Template for ELEC230 Assignment 2 2021-22 (put title here)

[Don’t put your name here or in any filenames – it’s anonymous marking]

[Academic Integrity Declaration here]

Note (don’t include this note in your submission…)*:*

The Assignment script and extensive earlier guidance gave you a lot of ideas of things to include in your report. Some students are finding it difficult to structure these. The below gives you a possible structure which you may find helpful. So if it helps you, you can use the following section headings and hints.

However*, the overall purpose of this Assignment is to allow you to provide evidence of how you have engaged with the practical laboratory work and associated topics given in the learning objectives. Therefore, there is considerable scope in how you choose to address certain points, and creativity is welcomed. You may have already structured your report in a different way; as long as it meets the Assignment instructions that’s fine. While the structure outlined below would be a good way to set out the report, please do not treat your Report as a ‘tick-box’ exercise: we are interested in how well you have implemented and understood what you have done and the associated topics. There are fairly obvious core issues to report on in terms of the lab work you’ve done, but, as it says in the script, you might not get through every last one of the other details in the script, and that’s OK. You might give most attention to some aspects you find more interesting and that is also OK. Answering every single question would be less important than a high quality of work on the questions you do answer.*

Part 1 (50%) Range Finder

Introduction, Method and Design

In this part, set the scene for your work with the Range Finder.

Introduction: Theory and background about the laser rangefinder.

Write some theory and background about the rangefinder.

Method: Interfacing the range finder with the Pi via the I2C bus

For example, include some theory of I2C as directed in the questions, and also discuss and show how you practically made the connections of particular pins etc. and checked for them from the command line, etc. Photos and screenshots would obviously help here.

Method: obtaining range measurements

In this part you could discuss how you imported the demo code and got it working for the rangefinder. Again, photos and screenshots would presumably help.

Method: further work

If you did either of the following, then this would clearly be a good place to discuss and explain your method for one or both of these aspects:

- [Questions 1(d) and 1(e)] Attempted to modify the code, to record the measurement time and measure or estimate the measurement rate, and did some work to test this
- [Bonus] Tried to modify the code to save output to a file

Design: 5 drops of the ping pong ball

Discuss how you set up and went about your experiment. Discuss any aspects of this you believe to be significant. Perhaps this is a good place to talk about the minimum distance at which the rangefinder provides a reading, and how this is relevant to your experimental work. You could include a photo if you have one.

Design: further work

Discuss how you went about the testing for the 'further work' in the bullet points above.

Note: if you want to combine the 'method' and 'design' for each aspect, above, you can.

Results

Results: Ping pong experiment [and add subtitles for your other work]

This would presumably be a sensible place to put your answer to question 1(b), plus any results of your possible further work towards 1(d)/(e) and the Bonus, as mentioned in the bullet points above.

It would help here to explain the units of measurement in the data printed to the terminal.

Discussion

Discussion: Ping pong experiment [and add subtitles for your other work]

It would seem to be important here to analyse your results, so this would be a great place for 1(c). You could also discuss your other results (from the Results section), summarising what they show. Here it would seem relevant at some point to discuss *why* the rangefinder doesn't show a reading when an object is very close to it.

Discussion: analysis of the demo code

You could also discuss your understanding of the overall demo code, what each segment of the code achieves and the question of classes.

Discussion: Comparison of results with theory

You could use the Discussion section to try and compare your results, particularly for the ping-pong ball experiment, with the theory in the Week 11 Lab Script, and even do some mathematical analysis to compare the two. [If you find the Maths and Physics in the script a bit too challenging, you could try and do a simpler comparison with your general expectations from the laws of gravity, instead.]

Part 2 (30%) IMU

Introduction, Method and Design

In this part, set the scene for your work with the IMU.

Introduction: Theory and background about the IMU

Write some theory and background about the three devices included in the IMU.

Method: interfacing the IMU via the I2C bus

You could report here on relevant parts of your answer to 2(a), in terms of the practicalities of interfacing the hardware with the Pi. Include any relevant photos and/or screenshots.

Method: obtaining measurements with the accelerometer and gyroscope

You could report here on relevant parts of your answer to 2(a), in terms of the practicalities of importing the code and setting up the system to take accelerometer and gyroscope readings. Include any relevant screenshots.

Method: obtaining measurements with the magnetometer

You could report here on relevant parts of your answer to 2(a), in terms of the practicalities of importing the code and setting up the system to take magnetometer readings. Include any relevant screenshots.

Design: experiments with the three IMU sensors

Discuss how you set up and went about any experimentation with the three sensors to make sense of the readings you were seeing. (Your experimentation was probably geared around answering some of the bullet-point questions in the Part 2 assignment script, but possibly you investigated other aspects too.) Discuss any aspects of this you believe to be significant. Perhaps this is a good place to talk about the minimum distance at which the rangefinder provides a reading, and how this is relevant to your experimental work. You could include relevant photos if you have them.

Results and Discussion

You might prefer to combine the 'Results' and 'Discussion' sections for each sensor, if you find them hard to separate; that's what I've done here. But feel free to separate them if you wish.

This would be a good place to put the parts of your answer to 2(b) which are relevant to each section below i.e. an account of the results of your experimentation (which was probably geared around answering some of the bullet-point questions in the Part 2 assignment script, but possibly you investigated other aspects too.) Include relevant screenshots and photos. It would clearly also help here, as part of each section below, or in the 'Design' section above, to explain the units of measurement in the data printed to terminal.

Results and Discussion: accelerometer

See above. Clearly your focus will be on the 2nd and 3rd bullet points plus any other points you think are interesting ['Bonus'].

Results: gyroscope

See above. Clearly your focus will be on the 5^{th} and 6^{th} bullet points plus any other points you think are interesting [‘Bonus’].

Results: magnetometer

See above. Clearly your focus will be on the 7^{th} and 8^{th} bullet points plus any other points you think are interesting [‘Bonus’].

Part 3 (20%) Supplementary Questions

Simply answer the questions on Canvas according to the rules laid out there. You will need to do a little research within Canvas or more widely, and think about your answers, while sticking to the word limit.