American International University- Bangladesh
Department of Electrical and Electronic Engineering
EEE4103: Microprocessor and Embedded Systems Laboratory

Title: Taking external inputs in Arduino: Implementation of runway approach lights

Introduction:

- The objective of this experiment is to learn how to take external inputs in Arduino. Here, the external input will be given by a push switch.
- The objective of this experiment is also to get familiarized with Debouncing: Implementation and effects in Microcontroller.

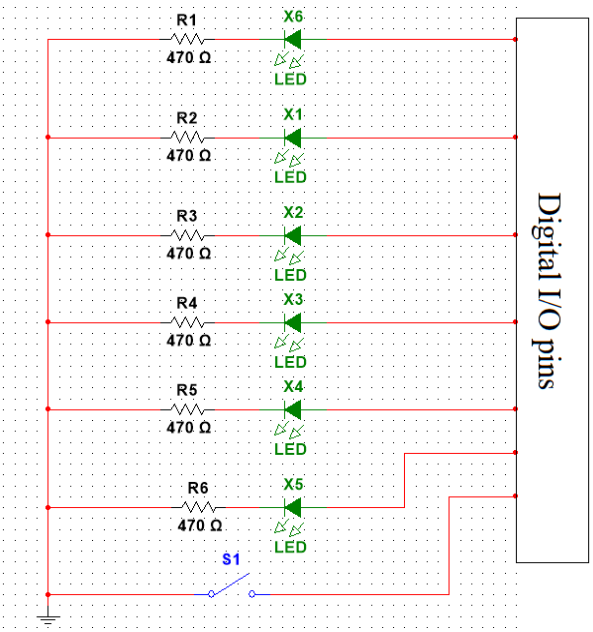
Theory and Methodology:

Runway approach lights to an airport runway are a series of lights that flash quickly in sequence to guide an aircraft to the runway. These lights are especially effective during bad weathers, such as heavy rain; fog etc. when the visibility is very poor. The aim of this experiment is to mimic this system.

A series of 6 LEDs will flash in a specific sequence and upon pressing the switch; the sequence will reverse the direction. The switch will be connected to an I/O pin and will be set as an input. Upon pressing the switch, the microcontroller will read the change of state of the I/O pin (here set as an input) and execute instructions to reverse the flash sequence.

Debouncing: Bouncing is the tendency of any two metal contacts in an electronic device to generate multiple signals as the contacts close or open; debouncing is any kind of hardware device or software that ensures that only a single signal will be acted upon for a single opening or closing of a contact.

Experimental setup:



Apparatus:

- Arduino Uno
- LED
- Resistor
- Push switch

Code implementation of a traffic system with Timer:

```
#define _______ __  //define name of pins used
#define _______ __
#define _______ __
#define _______ __
#define _______ __
#define _______ __
#define _______ __

//define the delays for each LED
int LED_blink = 700;

//define variable for switch press
int switch_read;    //defining a variable which will read the state of the switch
int LED_sequence=1; //defining which way the LEDs will light up (left to right or right to
left)

int delay_timer (int miliseconds)
{
  int count = 0;
  while(1)
  {
    if(TCNT0 >= __)  // Checking if 1 milisecond has passed
      {
       TCNT0=0;
       count++;
       if (count == miliseconds) //checking if required miliseconds delay has passed
       {
          count=0;
          break; // exits the loop
       }
      }
  }
  return 0;
}

void setup() {
   //define pins connected to LEDs as outputs and the switch as input
   _______ (_______, OUTPUT);
   _______ (_______, OUTPUT);
   _______ (_______, OUTPUT);
```

```
   _______ (_______, OUTPUT);
   _______ (_______, OUTPUT);
   _______ (_______, OUTPUT);
   _______ (_______, INPUT);

   //set up timer
   TCCR0A = 0b00000000;
   TCCR0B = _______; //setting prescaler for timer clock
   TCNT0=0;
}

void loop() {

  switch_read=digitalRead(switch1);
  if (switch_read==LOW){
    LED_sequence=!LED_sequence;
  }
  if (LED_sequence==1){

   //to make green1 LED blink
   digitalWrite(_______, HIGH);
   delay_timer(LED_blink);
   digitalWrite(_______, LOW);

   //to turn red1 LED blink
   digitalWrite(_______, HIGH);
   delay_timer(LED_blink);
   _______ (_______, LOW);

   //green2 blink and so on
   digitalWrite(_______, HIGH);
   delay_timer(LED_blink);
   digitalWrite(_______, LOW);

   digitalWrite(_______ HIGH);
   delay_timer(LED_blink);
   digitalWrite(_______, LOW);

   digitalWrite(_______, HIGH);
   delay_timer(LED_blink);
   digitalWrite(_______, LOW);

   //green2 blink and so on
   _______ (_______, HIGH);
   delay_timer(LED_blink);
   digitalWrite(_______, LOW);

//   digitalWrite(_______, HIGH);
```

```
//    digitalWrite(_______, HIGH);
//    digitalWrite(_______, HIGH);
//    digitalWrite(_______, HIGH);
//    digitalWrite(_______, HIGH);
//    digitalWrite(_______, HIGH);
//    delay_timer(LED_blink);
//    delay_timer(LED_blink);
//    digitalWrite(_______, LOW);
//    digitalWrite(_______, LOW);
//    digitalWrite(_______, LOW);
//    digitalWrite(_______, LOW);
//    digitalWrite(_______, LOW);
//    digitalWrite(_______, LOW);
//
    delay_timer(LED_blink);

  }
  else {

    digitalWrite(_______, HIGH);
    _______ (LED_blink);
    digitalWrite(_______, LOW);

    digitalWrite(_______, HIGH);
    delay_timer(LED_blink);
    digitalWrite(_______, LOW);

    digitalWrite(_______, HIGH);
    delay_timer(LED_blink);
    digitalWrite(_______, LOW);

    digitalWrite(_______, HIGH);
    delay_timer(LED_blink);
    digitalWrite(_______, LOW);

    digitalWrite(_______, HIGH);
    delay_timer(LED_blink);
    digitalWrite(_______, LOW);

    digitalWrite(_______, HIGH);
    delay_timer(LED_blink);
    _______ (_______, LOW);

    delay_timer(LED_blink);

  }
}
```

Questions for report writing:

1) Include all codes and scripts into the lab report following the writing template mentioned in appendix A of Laboratory Sheet Experiment 4.
2) According to your opinion, explain how to prevent a switch from debouncing.
3) Design the same system using the Proteus simulation tool.

Reference(s):

1) https://www.arduino.cc/.
2) ATMega328 manual