CSE2006
Microprocessor & Interfacing

Module – 7
Introduction to Arduino Boards

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VIT®

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

Syllabus

CSE2006	MICROPROCESSOR AND INTERFACING	L	T	P	J	C
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Pre-requisite	**CSE2001-Computer Architecture and Organization**	**Syllabus version**				
		v1.1				

Course Objectives:

1. Students will gain knowledge on architecture, accessing data and instruction from memory for processing.
2. Ability to do programs with instruction set and control the external devices through I/O interface
3. Generate a system model for real world problems with data acquisition, processing and decision making with aid of micro controllers and advanced processors.

Expected Course Outcome:

1. Recall the basics of processor, its ways of addressing data for operation by instruction set.
2. Execute basic and advanced assembly language programs.
3. Learn the ways to interface I/O devices with processor for task sharing.
4. Recall the basics of co-processor and its ways to handle float values by its instruction set.
5. Recognize the functionality of micro controller, latest version processors and its applications.
6. Acquire design thinking capability, ability to design a component with realistic constraints, to solve real world engineering problems and analyze the results.

Syllabus

Student Learning Outcomes (SLO):	**2, 5, 9**	
Module:1	**INTRODUCTION TO 8086 MICROPROCESSOR**	**6 hours**
Introduction to 8086, Pin diagram, Architecture, addressing mode and Instruction set		
Module:2	**INTRODUCTION TO ALP**	**5 hours**
Tools- Assembler Directives, Editor, assembler, debugger, simulator and emulator. E.g., ALP Programs-Arithmetic Operations and Number System Conversions, Programs using Loops, If then else, for loop structures		
Module:3	**Advanced ALP**	**2 hours**
Interrupt programming using DOS BIOS function calls, File Management		
Module:4	**Introduction to Peripheral Interfacing-I**	**5 hours**
PPI 8255, Timer 8253,Interrupt controller-8259		
Module:5	**Introduction to Peripheral Interfacing-II**	**4 hours**
IC 8251 UART, Data converters (A/D and D/A Converter), seven segment display and key- board interfacing		

Syllabus

Module:6	Co-Processor	4 hours
Introduction to 8087, Architecture, Instruction set and ALP Programming		

Module:7	Introduction to Arduino Boards	2 hours
Introduction to Microcontroller- Quark SOC processor, programming, Arduino Boards using GPIO (LED, LCD, Keypad, Motor control and sensor), System design application and case study.		

Module:8	Contemporary issues	2 hours
Architecture of one of the advanced processors such as Multicore, Snapdragon, ARM processor in iPad		

Text Book(s)	
1.	A.K. Ray and K.M. Bhurchandi Advanced Microprocessors and Peripherals, third Edition, Tata McGraw Hill, 2012.
2.	Barry B Bray , The Intel Microprocessor 8086/8088, 80186,80286, 80386 and 80486 Arcitecture, programming and interfacing, PHI, 8th Edition, 2009.
Reference Books	
1.	Douglas V. Hall, SSSP Rao Microprocessors and Interfacing Programming and Hardware. Tata McGraw Hill, Third edition, 2012.
2.	Mohamed Rafiquazzaman, Microprocessor and Microcomputer based system design, Universal Book stall, New Delhi, Second edition, 1995
3.	K Uday Kumar, B S Umashankar, Advanced Micro processors IBM-PC Assembly Language Programming, Tata McGraw Hill, 2002.
4.	Massimo Banzi,Getting Started with Arduino , First Edition, pub. O'Reilly, 2008.
5.	John Uffenbeck and 8088 Family. 1997. The 80x86 Family: Design, Programming, and Interfacing (2nd ed.). Prentice Hall PTR, Upper Saddle River, NJ, USA.
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

