signal loss was also observed at greater distances or with obstacles. To improve performance, future versions should include voltage regulators, software-based signal filtering, and enhanced Bluetooth modules with extended range and feedback capabilities. Shielded cables and sensor housing could also improve reliability in noisy or variable environments.

Conclusions:

Smart Car 877A successfully demonstrates how Bluetooth control, sensor integration, and microcontroller logic can create a responsive and interactive vehicle. The project validates the use of PWM for motor control, UART communication for wireless input, and sensor fusion for autonomous behavior.