

Lab Manual

CYSL – Embedded System Security Lab

Topic: Embedded Systems and Arduino
Platform

Class: **BSCYS**

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Objectives

In this lab, you will:

- Understand what is meant by Microcontroller, Microprocessor, Embedded System, Integrated Development Environment (IDE) and Arduino.
- Understand the layout of Arduino UNO board.
- Understand Arduino IDE, and how to write, compile and upload a code to Arduino.
- Deal with LED using Arduino digital output pins

1. Embedded Systems

1.1 Generic Embedded Systems Structure and its Components

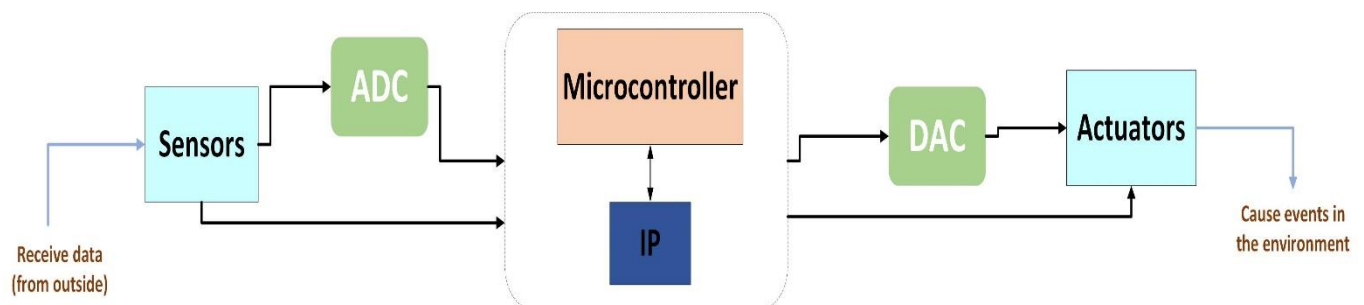


Fig 1: High level generic view of what an embedded system looks like

1.2 Microcontroller Properties/features

- Bitwidth of Datapath
- Input/Output Pins
- Performance/ Clock rate
- Timers
- Analog-to-Digital Converters
- Low Power Modes
- Communication Protocol Support
- Microcontroller Storage Elements

