Servo Control

Introduction

Servo motors are highly efficient and precise rotary actuators that find extensive use in a wide array of applications. Equipped with integrated feedback systems, these motors continuously monitor and adjust their rotational position to maintain precise control. The feedback loop, often using position sensors like encoders or resolvers, enables the motor controller to compare the actual shaft position with the desired position and make real-time adjustments, ensuring accuracy and stability even under varying loads or disturbances. As a result, servo motors are crucial components in robotics, powering precise movements in robotic arms and manipulators, as well as in industrial automation for CNC machines, providing accurate tool positioning for manufacturing processes.

The versatility of servo motors extends to other fields as well. In consumer electronics, they drive the precise movements of camera gimbals, enhancing image stabilization in photography and videography. Furthermore, servo motors play an essential role in medical equipment, where precise and controlled motion is vital for procedures such as robotic-assisted surgeries. With their ability to deliver consistent and repeatable performance, servo motors have revolutionized various industries, empowering automation and robotics while enabling enhanced efficiency and accuracy in a multitude of applications.

Mandatory Part

You will be given the following components:

- A microcontroller (Arduino Uno)
- 2 Servo motors
- 3 Light sensors - photoresistors
- 3 10KOhm resistors
- A breadboard
- Jumper cables

Design and implement a light-following system using Arduino Uno, a servo motor, and up to three sensors. The project should enable the servo motor to move and orient itself in the direction of a light source detected by the sensors. Students should perform testing to verify the accuracy of their light detection algorithm and motor movement. You can adjust the sensor positioning, algorithm parameters, or servo motor angles as needed to enhance performance.

Feel free to find a creative solution for the setup using your own materials or lasercut/ 3D printed parts (only use the 3D printers or laser cutter if you had an introduction).

Bonus Part

Now that your project works flawlessly with one servo motor, the bonus challenge will be to integrate a second servo motor for another angle. You should be able to design and implement a mechanism to syncronize the movement of the two servo motors. The dual servo integration should allow for smooth and coordinated tracking of the light source.

Submission and peer evaluation

To validate this project, you should submit the code in the given repository by the set deadline.

You will get your project evaluated during the next session and you will get to evaluate another team's project. Make sure all the team members participate in the project and are able to explain everything about the written code and the electronic components. The code for the mandatory part and the bonus part should be uploaded separately.

Safety Instructions:

Please use the electronics components safely:

• Power supply: Always use the correct voltage and current rated power supply for your Arduino board to avoid damaging the board or causing a fire.

• ESD protection: Electrostatic discharge (ESD) can damage electronic components, including the Arduino board. Avoid touching the pins and connectors of the board with

your bare hands. Use an anti-static wrist strap or touch a grounded metal object before handling the board.

• Overheating: Do not overload the board with too much current, as this can cause the board to overheat and possibly catch fire. Use external power sources and avoid powering high current devices directly from the board.

• Short circuits: Avoid creating short circuits on the board by ensuring that there are no loose wires or connections touching each other. Use proper insulation and avoid exposing the board to moisture.

• Software safety: Always use reliable and tested code when programming the Arduino board. Do not run code that could potentially cause harm to people or property. Always use the appropriate safety precautions when testing and using your projects.