Lab 2: Game Control with Joy Stick, Gyro and Accelerometer

last update: 02/21/24

General Information

Lab Mode: Remote. You need to work on the lab remotely on your own computer with your own lab kit.

Lab Due Date: Posted in Blackboard. You need to submit all the required deliverables on or before the due date.

Lab Report Submission: Submit via Blackboard. No email submissions are accepted

Lab Contents: Additional requirements applied for EECE.5520. EECE.5520 (graduate level section) students need to complete additional lab requirements.

Lab Description

This lab is to design a game controller for a "Snake" game. The "snake" in the game needs to eat the apples that randomly appear in the arena. The snake can move in four directions: up, down, left, right. It grows its length by one unit every time an apple is eaten, and the player earns 10 points. The snake cannot hit the boundary of the arena. The game ends when the snake hits onto the boundary.

The game is initially controlled with four keys on the keyboard: "w", "a", "s", "d". Your task is to alter the control of the game with the following:

(1) use a joystick to control the movement of the snake
(2) use the gyro sensor (MPU-6050) to control the movement of the snake. For example, tilting the sensor board to the left will cause the "snake" to move to the left.
(3) beep the buzzer when an apple is eaten.

Note that your design does not have to support both (1) and (2) at the same time, although it is possible to support both simultaneously.

Additional requirements for EECE.5520 students

(4) "Shake" the accelerometer to double the number of points for eating an apple. To do that, you need to measure the acceleration from the sensor (MPU-6050), design a criteria (algorithm) to detect if the sensor is being shaken, if so, notify the game to double the points for the next apple (so now 20 points per apple). After the next apple is eaten, revert the points back to normal (i.e., 10 points per apple).
(5) You need to change the color of the apple to "golden" to indicate the points are doubled for the new apple. Then change the color back to red after the golden apple is eaten.

Lab Materials:

Required Parts:

Part name	Quantity	Notes
Arduino board	1	
Joystick	1	

MPU-6050	1	gyro and accelerometer
Active Buzzer	1	
assorted jumper wires	as needed	

Required Software:

(a) Arduino IDE: https://www.arduino.cc/en/main/software
(b) The resource files (sample code and tutorials) from Elegoo:
   https://www.elegoo.com/download/
(c) Python3 : https://www.python.org
(d) Lab 2 sample code from our course github repository:
   https://github.com/ACANETS/eece-4520-5520-labs

Lab Instructions

Step 1:
(a) You can first check the resource files under the following folders

   2.12 Joystick

   2.15 MPU-6060 (gyro and accelerometer)

   2.5 Active Buzzer

   2.4 Serial Monitor

These folders contain useful instructions on hardware wiring and sample code to drive these components. You are strongly suggested to run the above examples on your Arduino kit, and build upon them to implement Lab 2.

Step 2:
(a) To run the game program, you need to have Python3 installed. You can choose the appropriate installation package for Windows, Mac or Linux. After you install Python3, you need to then install "pyserial" Python package using "pip3 install pyserial" command.

(b) Try to execute the pyserial-test.py and Serial-RW.ino in the Lab2/ folder to test the communication between the host and Arduino via the serial port. Note how the two sides send messages to the other side.

(c) It is important to extend the pyserial-test example to a more comprehensive one that allows the host and the Arduino to communicate control and status information.

Step 3:
Open a terminal application. Play the snake game first by type in the following commands in the terminal:

```
cd micro2-labs/lab2
python3 snake.py
```

Read the source code (in Python) to understand the structure and how keys are used to change the movement direction of the snake, and how the "apple" is drawn, and how the scores are displayed.

Step 4:
You need to wire up the joystick and write code on Arduino to read the output from joystick. The output from the joystick will be used to control the direction of the snake movement.

Step 5:
Use your design communication protocol to send the direction information from Arduino to host. Modify the snake game to control the movement of the snake using the communication protocol you define in Step 2(c).

Step 6:
Wire up the MPU-6050 sensor board. Use output from its Gyro sensor to control the movement of the snake.

Step 7:
Beep the buzzer if the apple is eaten.

EECE5520:
<**For 5520 Students>**: you also need to use the accelerometer to detect shaking of the sensor. if "shaking" is detected, then change the score from 10 to 20 for eating the apple. Also change the color of the apple>

Step 8:
Test and debug your design.

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Please refer to lab demonstration and report guidelines for demonstration and report writing.