

## Embedded Systems Essentials with Arm: Getting Started

### Module 3

#### SV2 (3): Module 3 Lab Project: Part 1

Now let's start looking at the exercise. For this lab, you will be using the Mbed simulator, a simulation of an Mbed microcontroller and hardware peripherals.

Here you can see a diagram mapping out the design of the simulated microcontroller. The pin descriptions can also be seen.

As previously mentioned, in this lab we will be creating a program that controls LEDs based on the status of switches.

Begin by opening up the simulator and loading the "Module 3 – Digital I/O Skeleton" lab demo.

We will now go through the code required for completing this project.

In this part of the exercise, you need to write the code for setting up the input and output pins and bus, and you will also populate the function "ControlLED\_DigitalIO" in the code skeleton provided. Some use will be made of the DigitalIn and DigitalOut interfaces, as well as basic Boolean algebra.

In terms of which LEDs should be lit, it depends on the status of 4 switches. Each switch represents an unsigned binary number  $N$ , where button 1 is the least significant bit or LSB, and button 4 is the most significant bit or MSB. So for example, 0001 would mean switch 1 is on, and 1000 would mean switch 4 is on. Your function should turn on the right combination of LEDs for all ranges of  $N$  as specified in this table.

To build upon the skeleton code, the first thing to do is define the input and output pins for the buttons and LEDs. We start by using '#define' to associate a given identifier with a value. In this case the identifier is the button or LED, and the value is the respective pin.

Once these are defined, we create some DigitalIn and DigitalOut objects for our buttons and LEDs. We name them and use the relevant defines as parameters. This assigns the objects to their relevant pins.

Furthermore, we create a BusIn and BusOut object, which essentially act as a grouping of our buttons and LEDs respectively.

Next, we declare the two functions that we will be writing to complete the lab. These functions are called "ControlLED\_DigitalIO" and "ControlLED\_BusIO".

Here we populate the 'ControlLED\_DigitalIO' function. We write some Boolean equations to determine which LED should light up. These equations are determined using the table previously shown.

Try running the code with the relevant peripherals added and try flicking the switches to different states.