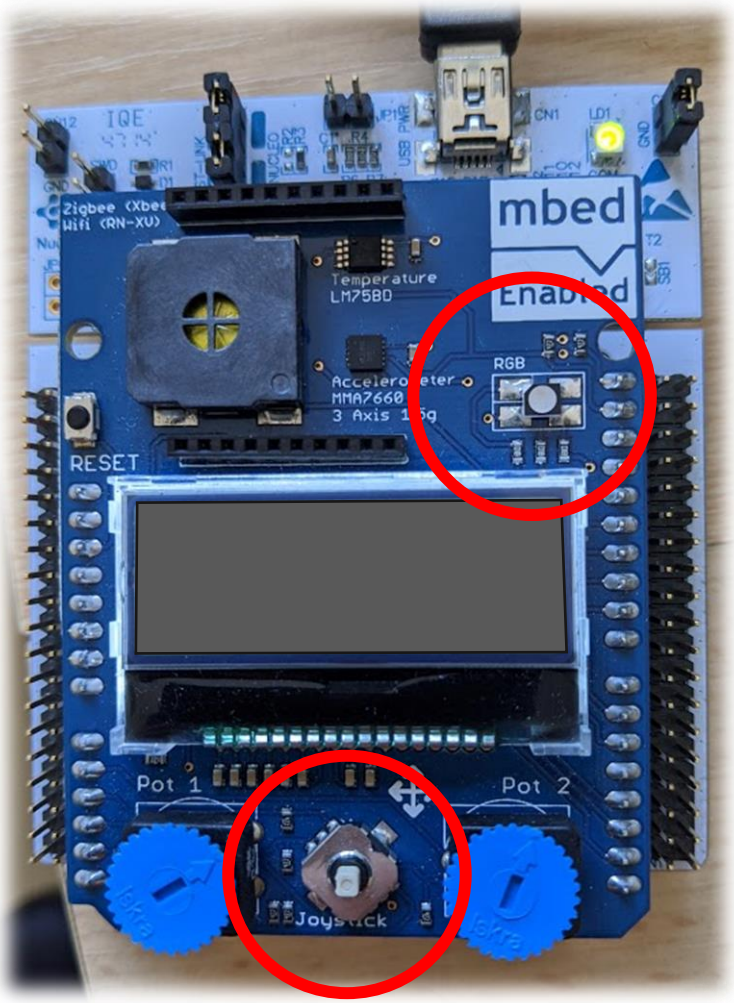
EEEN20011 Microcontroller Engineering II

Dr L A Marsh

Lab Task 1 (30 Marks / 6% of module weighting)

In this lab task you are expected to use the joystick and the RGB LED on the Application shield. These are shown in the diagram below:



You should create a **class** that represents the Joystick. This class will use 5 DigitalIn objects to represent the positions of *up*, *down*, *left*, *right* and *centre* as a single 'Joystick'. The pin names of each of these inputs should be passed to the constructor of the joystick class. If this class is correctly written it can be used for any joystick on any application board. All that is required is that the appropriate pin identifiers are passed when a Joystick object is created. This makes the class 'Joystick' reusable; this is an inherent advantage of object oriented programming.

The aim of the program is such that you should be able to illuminate either a single LED, or a combination of LEDs when a particular joystick button is pressed. This means that you will also need to make use of the LED class that is provided in the example programs.

When the centre (also known as "Fire") button is pressed the selected colour LED should flash at a prespecified frequency.

You will be provided with a table by your examiner, which will specify which colours should be illuminated when a particular button is pressed, and the frequency that your LED should flash at.

This will be similar to what is shown in Table 1. You may wish to use these values to test your program during development.

Button	LED Colour
None	None
Up	Red
Down	Green
Left	Blue
Right	Yellow
Fire	White, 2Hz

Table 1: Example LED mapping for task 2

The Joystick class should have the same format of that shown in Listing 1 below.

```
class Joystick {
private:
        DigitalIn up, down, left, right, fire;
public:
        Joystick(PinName u, PinName d, PinName l, PinName r, PinName f);
        bool upPressed(void);
        bool downPressed(void);
        bool leftPressed(void);
        bool rightPressed(void);
        bool firePressed(void);
};
```

Listing 1: Class declaration for Task 2

Marking Requirements

The class should contain:

- Data members for the DigitalIn objects corresponding to each of the joystick buttons.
- The five member functions shown in Listing 1, which will return a value of true when the corresponding button is pressed, and false otherwise. Consequently, the return type of these member functions is bool.

