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SUBJECT: Servo Light Finder

Description:

The servo's movement range is about 180 degrees and is controlled with a PWM signal. The signal's frequency is around 125 Hz and the pulse width is approximately 6% to 30% duty cycle. The servo moves the arm in the range according to the width of the pulse.

The system is primarily defined by two behaviors FULLSWEEP, LOCALSWEEP and two modes, FOLLOW THE LIGHT and AVOID THE LIGHT.

Modes:

> **Follow the Light Mode**: Finds the angle of MOST illumination. The LCD displays 'FTL' and pressing UP on the joystick activates this mode.
>
> **Avoid the Light Mode**: Finds the angle of LEAST illumination. The LCD displays 'ATL' and pressing DOWN on the joystick activates this mode.

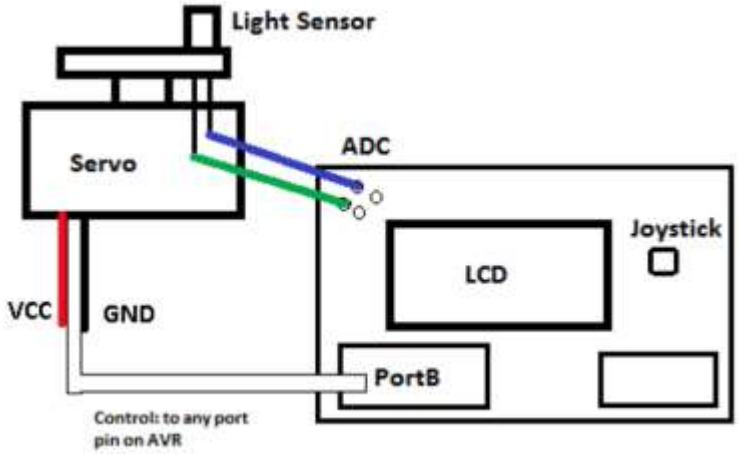
Behaviors:

In each mode, there are two behaviors: FULLSWEEP and LOCALSWEEP. The FULLSWEEP behavior is automatically followed by the LOCALSWEEP behavior. While in the FULLSWEEP behavior, the system does not respond to any button presses.

> **FULLSWEEP:** A full sweep of the range is performed starting at 0^o and sweeping to 180^o in about 20^o increments. An illumination measurement is taken at each step. The optimum angle (most light or least light depending on the mode) is decided, called the initial primary angle and is displayed on the left 3-character positions on the LCD as a value in the range [0,180]. The next behavior should then commence.
>
> **LOCALSWEEP:** Starting at the primary angle, the servo continuously moves in the cycle given below, finding the optimum of the three angles:
>
> $$\text{primary angle} > (\text{primary angle} - 10^o) > (\text{primary angle} + 10^o)$$

After each cycle, a new primary angle is decided and displayed. If the primary angle is at the limit of the servo range, the local search pattern will not involve one of the $+10^o$ or -10^o measurements.

System Block Diagram:



Completeness/Functionality:

The project is fully functional. Both the FTL and ATL modes full sweep and local sweep, where after each cycle the primary angle and the current mode is displayed to the LCD. All external hardware functions correctly as well, where the servo changes angles accurately, the LCD displays data normally without any bugs or flickering, and the light-detecting resistor properly reads light values to the AVR.

Usage Manual:

This project is to be run on the AVR Butterfly and Atmega169P through Microchip Studio. Connected to the AVR Butterfly is a servo motor that is connected to pins GND, VCC, and PB5. Attached to the servo, is a light-detecting resistor that is connected to the two top left pins of the AVR Butterfly.

When the program is run, the program will wait until the user selects a mode through the AVR Butterfly joystick. Pushing up on the joystick selects the follow the light mode (FTL) and pushing down on the joystick selects the avoid the light mode (ATL). When the user pushes right, the program will go into FULLSWEEP behavior, where the servo will go from 0^{o} to 180^{o} and then print to the LCD screen the current mode and the primary angle of the current mode. After FULLSWEEP, the program goes to LOCALSWEEP behavior and the servo will go to the primary angle and performs a cycle of primary angle, primary angle + 10, and primary angle – 10, printing the new primary angle and the current mode to the LCD after each cycle. This cycle repeats until next right joystick push.