A2: Embedded Computing with Particle

Assigned: Feb 16 2024 **Due: 11:59 pm EST March 1 2024**

***Last Updated**: 2/13/2024, 5:59pm EST*

Hardware:

Particle Argon, Particle-Grove Shield, Sparkfun Qwiic Shield,
QwiiC Accelerometer (MMA8452Q based), 1 x Qwiic Cable, 1 x RGB LED

Project Description:

You will build a simple gesture detector using the Particle Argon and the Qwiic-based accelerometer we have provided and be able to send the gestures to the cloud. The aim of this assignment is to learn how to write basic microcontroller code, interface with a sensor, and stream data over the serial port (for debugging) and to the particle cloud. We also want you to use some of the particle programming constructs demonstrated in the class (Particle Variables, Particle Functions).

Part A (Detecting 4 gestures and showing a visual notification):

Using the Accelerometer library on Particle Cloud (search for SparkFunMMA8452Q), you will sample raw data from it and do some preprocessing (basic filtering) to detect four simple gestures on the microcontroller itself. You are expected to detect 4 drawing gestures (a line, a circle, a square, and a triangle). You are welcome to use whatever heuristics you like to detect the gestures, but you must detect the particle Argon itself. While it is tempting to stream all the raw data from the sensor to a laptop or the cloud, often for multiple reasons that are not tenable (e.g., for battery lifetime or for communication bandwidth). Next, connect the Grove chainable LED (tri-color, Red, Green, and Blue in one) to the Particle-Grove Shield. Assign each of the 4 gestures to a color (e.g., Line=Red, Circle=Green, Square= Blue, Triangle= Magenta) so that when you do the gesture, the appropriate color is shown on the LED. At rest, you can switch the LED off.

NOTE: You are free to choose a fixed IMU orientation and plane of reference for your gesture (axes on which your gesture is detected), but the gesture itself should resemble a line/circle/square/triangle. **However, if you assume a plane and orientation, all gestures should be in the same plane.**

Part B (Connecting to the Cloud):

Next, send the gestures recorded to the Particle cloud using the Particle PubSub functionality. Your goal is to show that the detected gesture is sent using a terminal's “particle subscribe” command.
Additionally, using the particle cloud function to implement a function wherein you can send the gestures you want to detect (e.g., “up-down”), and only those gestures are sent over the pub-sub channel, and the rest gestures are not sent.
Reference: https://docs.particle.io/reference/device-os/api/cloud-functions/particle-function/

Part C (Detecting more complex gestures):

To make it more interesting, implement a way to detect more complex gestures, for example, detecting if the user draws any 3 (three) of the alphabet (“a” - “z,” or “Aa” - “Z”) in the “air” using the accelerometer. For Part C, you can just output the detected gesture character using the Particle PubSub functionality and show it using “particle subscribe” on the terminal or even just using the “particle serial monitor” if you send it over the serial port.

Deliverables:

(a) Particle Source Code, including information on how to test and run it.
(b) Video showing the output of all the parts working (A, B, and part C).
(c) Demo your system during the TA or Instructor OHs

Grade Rubric

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Part A (Focus: accuracy of gesture detection): 35%
Part B (Cloud Connection) : 15%
Part C (Accurately detecting 3 “alphabets”) : 35%
End-to-End Demo : 15%
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Total Pts : 100%
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