Lab Manual for Embedded System Design

Lab No. 1

Introduction to Single Board Microcontroller, Arduino Programming & Digital Hardware Interfacing

Objectives

In this lab students are introduced to open source single board microcontroller-Arduino, and its various design applications in designing embedded systems. Interface of components like SPDT switch & LED with digital pins of Arduino.

LAB # 1

Introduction to Single Board Microcontroller, Arduino Programming & Digital Hardware Interfacing

Introduction

Part I: ARDUINO

Arduino is a simple microcontroller board and open source development environment that allows you to make computers that drive both functional and creative projects alike. The Hardware consists of an open-source hardware board designed around an 8-bit Atmel AVR. It features a USB interface, 6 analog input pins, as well as 14 digital I/O pins that accommodate various extension boards. In this lab, Arduino hardware platform will be introduced along with digital hardware like relay, seven segment display and LCD will be

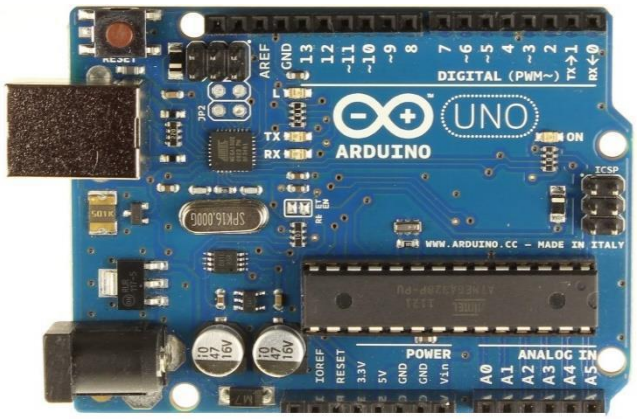

Fig. 1.1: Arduino UNO

Arduino IDE:

Arduino comes with a simple integrated development environment (IDE), as in figure 2, that runs on regular personal computers and allows users to write programs for Arduino using C or C++. It is a cross-platform application written in Java and includes a sketch editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. A program or sketch written for Arduino is called a sketch. In Arduino

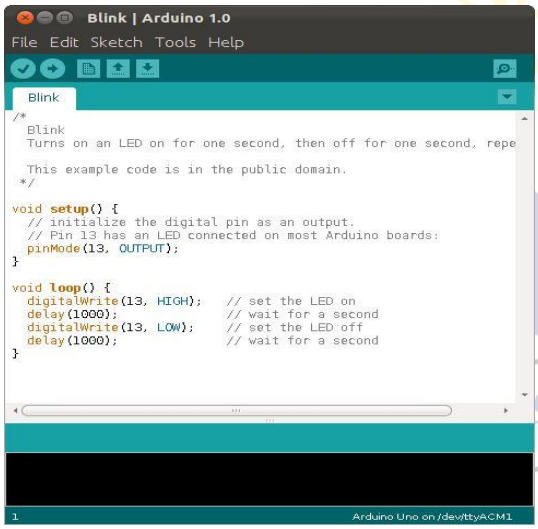

Fig. 1.2: Arduino IDE

IDE, users only need define two functions to make a runnable cyclic executive program:

setup(): a function run once at the start of a program that can initialize settings.

loop(): a function called repeatedly until the board powers off.

Part II: DIGITAL HARDWARE INTERFACING:

SPDT Switch:

SPDT switch stands for single pole double throw, it has single input and two dissimilar outputs , when it is used as on-off switch it pass ‘high’ & ‘low’ logics to output.

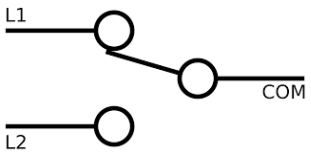

Fig. 1.3: Schematic symbol of SPDT switch

Fig. 1.4 SPDT switch

Light Emitting Diode (LED):

Light emitting diode LED is a semiconductor device, it has two terminals Anode and cathode, when anode is made positive w.r.t cathode it emits light. LEDS are available in different colors and are used in display devices.

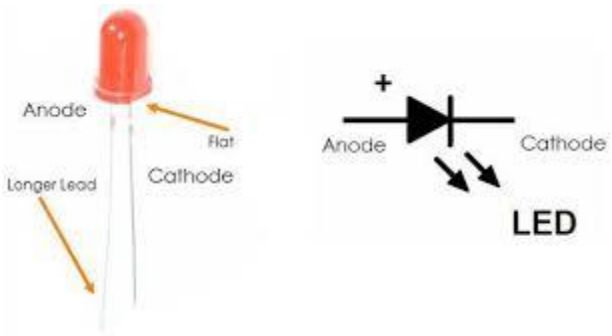

Fig 1.5: Light emitting diode (LED)

Time Boxing

Activity Name	Activity Time	Total Time
Login Systems + Setting up Proteus and Arduino Environment	3 mints + 5 mints	8 mints
Walk through Theory & Tasks	60 mints	60 mints
Implement Tasks	80 mints	80 mints
Evaluation Time	30 mints	30 mints
	Total Duration	178 mints

Objectives

In this lab students are introduced to open source single board microcontroller-Arduino, and its various design applications in designing embedded systems. Interfacing of LED and SPDT switch with Arduino Uno.