1.3 Software Tool Chain



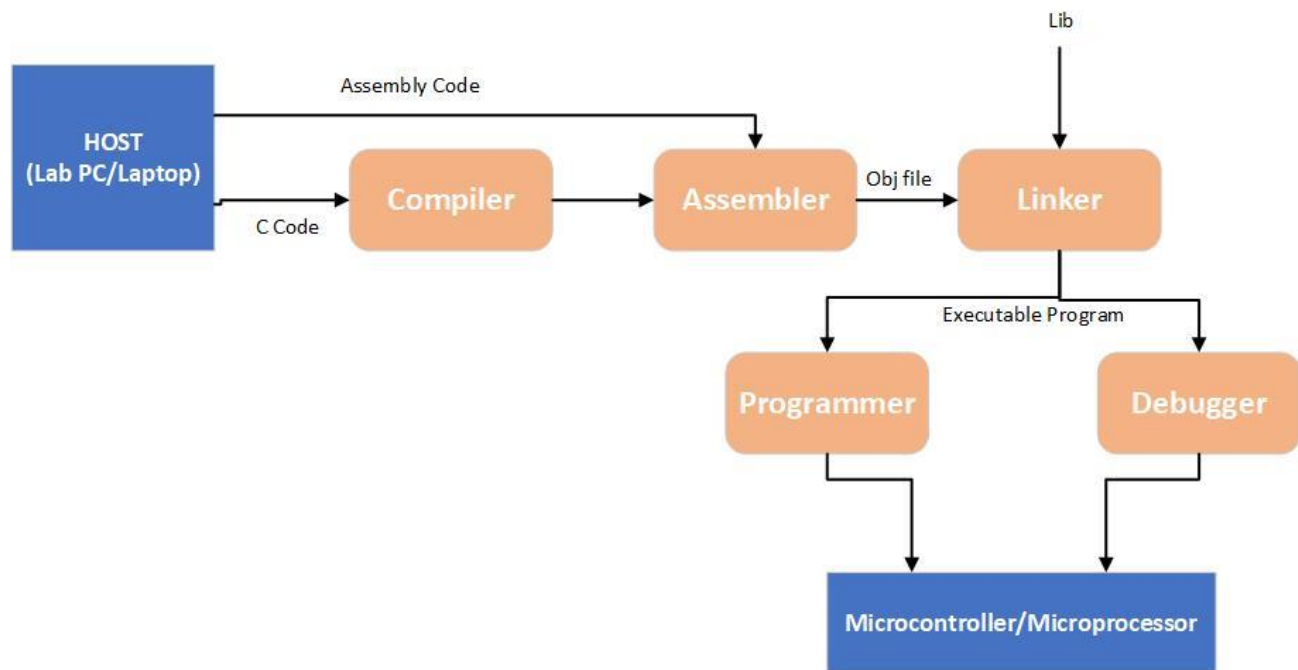


Fig 2: A high level view of your standard Software Tool Chain

2. ARDUINO PLATFORM

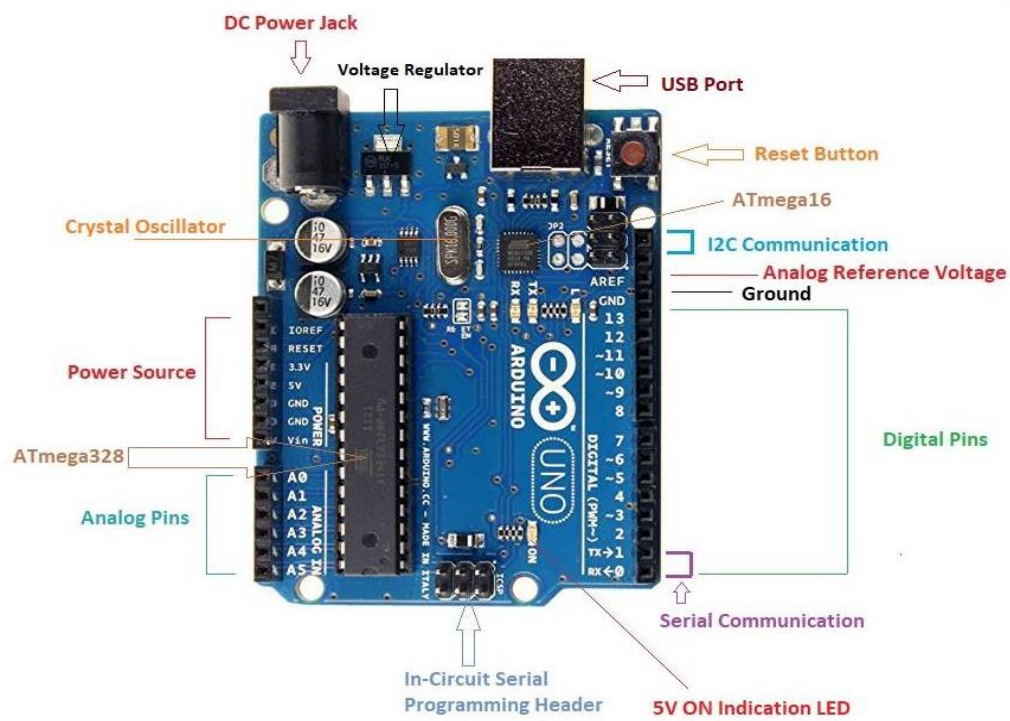


Fig 3: Arduino UNO

2.1 Arduino UNO Microcontroller (ATmega328)

Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

Table 1: Arduino UNO Microcontroller Specifications

3. LED BLINKING EXPERIMENT

3.1 Components Required

1. Breadboard
2. Resistor
3. LED
4. Connecting Wires

3.2 Schematic Diagram



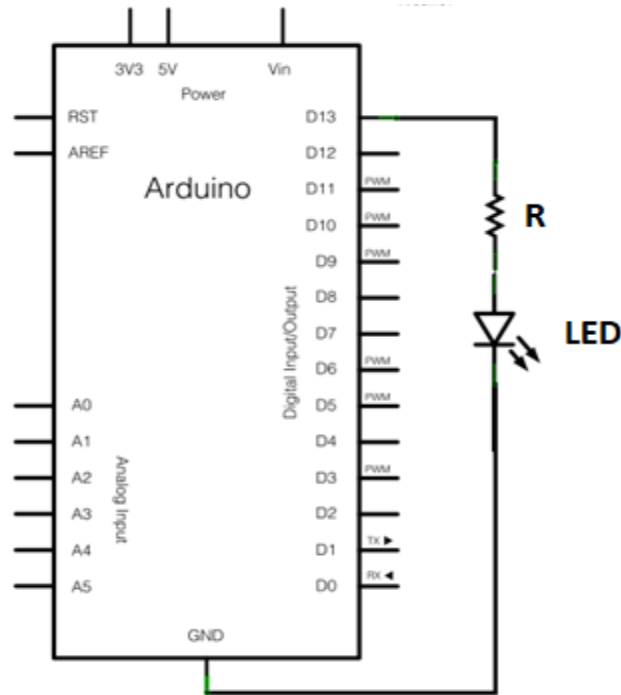


Fig 1: Schematic diagram of LED connection with Arduino UNO

3.3 Procedure

1. Install Arduino IDE on your computer
2. Launch the Arduino IDE. Set the comm port
 - Tools > Port > Comm___ (It can be verified from the device manager)
3. Set the corresponding microcontroller board
 - Tools > Boards > Arduino AVR boards > Arduino UNO
4. Connect the circuit as shown in the Fig 1.
5. Now connect the Arduino with your PC/Laptop using a printer cable. Note that, the Arduino UNO can be powered via the USB connection or with an external power supply. The power source is selected automatically.
6. Subsequently
 - Write your program on the Arduino IDE editor,
 - Compile (to check for errors)
 - and then upload it (to program the Arduino)
7. The LED will start blinking.
8. Increase the resistor values gradually from 330, 470, 1K, 10K ohm. The LED illumination decreases as larger resistance is used.

4. Assignment 1:

Write a program that will blink two LEDs in an alternate manner for 2 seconds ON and OFF. The LEDs should be connected on digital pins 2 and 4 respectively of Arduino.