Your main program, int main(), should contain code capable of:

- Creating an object of type Joystick with the correct parameters for the pins which the Application Shield's joystick is connected to.
- Creating as many LED objects as are necessary to achieve the required functionality.
- Infinitely looping, with the following action:
    1. Checking if a particular button (or no button) has been pressed
    2. Illuminating the correct LED(s) to display the correct colour
    3. Flashing an LED if the centre pin is pressed
    4. No LEDs should be illuminated unless buttons are being pressed.

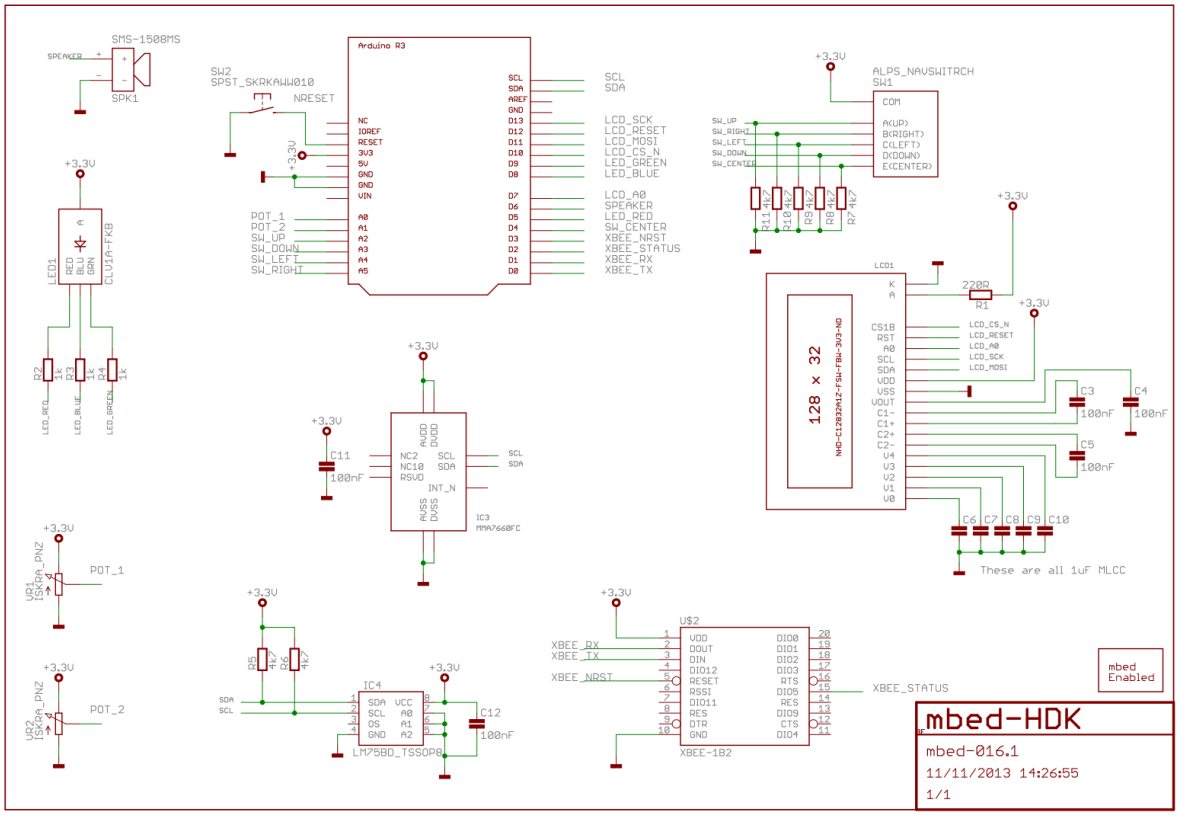
You are suggested to undertake the following tasks in working towards your solution:

1. **Determine which I/O pins the joystick uses for each of its 5 positions.**
2. **Determine which I/O pins the RGB LEDs are connected to.**
3. **Be clear whether each of the above inputs/outputs are active high or active low. If you cannot deduce this from the schematics then you can write a small test program to help you to determine the answer.**
4. **Experiment with getting an LED to flash in a simple program.**
5. **Develop the Joystick class by writing the member functions.**
6. **Code the int main() function which illuminates the relevant LEDs when the relevant joystick button is pressed.**

You may optionally want to explore with the Mbed program that uses the joystick, which is available from:
https://os.mbed.com/components/mbed-Application-Shield/

Please note that you should not copy any code directly from this example in your task 2 solution. It is not in the correct format to meet the markscheme for this task.

Application Shield Schematic



https://os.mbed.com/cookbook/mbed-application-shield