

Assignment 2 Initial Guidance

This guidance is issued prior to release of the formal Assignment 2 brief, to help you get started.

Assignment 2 will be worth 25% of your module grade and will provisionally come due at the end of Semester 2 Week 2.

Report Phase 1 – “playing” – initial experiment with VL53L1X

As you have obtained measurements from 5 drops of the ping pong ball in the Week 11 lab (or possibly in a Week 12 catch-up lab), you can start this part of your Assignment 2 Report now.

You should have exported your data from the command line interface by some means, and the first thing you should do is to graph up this data. At the moment, your data is almost certainly just five sequences of range measurements (without time measurements). You can still graph these in Excel – the horizontal axis will just be a sequence (measurement 1,2,3 etc.) rather than showing the measurement time.

Can you also graph the means of the 5 measurement series, and produce error bars of your data points (use standard error which is standard deviation divided by the square root of the number of measurements used for the mean)? To what extent is this meaningful with these experiments?

Next, write up what you did: document parts you judge to be significant, using screenshots (and photos if obtained) to support your writing.

After this, write up what questions have been thrown up in your mind from this initial experiment, and begin to research the answers. Some questions you should try to address are:

- Why did you connect particular pins? How does the I²C bus work? Why does an I²C bus have the name it has?
- How does the data you obtained compare with the theory outlined in the Week 11 Lab Script?
- Why doesn't the rangefinder show a reading when the object is very close to it?*
- What is the minimum distance at which the rangefinder begins to show a reading?
- What are the units of measurement in which the readings are given?
- How could you alter the demo code to get a time measurement along with each range measurement?
- What is the actual rate of measurement generated by the demo code (measurement frequency)? Note that the mention of “20 Hz” given in the Week 11 Lab Script is a very optimistic estimate. How could you edit the code to come up with a calculation of the measurement rate?*
- In one part of the demo code, a class is created. What is your understanding of this part – can you explain what each segment of it achieves? How about other aspects of the overall code?
- Bonus: how could you alter the demo code to facilitate automatic saving of the generated data in an appropriate format?

As stated above, **you will need to do some research** (independent, self-guided reading) for some of the above questions. Relevant resources (manuals, datasheets etc.) are provided in the 'Assignment 2 Initial Guidance' section on Canvas – but you don't have to restrict yourself to these. You could also visit the [VL53L1X 'WaveShare Wiki' page](#), for example, for more resources. Note that some resources refer to an API and other software – you don't have to engage with these pieces of software. This guidance document assumes that you are interacting only with the demo software plus modifications you make to it. (You will be making the modifications in Phase 2.)

**A lot of 'red herrings' were thrown around by us in the Week 11 lab about this question. It isn't necessarily a calibration or coding issue...*

***You are not being asked to find ways to increase this rate as originally stated in the original Lab 11 script.*

Report Phase 2 – a more rigorous approach with the VL53L1X

This part of your Report will be based on work you do at home [and/or in following lab session(s) as advertised in the various Canvas announcements.] As mentioned in Lab 11 and subsequent announcements, you can collect your VL53L1X in Week 12 (email Dave) to take home and experiment further with it, if you wish. This, and/or taking advantage of extra Week 12 lab time, could help you with Phase 2 although it is not compulsory.

For Phase 2 of the Report, you need to start by trying to address all of the above questions from Phase 1, by actually altering the demo code and testing the results. Clearly, to fully answer some of the above questions would require you to examine and edit the demo code and run further experiments.

Except for the first question, your further experiments don't necessarily need to be with a ping pong ball in a tube; for example, you could trial new code by getting arbitrary range measurements from an object you hold in the field of view of the sensor. (Although it is only Class 1 and should be safe, make sure not to point the laser emitter at anybody – including yourself – or accidentally focus it through optics.)

Report Phase 3 – interfacing the Grove IMU 9DOF (ICM20600+AK09918)

You will be undertaking the lab work for this part during the Semester 2 Week 1 lab – more information will be shared nearer the time, along with the formal Assignment 2 brief. There will also be an opportunity to work on Phase 2 during the Semester 2 Week 1 lab.

The formal Assignment 2 brief will incorporate further questions relevant to Sensors, Linux multi-threading and IPC.