Syllabus

List of Challenging Experiments (Indicative)		
1.	Arithmetic operations 8/16 bit using different addressing modes.	2.5 hours
2.	Finding the factorial of an 8 /16 bit number.	2.5 hours
3.	(a) Solving nCr and nPr (b) Compute nCr and nPr using recursive procedure. Assume that n and r are non-negative integers	2.5 hours
4.	Assembly language program to display Fibonacci series	2.5 hours
5.	Sorting in ascending and descending order	2.5 hours
6.	(a) Search a given number or a word in an array of given numbers. (b) Search a key element in a list of n 16-bit numbers using the Binary search algorithm.	2.5 hours
7.	To find the smallest and biggest numbers in a given array.	2.5 hours
8.	ALP for number system conversions.	2.5 hours
9.	(a) String operations(String length, reverse, comparison, concatenation, palindrome)	2.5 hours
10.	ALP for Password checking	2.5 hours
11.	Convert a 16-bit binary value (assumed to be an unsigned integer) to BCD and display it from left to right and right to left for specified number of times	2.5 hours
12.	ALP to interface Stepper motor using 8086/ Intel Galileo Board	2.5 hours
	Total Laboratory Hours	30 hours

Module 7: Introduction to Arduino Boards

- Introduction to Microcontroller
- Introduction to Quark SOC processor
- **Introduction to Arduino Boards**
- **Arduino Programming**
- **GPIO (LED, LCD, Keypad, Motor control and sensor)**
- System design application and case study

Introduction

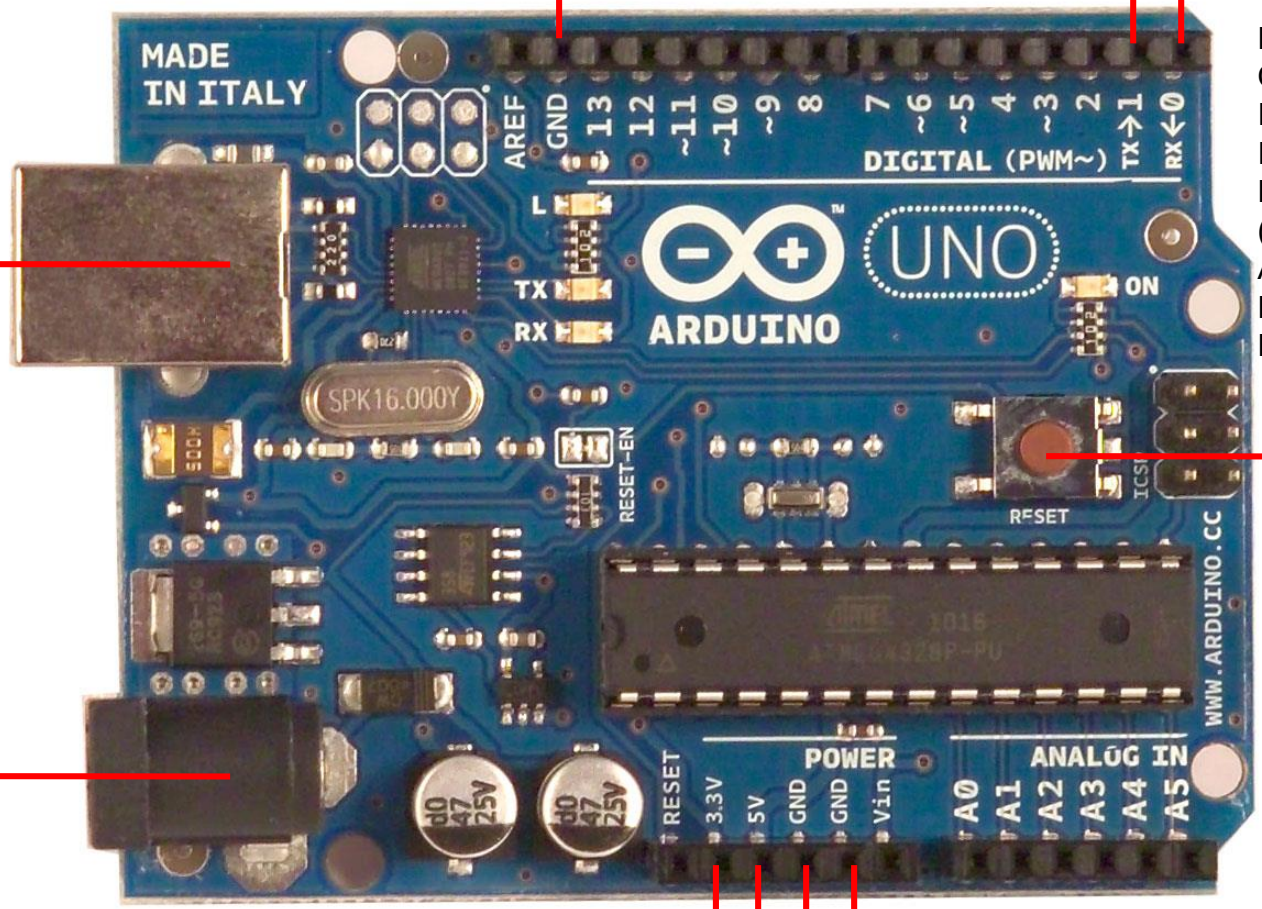
Open Source electronic prototyping platform based on flexible easy to use hardware and software.