Lab Tasks/Practical Work

1. **Write a sketch to interface Arduino with LED, LED should blink with a delay of 1 second.**

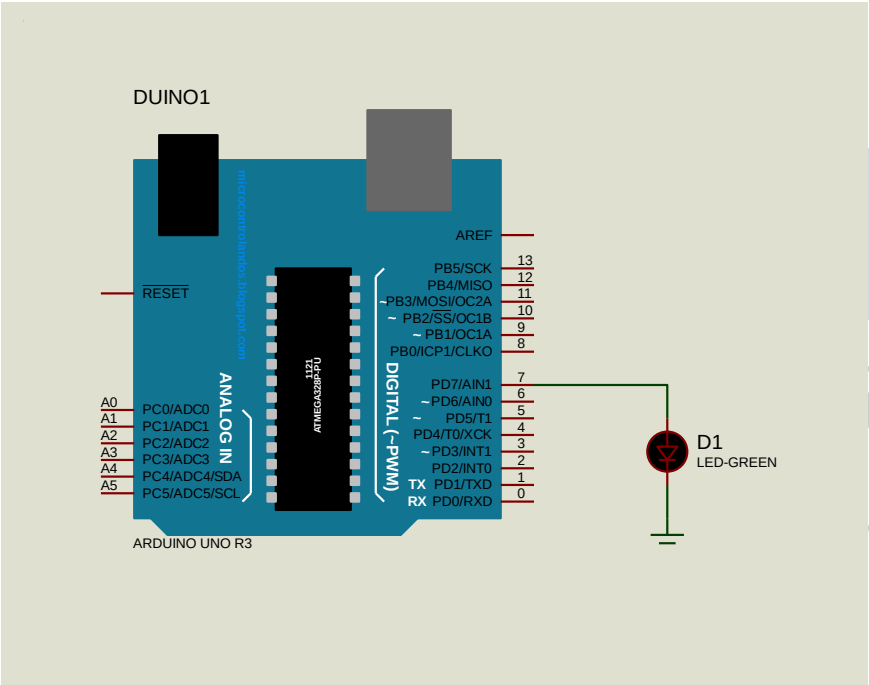

Fig. 1.6: Arduino – LED Connection

Code

```
int LED  = 7;

void setup( )
{
        pinMode(LED, OUTPUT);
}

void loop( )
{
                digitalWrite(LED, HIGH);

                 delay(1000);

               digitalWrite(LED, LOW);

                 delay(1000);


      }
```

2. Write a sketch to interface Arduino with SPDT switch & LED

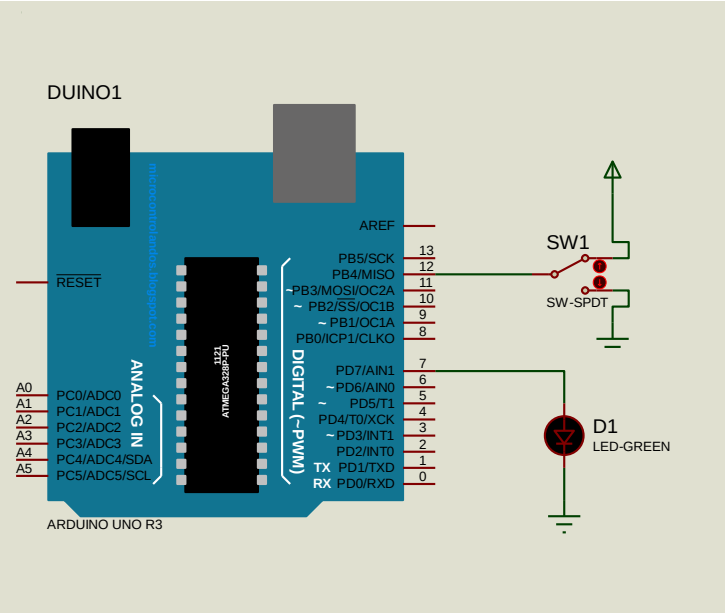

Fig. 1.7: Arduino – SPDT & LED Connection

Code:

```
int LED =7;
int SW = 12;


void setup()

{
                pinMode(LED,OUTPUT);

                pinMode(SW,INPUT);

        }

void loop()
          {    int buttonstate = digitalRead(SW);

              If (buttonstate == HIGH)
  {
                  digitalWrite(LED , HIGH);
                                                  }
                Else
                        {      digitalWrite(LED , LOW);

                                        }   }
```