

**ENGD2103 EMBEDDED SYSTEMS FUNDAMENTALS**  
**Laboratory guidance notes**  
**Part 1: Hardware Construction**

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v1.0

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### Version record

Version	Notes	Date	By
1.0	Initial version	29/09/22	MAO

## PLEASE READ THIS CAREFULLY

This is the first of a series of guidance documents to get you started with your Embedded Systems Fundamentals project. They are aligned with the key aspects of the coursework specification, and thus this document should be read in conjunction with the coursework specification document. These documents will start off with some fairly close guidance - however as you develop your skills the notes will provide less and less detailed guidance and become more of an overview.

### 1 Aims and objectives

This document covers an introduction to the construction of hardware that you will be used throughout the duration of the module, and extended into ENGD2104.

### 2 Component Kits

You will be provided with a kit of components during the first laboratory session, which you will need to sign for.

This will consist of a breadboard, Arduino nano, accelerometer, shift register, 7-segment display, LEDs and resistors.

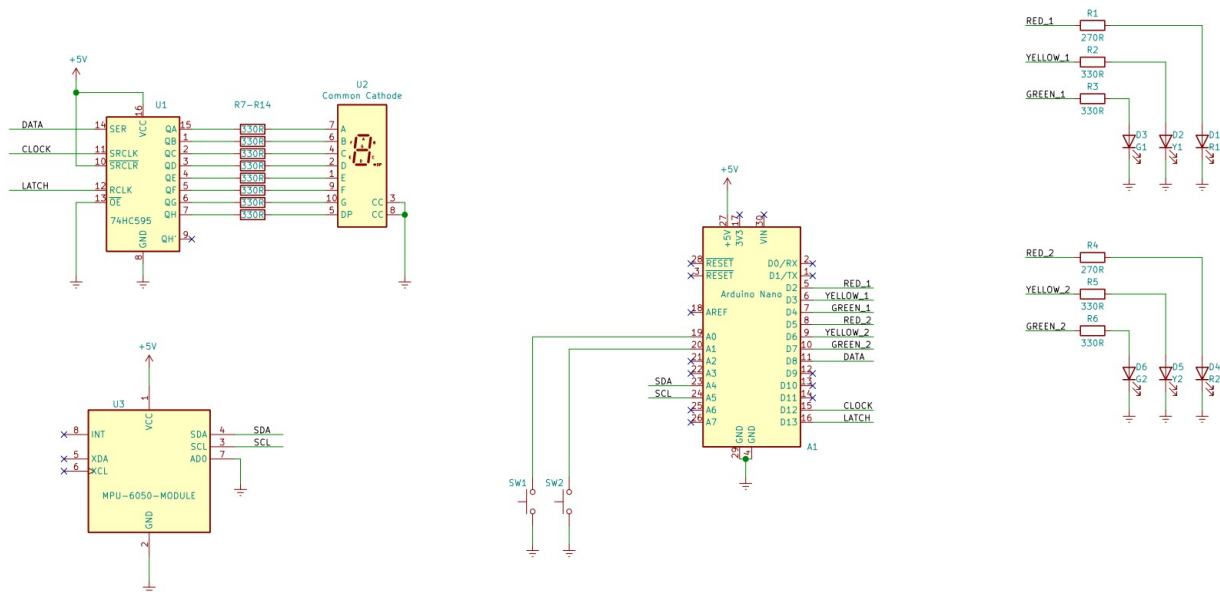
It is your responsibility to look after your kit. If you lose your kit, you will be required to purchase a replacement.

It is recommended that you purchase one or two Arduino Nanos as contingency for if you accidentally damage the one in the kit. Even if you don't use them for this module, you should hopefully have the inspiration to use them in extra-curricula “home projects”!

Also, it is recommended that you have some form of box to prevent your circuitry from getting damaged in transit.

