CPE 4010 – Sensors, Actuators, and Integration Project
Red Light - Green Light Game

Description:

The objective of this project is to implement **"Red Light - Green Light"** game environment from *Squid Game* movie using Arduino, multiple sensors, and actuators. The basic principle of this game is one person stands at one end of the field with a group of players standing on the other side. Facing away from the group, the lone player turns back and front saying "Green Light" and "Red Light" as fast or as slow as he/she wants. The group can only move forward during "Green Light" period (when the lone player is not looking at) and stand still during "Red Light" period. If you reach the other side without getting caught, you win. But if you're moving while the lone player turns to look at everyone else or the time is up, you're eliminated.

You can watch the PG-13 (no blood) version of the game scene in the *Squid Game* movie from this link: https://www.youtube.com/watch?v=Ww9HCin8ORs

Note: You may watch the original movie scene if you wish at your own risk!

Scenario and Implementation:

In this project, you must implement a peaceful version of this game scenario on a cardboard or thin plywood sheet.

- For the lone player, you will use the ultrasonic range sensor (HC-SR04) placed (attached/glued) on top of a servo motor so that it can turn back and front 180º.
- You will also use a Red and Green led facing towards the player to be turned on during "Green Light" and "Red Light" periods.
- You will use a buzzer to generate two significantly different tones in these periods.
- The game should be completed in 60 sec by the player moving from one side to the other successfully. Otherwise, the player will be eliminated. To show the time left, an LCD display will be used to down count from 60 sec to 0 sec.
- The elimination of the player will be done with another servo motor attached to left or right side of the game field with a long (plastic or cardboard) arm horizontally movable (such as up to 90º or 180º depending on the placement) so that it can sweep parallel to the surface hitting the player and dropping from the field during elimination.
- The player will be a lightweight target that can move on the field towards ultrasonic sensor (lone player in this case). It should also be tall enough which can be seen easily with the ultrasonic sensor without getting effected by other objects around.
- The game should start with a push button. When for any reason, the game is completed, it can be restarted by the same push button. The starting states should be initialized!

Minimum requirement: Moving the player manually by hand or with a magnet under the field. In this case the base of the player should have a light metal. *Green Light* and *Red Light* periods have to be chosen as 2 sec and 3 sec, respectively. When the rotation of the ultrasonic sensor is completed towards the player (Red Light period), the sensor would make continuous range measurements to determine any motion during Red light period. *Consider discarding small changes due to measurement error during consecutive sensor reading!*
External and timer interrupts should be used to detect push button and down counting timer (60 sec to 0 sec).

Stretch Goal: The player object will have a hook in front of it which can be connected to a step motor with a string. The stepper motor can be controlled with a second Arduino where it can be activated with a push button. In this case a thread spool (or a pulley) can be attached to the step motor with the string wound/unwound. Another push button can unwind the string in its original position.

Challenging Goal: The stepper motor can be controlled with MPU-6050 accelerometer. When the tilt angle on one axis is above 45º, the stepper motor will wind the string making the player move forward. When the tilt angle is below -45º, the step motor will unwind the string. Also instead of fixed time periods of 2 and 3 sec for Green Light and Red Light, you will use random numbers (for each move) generated in the code that set the period between 1 to 4 sec randomly in each cycle.

Project Requirements:

- You can work alone or as a group of 2 people.
- Minimum requirement is expected for the full grade. Stretch and challenging goals are optional and will be reflected as an extra credit. If you aim to complete "Challenging Goal", the number of people in the group can be 3 demonstrating significant contribution from every group member clearly defined in the report.
- Achieving the minimum requirements, any innovative solution will be credited.
- Projects directly copied from external resources will not be accepted.
- Project report should include a cover page with group members names, date, and title. A description of the problem, component list, implementation steps, how the workload for the project has been distributed amongst the group members, picture of the setup and game field, the codes and a conclusion should be included.
- A 10-minute in-person demonstration of the project is required which will include a Q/A session. No recorded videos, or projects without a demonstration will be accepted for grading.

A game field layout for your reference:

Note that this is just a sample layout. You can use your own layout that satisfy the requirements.