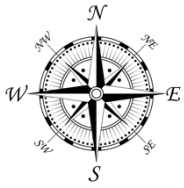
Alexandria University
Faculty of Engineering
Computer and Systems Engineering Department

Embedded Systems
Assigned: Sunday 4th Mar, 2018
Due: Sunday 11th Mar, 2018

Arduino LAB

Assignment 2

1-Arduino Compass (Only for the groups who have the LSM303D):



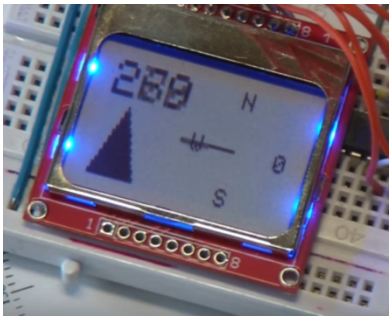
A **compass** is an instrument used for navigation and orientation that shows direction relative to the geographic "cardinal directions", or "points". Usually, a diagram called a **compass rose**, shows the directions north, south, east, and west as abbreviated initials marked on the compass. When the compass is used, the rose can be aligned with the corresponding geographic directions, so, for example, the "N" mark on the rose really points to the north. Frequently, in addition to the rose or sometimes instead of it, angle markings in degrees are shown on the compass. North corresponds to zero degrees, and the angles increase clockwise, so east is 90 degrees, south is 180, and west is 270. These numbers allow the compass to show azimuths or bearings, which are commonly stated in this notation.

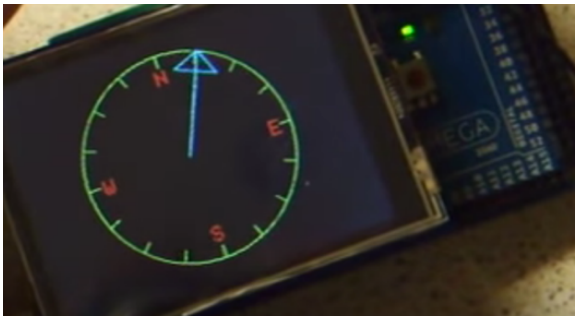
It is required to create an efficient compass using the LSM303D / HMC5883l and display it on the Graphic LCD (Nokia 5110).

In order to understand how to use the Graphic LCD and display the compass rose please refer to this youtube video with similar project: https://www.youtube.com/watch?v=zo_ZA-SmXtg

You are required to deliver a similar project with the same display specifications (Notice the diagram and the angles). In addition, you are required to add a fixed coordinate like the Qibla (135° from North clockwise) on the diagram.

Below are some photos of acceptable compass designs. (You are free to choose a suitable one).





Requirements

- Place the Nokia Screen and LSM303D sensor firmly on the breadboard to start getting the compass readings.
- Use this link to get the suitable Screen connections and library for interfacing the Arduino: https://learn.sparkfun.com/tutorials/graphic-lcd-hookup-guide .
- (**IMPORTANT**) Please read carefully the **resistors** values.
- Use the Nokia Screen to draw the compass (compass diagram).
- Test the screen update (refresh rate) with variable data (not necessary from the sensor) to illustrate the expected heading updates.
- Start using the LSM303D compass to get the current heading.
- Add the fixed coordinate (Qibla).
- Make sure that the screen updates itself with an acceptable interval to reflect the sensor movements.
- Bring your project during the next LAB and be prepared to explain your work.

2- 2-Axis Servo controlled by the Gyro + Accelerometer (Only for the groups who have the MPU6050):

The idea is to connect two servo motors such that they rotate on different axes. 2 Axis-Motors are quite useful in real life e.g. Robot arms. Controlling the movement of these motors can be done with various controllers among them are the thumb joystick (Playstation analog button) and gyro + accelerometers.

It is required to control the movement of the 2 axis motors using the MPU6050 by combining both the gyroscope readings and the accelerometer readings. In order to understand how this can be done, please refer to the complimentary filter explanation which was done during the previous LAB:
http://d1.amobbs.com/bbs_upload782111/files_44/ourdev_665531S2JZG6.pdf

To practice the motor movements and how the motion is controlled, you are first required to use the Joystick shields to control the motors. Please keep in mind that the joystick button will always return to its initial position which may cause the servo motor to return to the previous position. Such movement should be compensated to ensure that the servo motor stays at its final position.

For servo connections and library please refer to last term's LABs

For joystick connections and codes please refer to this link:
http://www.elecfreaks.com/wiki/index.php?title=Joystick_Shield

Requirements

- Place the Servo motors firmly on a custom made surface (polystyrene for example) and make the suitable connections with the Arduino and the MPU Sensor.
- Combine both readings from the sensor (Acceleromter & Gyro) to control the servo motors rotation.
- Make sure that the movements are stable (not so quick and the servo remains at the final position).
- Try fixing a pencil above the Servo arm and use it to draw on paper to make sure that the movement is steady (You may be asked during the discussion to fix a laser pointer and trace a line drawn on the projector).
- Bring your project during the next LAB and be prepared to explain your work.

Good Luck