IoT exercises – Week 2

This week, you will go on familarising yourself with NodeMCU/ESP8266, the low-cost and efficient platform, creating your own project using PyFlasher/Esplorer and using the built-in modules. If you have not finished the exercises for Week 1, please go on with them. Should you need further support, please just let me know it during the practical or by mail (preferred as we could not have hand by hand support during face-to-face suspension).

The official documentation is provided here again for your reference. Please remember, when you are building your own IoT project in the future, always refer to the bespoke built-in modules and read their documentation first, which will be helpful!!!

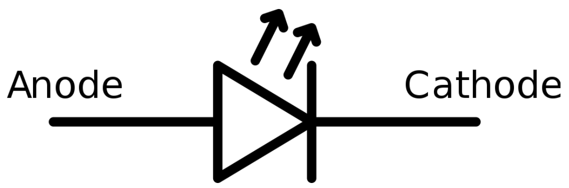
https://nodemcu.readthedocs.io/en/master/

In the lecture we have talked about the control of SoC and categorise them into adjustable control and ON/OFF control. This week we will mainly practice on the adjustable control using Pulse Width Modulation (PWM). The PWM control is provided by the NodeMCU/ESP8266 platform in the pwm module, which has been included in your firmware bin file.

The ON/OFF control with button click detection will be practiced on in later weeks together with other application. The relay will not be included in our exercises because it is most commonly used in the voltage range above 220V. Please be aware of SAFETY if you work with relay to control the sockets or any appliances at home.

Exercise 1:

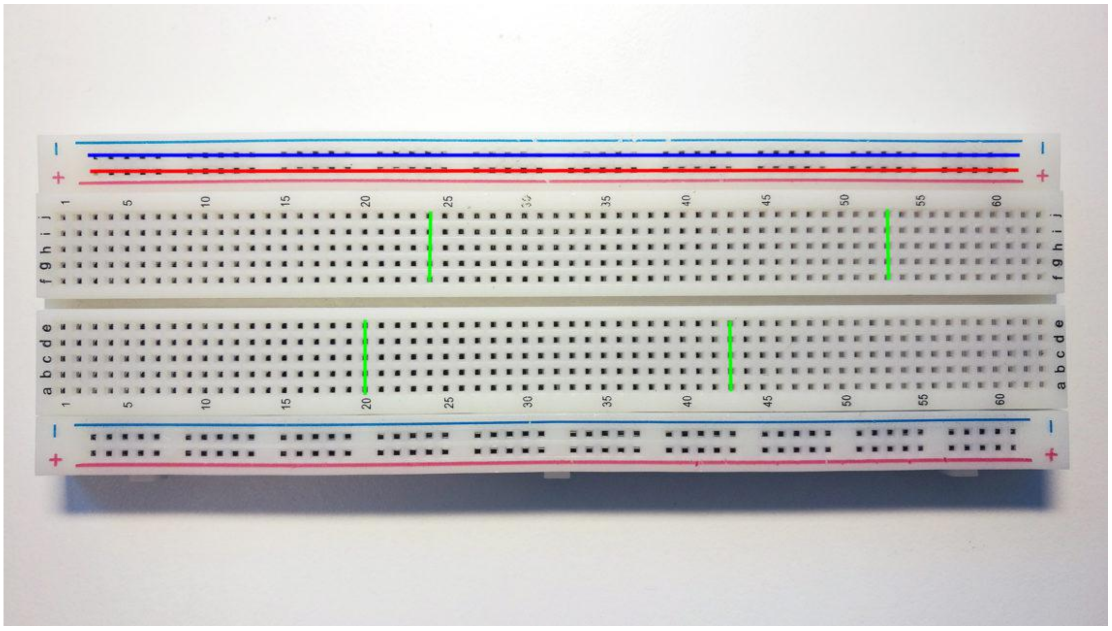
In this exercise, you will need to connect the LED to the NodeMCU/ESP8266 using a breadboard and Dupont wires. Please note that the LED is a diode, which can only be



properly lighted up by current flow through one single direction.

- You are given with either a 2pin LED or a 3pin LED.
  - For 2pin LED, one pin is connected to the ground pin ('GND' as shown on your NodeMCU/ESP8266), another pin is connected to the 3V3 output pin. You might need a resistor within the loop of LED and SoC to lower the current flow to avoid burning the LED.
  - For 3pin LED, the middle pin is connected to the ground pin, while you can use either one of the rest pins to connect to the '3V3' output pin. You can also use both to connect to different '3V3' output pins to use it as 2 LEDs.

- In case that you have not used the breadboard before, the 5 pin holes in a row (denoted by Green) are connected, the Blue/Red pin holes are connected respectively.



- Now light up the LED and swap the pin holes to see if it is still lighted.

Exercise 2:

In this exercise, you will need to use the pwm module built in the NodeMCU/ESP8266 to dim the LED.

- Now connect your LED to GND and GPIO pin 3
    - **A resistor of 10K could be used in the loop (optional)**
- pwm module is used here:

```
=====================================================================
dc=1023
pinDim = 3
pwm.setup(pinDim,1000,dc)
pwm.start(pinDim)
mytimer = tmr.create()
mytimer:alarm(200,tmr.ALARM_AUTO,function()
        dc=dc-10
        print(dc)
        pwm.setduty(pinDim,dc)
        if (dc<10) then
            dc=1023
        end
end
)
=====================================================================
```

- Save them as the init.lua file to NodeMCU through Esplorer. Check the LED dimming. (Reset after every time you save files to the chip to run them automatically.)
- For more about pwm module, refer to

https://nodemcu.readthedocs.io/en/master/modules/pwm/

- Now you can change the rate (1000) and the duty cycle (dc) to see their effect on the PWM control.
- **Please note that we no longer set the pin with GPIO commands. They are built in in the PWM.**

Exercise 3:

In this exercise, you will need to make the LED dim in a cycle of "Top-down and Bottom-up", ie. to control the LED with pwm from the light to dark, then dark to light. Please note that in the previous exercise, you were doing the "Top-down" from the light to dark.

Exercise 4:

In this exercise, you will need to combine the PWM and Timer to create a traffic lights system (Green light and Red light are ON consecutively with Yellow light ON between the switch as a buffer). Use 3 LEDs to represent the Red, Green, Yellow. Both pwm and tmr modules will be used.

- Please consider the following local function to control the intensity (ON/OFF in our case) of light.

```
=================================================================
function trafficLight(dc_r,dc_g,dc_y)
    pwm.setduty(pinR,dc_r)
    pwm.setduty(pinG,dc_g)
    pwm.setduty(pinY,dc_y)
end
=================================================================
```

- For example, the Green light is ON for 4 seconds, then OFF and Yellow light is ON for 0.5 seconds, then Red light is ON for 2 seconds, then OFF and Yellow light is ON for 0.5 seconds. (Red, Yellow, Green, Yellow, Red, …)

(Optional) Exercise 5:

In this exercise, you will need to combine the optional exercise in Week 1 and pwm module to build a blinking dimming LED

- Dimming of the LED will be combined with an ON/OFF state.
- Duty Cycle (dc) keeps changing at its own rate (eg. 1000).
- ON/OFF follow another cycle (eg. ON for 500ms, OFF for 300ms, then ON for 500ms, OFF for 300ms, …).