Environmental Sensing-Based Object-Following Rover (with real-time digital feedback controller)

Mechatronics- Graduate Research Project

Problem Statement & Goal:

The main goal of this project is to build an environmental sensing-based object-following rover. Our main objective can be divided into two main tasks: panning and following an object around. The Arduino installed on the robot receives two types of input. The first kind comes from an ultrasonic sensor -HC- SR04. This sensor is expected to measure the object's distance using ultrasonic waves. The second input comes from multiple proximity sensors that detect the presence of nearby objects. Both types of sensors are located on top of a 1 Dof pan mechanism that allows for a turning motion. Arduino then produces a motion control output that results in 2 types of movement. The first type is the turning motion that allows for the "head" of our robot to turn and track the object. This motion is done by using a servo motor that makes the "neck" of our robot turn. The second type of motion that this robot is capable of achieving is known as object following. This motion of the rover is controlled by a pair of DC motors via the motor driver. The rover is put into motion when an object is introduced in its sight, otherwise the robot will be in a dead state. The robot's detection range for both sensing mechanisms goes for a proximity of 20– 30 cm and 120 ° degrees of spherical proximity respectively.

Concepts learned while working in this project:

- **Design** and **implement** a **real-time digital feedback controller** in your term project.
- Principles of **digital logic and analog circuits** in mechanical systems
- Electrical-mechanical interfacing
- **sensors** and **actuators**
- D**igital control** implementation
- **Precision** design and **system integration**