

Speed Sensor

Micro Controller

Motors

Ultrasonic Sensor

Voice Recognition

Accelerometer

Microphone

Title: RC Car

Group Members:

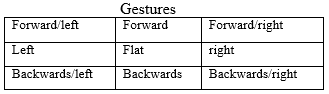
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Abstract:

A remote controlled car that is operated with alternative controls and assisted driving systems for users that are unable to use conventional controls. The user will drive the car using a gesture based control system that is wirelessly connected to the car. The car is equipped with assisted driving features that are able to avoid collisions and regulate speed.

1. Develop the motion controls for operating the vehicle.
   * The user will be able to rotate an accelerometer in different directions to control the vehicle.
   * The microcontroller on the user controller will read data from the accelerometer using SPI communication.
   * The microcontroller must determine the orientation of the accelerometer in terms of the following 9 gestures. Rotation will be defined by angles approximately 45 degrees (testing required).  
     
   * Successful implementation of this system can be demonstrated by using an accelerometer as an input to a microcontroller that will output the correct gesture via LEDs.
   * Ali will be responsible for the motion control portion of this project.
2. Develop a wireless communication system between the user controller and the vehicle.
   * The wireless communication between transmitter and receiver sections will be done using 433 MHz Radio Frequency signals.
   * ASK (amplitude shift keying) modulation technique will be used to modulate and demodulate RF signals.
   * The wireless transmitter and receiver will be implemented using an encoder IC HT12E and a decoder IC HT12D.
   * Communication has range of at least 20-200 meters.
   * Data can be transferred serially at the maximum baud rate of 2400bps.
   * The speed at which data will be transmitted is around 10 Kbps and transmitting power is approximately 10mW (to be verified in Lab).
   * Communication is only one way (controller to car).
   * Communication is not obstructed by obstacles such as tables or walls.
   * It is by design that the user have visual feedback of the vehicle.
   * Successful implementation of communication can be tested by switching LEDs.
   * Mohammed is responsible for the communication portion of the project.
3. Implement ultrasonic sensors to detect objects that are in the vehicle’s path to avoid collisions.
   * The microcontroller on the vehicle will sample distances from the vehicle and the closet object in its path using ultrasonic sensors.
   * The microcontroller on the vehicle will use this input to determine the distance between itself and obstacles in its path. The vehicle will automatically adjust its motion to avoid colliding with obstacles.
   * The vehicle should drive up to an obstacle and stop at approximately 10cm (testing required) away to avoid the collision.
   * Successful implementation of this system can be demonstrated by programming the vehicle to drive autonomously toward an obstacle. The vehicle will sample the distance it is away from the obstacle and it will stop to avoid the collision.
   * Matthew will be responsible for the collision avoidance portion of this project.
4. Develop a speed regulation system to assist the driver.
   * The microcontroller on the vehicle will read input from the vehicle to determine its speed. This input will come from a sensor that counts the revolutions of one of the tires on the vehicle.
   * The microcontroller will adjust the voltage applied to the motors to control the speed of the vehicle.
   * The microcontroller controls the voltage applied to the motors using a PWM signal.
   * The user should be able to select the relative speed that the vehicle travels however, the vehicle should accelerate smoothly between different speeds and drive at a constant speed.
   * Successful implementation of this system can be demonstrated by programming the vehicle to drive autonomously, regulating its own speed while it transitions from slow to fast to stopped.
   * Matthew will be responsible for the speed regulation portion of this project.
5. Develop preset maneuvers that the vehicle can perform autonomously and allow the user to invoke by command.
   * The vehicle will be programmed to perform specific maneuvers.
   * These maneuvers will have practical purpose such as pivoting approximately 90 degrees or travelling forward one meter (testing required).
   * While these maneuvers are performed, the vehicle will not respond to any input from the user except for an emergency stop command. Therefore minimal user input is required for testing.
   * The preset maneuver can be demonstrated by allowing the vehicle to execute its maneuvers in a controlled environment. If the vehicle is able to execute its maneuvers as expected, then the system is successful.
   * Matthew will be responsible for the preset maneuvers portion of this project.
6. Develop voice controls to increase user control over the vehicle (To be determined if practical).
   * The user will be able to speak into a microphone that is connected to the user's controller.
   * The microphone is an input for the voice recognition component. The voice recognition component will be programmed to trigger a response to the microcontroller in the user's controller if a particular command is recognized.
   * Example commands may be "on", "off", "fast", "slow", or something that defines a preset maneuver.
   * Successful implementation of this system can be demonstrated by using a microphone as an input to a microcontroller that will output the correct word via leds.
   * Mohammed will be responsible for the voice control portion of this project.