CECS 346 Project 2 – A Simple Smart House

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Preparation:

You will need a LaunchPad, 1 stepper motor with driver, 1 obstacle avoidance sensor.

Starter project: Lab 4

Reference Project: Stepper_Motor

Purpose:

1) learn how to use a stepper motor;
2) learn how to use an obstacle avoidance sensor; and
3) learn how to build an embedded system with timer interrupt and external interrupt.

System Requirements:

Design a simplified smart house with the following automatic control: you will use a stepper motor to simulate a garage door, an onboard push button to simulate a garage door button, three onboard LEDs to indicate garage door status, and an obstacle avoidance sensor to detect any object approaching/leaving the house. In this project, you are required to implement the following features:

1. Use the three LED to indicate garage door status: green indicates that the garage door is closed, blue indicates that the garage door is open, and flashing red indicates the garage door is moving.
2. Stepper motor direction: pointing downward indicates that the garage door is closed, pointing upward indicates that the garage door is open.
3. The system starts with the green LED on, stepper motor pointing downwards.
4. Open garage door operation: the green LED will be turned off, the red LED will start flashing with a frequency of 4Hz(0.25s on and 0.25s off), and the stepper motor will start rotating to the opposite direction. The red LED will keep flashing until the stepper motor finishes 180 degree rotating pointing upward. After that, the blue LED will be turned on.
5. Close garage door operation: the blue LED will be turned off, the red LED will start flashing with a frequency of 4Hz(0.25s on and 0.25s off), and the stepper motor will start rotating to the opposite direction. The red LED will keep flashing until the stepper motor finishes 180 degree rotating pointing downward. After that, the green LED will be turned on.
6. When the obstacle avoidance sensor detects an object moving inside a 15cm distance, an open garage door operation will be triggered if the door is closed. **If the door has already been open, no operation is needed for both the LED and the garage door.**
7. When the obstacle avoidance sensor detects an obstacle moving out of 15cm distance, a close garage door operation will be triggered if the door is open. **If the door has already been closed, no operation is needed for both the LED and the garage door.**
8. The onboard push button **sw1**(left switch) will be used to toggle garage door open and close operation. When the garage door is open, touch the push button will trigger a close garage door operation; when the garage door is closed, touch the push button will trigger an open garage door operation.

Technical Specifications:

You are required to use SysTick timer to implement the timing for LED flash and stepper motor steps, both edge interrupt for obstacle avoidance sensor output, and negative edge interrupt for push button.

Deliverables:

1. Demonstrate your system at Zoom. The following 6 test cases will be tested.

   1) When the garage door is closed, move an object from out of range to within range to observe an open garage door operation.

   2) When the garage door is open, move an object from within range to out of range to observe a close garage door operation.

   3) When the garage door is closed, press sw1 to observe an open garage door operation.

   4) When the garage door is open, press sw1 to observe a close garage door operation.

   5) When the garage door is closed, press sw1 to open garage door, then move an object close to the sensor to observe nothing happen to the stepper motor and onboard LED. After that, move the object away from within range to out of range to observe a close garage door operation.

   6) When the garage door is closed, move an object from out of range to within range to open garage door, then press sw1 to observe a close garage door operation.

2. A video or a link to your video that records all 6 test cases listed above.

3. All source code as separate files.

4. A project report: follow the project report template for report format. The following information needs to be included in your report:

   a. Flowchart for your software design.

   b. Hardware schematic and picture of your embedded system in hardware design session.

   c. Video link in Operation session.