Intro to IOT

2017 – Demonstration 3

1. Highway Traffic Light

Your task is to build a simplified traffic light (TL) controller using the Arduino Uno (or Intel Galileo) board and the provided set of sensors. The TL comprises three LEDs, a buzzer and a touch button.

Problem description:

- The TL goes from green through yellow to red, and from red through red-yellow to green.
- The TL remains in red for 10 seconds.
- The TL remains in yellow and red-yellow for 2 seconds.
- The TL has a touch button for pedestrians, it remains in green until the pedestrian button is pressed. The TL remains in green at least 5 seconds after the touch button has become active.
- The TL has buzzer for visual impairment aid with two modes. When in green the buzzer must be 500 ms on and 1500 ms off; when in red the buzzer must be 250 ms on and 250 ms off. (NOTE: You can put a finger tip on the top of the buzzer to reduce the sound volume)

HINT: The system can be modeled as a 4-state state machine: RED, RED-YELLOW, YELLOW and GREEN. A possible basic structure for the application is shown next

```
#define RED_PIN 2
#define YELLOW_PIN 3
#define GREEN_PIN 4
#define RED_STATE 0
#define RED_YELLOW_STATE 1
#define YELLOW_STATE 2
#define GREEN_STATE 3
#define RED_MILLIS 10000
int tl_state; // Traffic light state.
unsigned long tl_timer; // Traffic light timer.
void setup() {

  // Configure LED pins as outputs.
  pinMode(RED_PIN,OUTPUT);
  pinMode(YELLOW_PIN,OUTPUT);
  pinMode(GREEN_PIN,OUTPUT);

  // Initial state for states and timers..
  tl_state = RED_STATE;
  tl_timer = millis() + RED_MILLIS;
}
```

```
void loop() {
 // TL state machine.
 switch (tl_state) {
  case RED_STATE:
    // Turn red light on.
    if ( /*Timer expired*/ ) {       // Turn red light off.
      //Set timer for red-yellow state.
      tl_state = RED_YELLOW_STATE;
    }
  break;

  case RED_YELLOW_STATE:

      // Code for red-yellow state.
  break;

  case YELLOW_STATE:
      // Code for yellow state.
  break;

  case GREEN_STATE:
    // Turn green light on.
    if ( /*Timer expired AND touch-button was pressed*/ ) {
      // Turn green light off.
      // Set timer for yellow state.
      tl_state = YELLOW_STATE;
    }
  break;
 }

  // Detect touch-button pressed.

  // Buzzer state machine.
}
```