Gesture-Controlled Car Design and Implementation

A Wireless System Using ATmega328P and MPU6050

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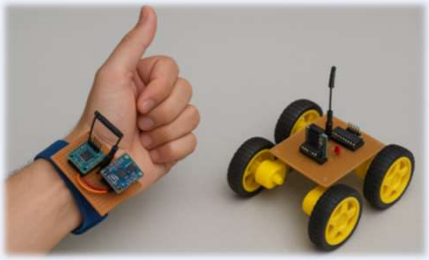
Introduction



In recent years, gesture-controlled devices have gained significant popularity due to their intuitive human-machine interaction. This project aims to design and implement a **Gesture-Controlled Robot** that moves based on the orientation and tilt of a handheld controller. The system uses the **MPU6050 accelerometer** to detect gestures, the **ATmega328P** for processing, and **RF modules** for wireless communication.

Background

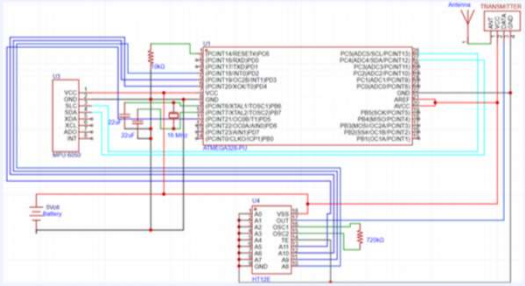
Robots have become an essential part of modern industry and daily life, with applications ranging from manufacturing to healthcare. Gesture control provides a more natural and intuitive way to command these robots, eliminating the need for traditional joysticks or remotes. This project explores the integration of sensor technology and wireless communication to create a responsive, real-time gesture-controlled robot.

Materials

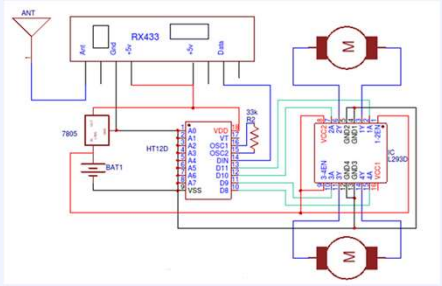
- **ATmega328P Microcontroller:** The core of the transmitter circuit, handling sensor data processing and signal transmission.
- **MPU6050 Accelerometer and Gyroscope:** Captures the hand gestures for directional control.
- **HT12E Encoder and HT12D Decoder:** Pair used for secure and reliable wireless data transmission.
- **RF Transmitter and Receiver Modules:** Allows wireless communication between the gesture controller and the bot.
- **DC Motors and Wheels:** Provides the physical movement for the robotic car.
- **Resistors (750kΩ in the transmitter side and 33kΩ in the receiver side):** Used for frequency stabilization and signal reliability.
- **Battery:** Provides the required power supply for the circuit.
- **Voltage Regulator:** Maintains a stable voltage supply for sensitive components.

Methodology

- Calibrate the MPU6050 to identify neutral positions for accurate gesture detection.
- Use the ATmega328P to process the accelerometer data and generate 4-bit control signals.
- Encode the control signals using HT12E and transmit them using the RF module.
- Decode the received signals using HT12D to drive the motors accordingly.
- Use the L293D motor driver to control the direction and speed of the robot.



➢ Transmitter Circuit of Gesture Controlled Bot



➢ Receiver Circuit of Gesture Controlled Bot

Results

- The system effectively detected forward, backward, left, and right gestures.
- Latency was minimized by reducing the pulse width for critical movements.
- Challenges included signal latching and interference, which were mitigated with proper grounding and signal timing adjustments.
- The overall system demonstrated reliable wireless control within a 20-meter range.

Conclusion

The project successfully implemented a gesture-controlled robot using an ATmega328P and MPU6050. This approach offers a user-friendly and intuitive way to control robots without direct physical contact, paving the way for more advanced human-machine interfaces.

Acknowledgements

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