### 3 System Schematic

The system schematic is shown below for completeness:-



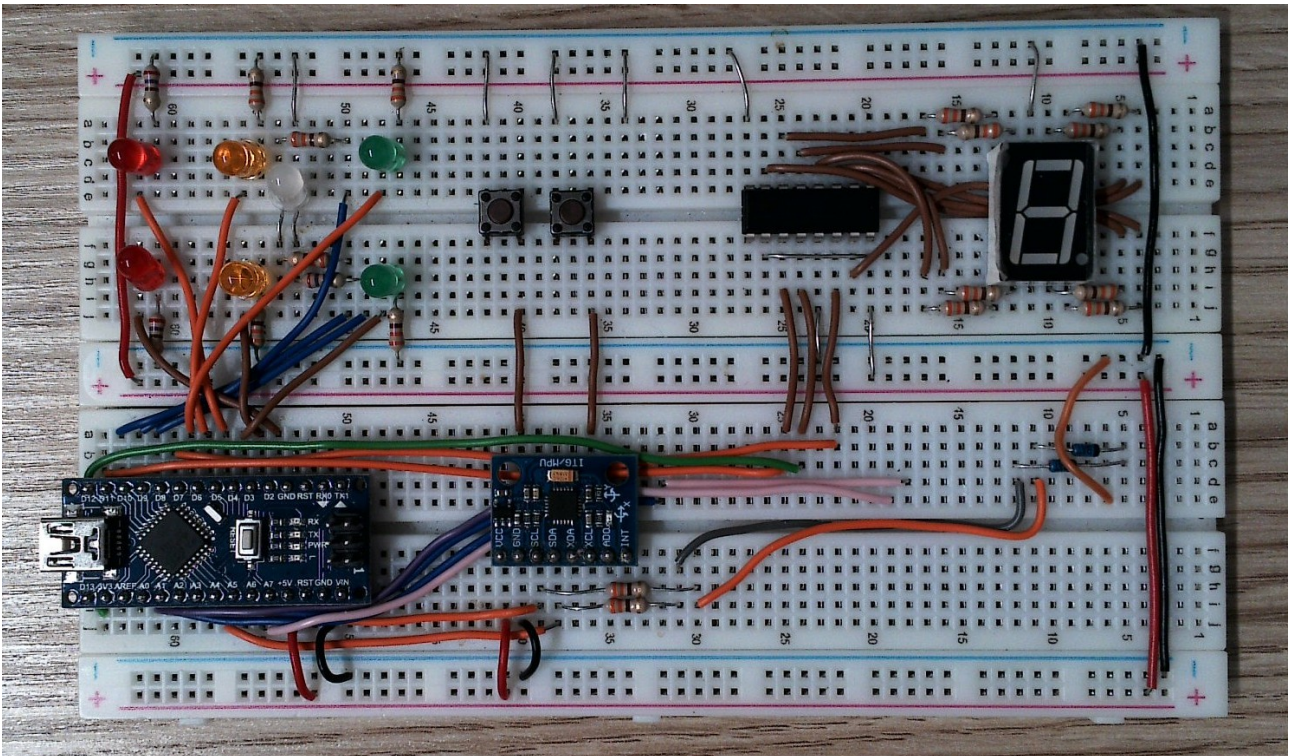
A landscape PDF of this is provided on Blackboard for greater clarity.

You will need to construct this on breadboard. It is worthwhile spending some time thinking about component placement.

You are seriously advised to avoid the use of the jumper wires provided with the breadboards. Even though a design can be quickly constructed, the end result could be messy. Additionally, these jumper cables are flimsy and are prone to internal fractures. Once a cable is internally fractured, fault finding becomes increasingly difficult and time consuming.

A better approach would be to use solid-core wire, cut to length with the ends stripped. This will lead to a neater, much more robust solution. The additional time invested in making a tidy solution could be significantly less than the time taken to debug a badly laid-out breadboard.

An example of a neatly laid out breadboard is shown below. Again, the source file for this is provided on Blackboard for greater clarity.



Please note that the wiring at the bottom-right of this breadboard is not part of this project.

## 4 Future and Additional Work

Over the forthcoming weeks, you will be engaging in some formative exercises. These will be used to primarily test the circuitry.

During the programming phase (Weeks 2 to 11), you will be primarily programming in C (facilitated by some C++). For those who may need a C refresher, there is a C crash course in the "Useful Information" section on Blackboard along with a self-paced "C Primer".