Laboratory 02 Part 02 – STM ARM Micro-controller

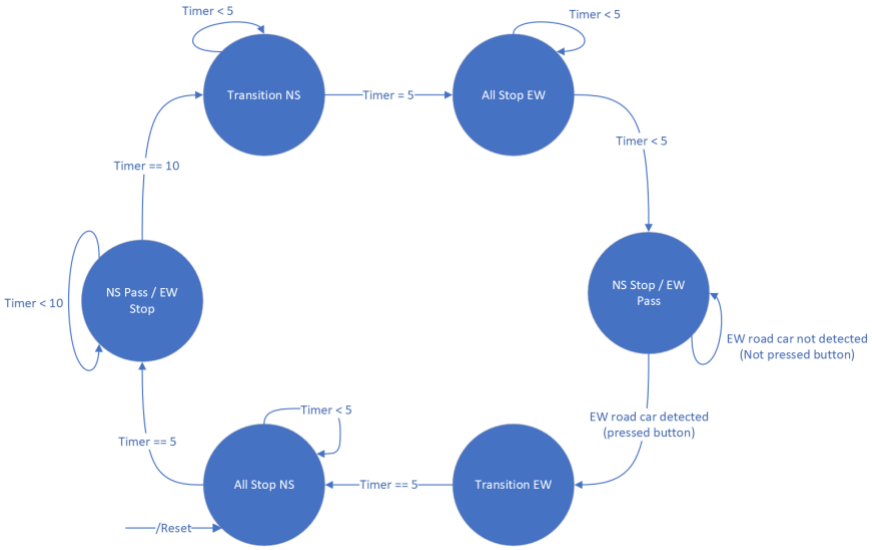
Follow up questions:

- Is the FSM provided a Mealy or Moore state machine design?
  The FSM provided is a Moore state machine design because the output depends on the current state.
- What changes could be implemented to improve the design?
  The things that could improve is to add another light designed for pedestrian. Pressing the button will make the light for pedestrian to cross and also add time to the system for the traffic light than the normal time.
- What state is redundant? And how could you modify the FSM to reduce the state?
  I think the state that is redundant would be All Stop EW and All Stop NS since their output are the same. The thing that needs to be modified is how divide the output since the two has different next state. I would probably add another variable indicating NS and EW road for which next state should go.
- Think about how you could use interrupts in a FSM. How could your FSM benefit from an interrupt?
  The benefit of interrupt is to stop the continuous loop where there could be a problem occurring it. Using interrupts serve as a backup shutdown to the system if the user occur a problem and also trying to test it.

Hardware demo: https://youtu.be/I3mXFksEP3s

Source code:

```
switch(eNextState) {
    case Transition_NS_State:
        eNextState = TransitionNorthSouthHandler();
        break;
    case NS_Pass_EW_Stop_State:
        eNextState = NorthSouthPassHandler();
        break;
    case All_Stop_EW_State:
        eNextState = AllStopEastWestHandler();
        break;
    case NS_Stop_EW_Pass_State:
        EastWestPassHandler();
        if(HAL_GPIO_ReadPin(GPIOB, Push_Button_Pin))
            eNextState = Transition_EW_State;
        break;
    case Transition_EW_State:
        eNextState = TransitionEastWestHandler();
        break;
    case All_Stop_NS_State:
        eNextState = AllStopNorthSouthHandler();
        break;
    default:
        eNextState = AllStopNorthSouthHandler();
        break;
}
```



Current State	Input	Next State	Output
North-South Pass/ East-West Stop	Timer delay < 10s	North-South Pass/ East-West Stop	NS_Green_led = 1 NS_Yellow_led=0 NS_Red_led=0 EW_Green_led =0 EW_Yellow_led=0 EW_Red_led=1
	Timer delay == 10s	Transition North-South	
Transition North-South	Timer delay < 5s	Transition North-South	NS_Green_led = 0 NS_Yellow_led=1 NS_Red_led=0 EW_Green_led =0 EW_Yellow_led=0 EW_Red_led=1
	Timer delay == 5s	All Stop EW	
All Stop EW	Timer delay < 5s	All Stop EW	NS_Green_led = 0 NS_Yellow_led=0 NS_Red_led=1 EW_Green_led =0 EW_Yellow_led=0 EW_Red_led=1
	Timer delay == 5s	North-South Stop / East-West Pass	
North-South Stop / East-West Pass	Push_Button_Pin = 0	North-South Stop / East-West Pass	NS_Green_led = 0 NS_Yellow_led=0 NS_Red_led=1 EW_Green_led =1 EW_Yellow_led=0 EW_Red_led=0
	Push_Button_Pin = 1	Transition East-West	
Transition East-West	Timer delay < 5s	Transition East-West	NS_Green_led = 0 NS_Yellow_led=0 NS_Red_led=1 EW_Green_led =0 EW_Yellow_led=1 EW_Red_led=0
	Timer delay == 5s	All Stop NS	
All Stop NS	Timer delay < 5s	All Stop NS	NS_Green_led = 0 NS_Yellow_led=0 NS_Red_led=1 EW_Green_led =0 EW_Yellow_led=0 EW_Red_led=1
	Timer delay == 5s	North-South Pass / East-West Stop	