Final Exam of Design of Embedded Systems   Acad Year: 2023/2024

1st Y Master IoT & cyber security   Duration; 1h30m

Exercise 01 (7 marks)

1- Describe the code above (4 marks)

ISR(TIMER1_OVF_vect)

ISR: "Interrupt Service Routine." It's a special function that the microcontroller jumps to when a particular interrupt occurs,

TIMER1_OVF_vect: identifies the specific interrupt being handled. it indicates that the interrupt is caused by an overflow of Timer 1.

```
TCCR1A = 0;, TCCR1B = 0;
```

both are Timer/Counter 1 Control Registers A (TCCR1A) and B (TCCR1B), are initialized to zero before configuring the timer.

```
TCCR1B |= B00000100;
```

Sets the prescaler for Timer 1 to 256. With a prescaler of 256, each increment of Timer 1's counter takes 256 system clock cycles.

2- How to use this code to handle the transition in the given diagram (3 marks)

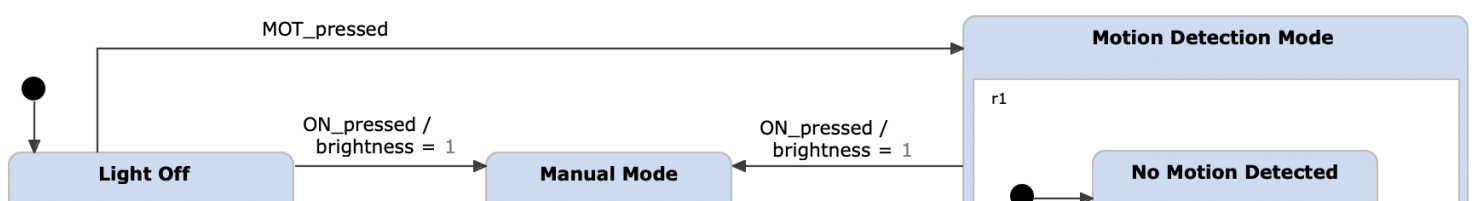The same setup of the code above but setting the prescaler to 1024

```
TCCR1B |= B00000101;
```

in the ISR(TIMER1_OVF_vect) call the action in transition

```
ISR(TIMER1_OVF_vect){
    toggleLed();
}
```

Exercise 02 (7 marks)

Solution

Exercise 03 (6 marks)

Solution

States: Idle, Cooling; Heating

Events: AtTemp

Variables: temp; min, max, threshold

```c
void handle_event(state_t *state, event_t event){
  switch(*state){
    case Idle:
      switch(event){
        case AtTemp:
          if(temp>min){
                Start heating
                *state = Heating:
          }else{
                Start colling
                *state = Cooling:
          }
          break;
       }
     break;
    case Heating:
      switch(event){
        case AtTemp:
          if(temp==threshold){
                Stop heating
                *state = Idle:
          }
          break;
       }
```

```
    case Colling:
      switch(event){
        case AtTemp:
          if(temp==threshold){
                Stop Cooling
                *state = Idle:
          }
          break;
      }
      break;
  }
}
```