Introduction

Digital Input/Output Pins
Pins with ~ are PWM
[Analog Output]

GRD

Transmitter/Receiver
Serial Connection



USB

7-12 v

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

3 v

5 v

GRD

Analog Input Pins

What can we do ?

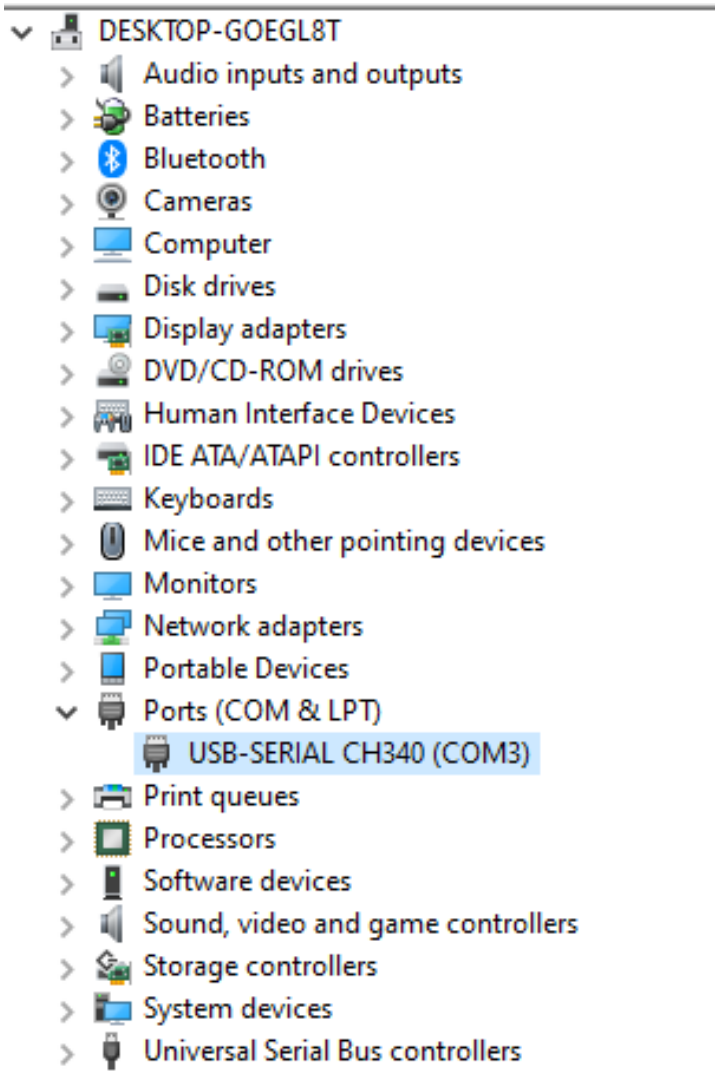
- Great for prototyping ideas
- Access to multiple I/O
- Drive motors, turn on lights, trigger controls.
- Low Power requirements
- Flexible / Open-source

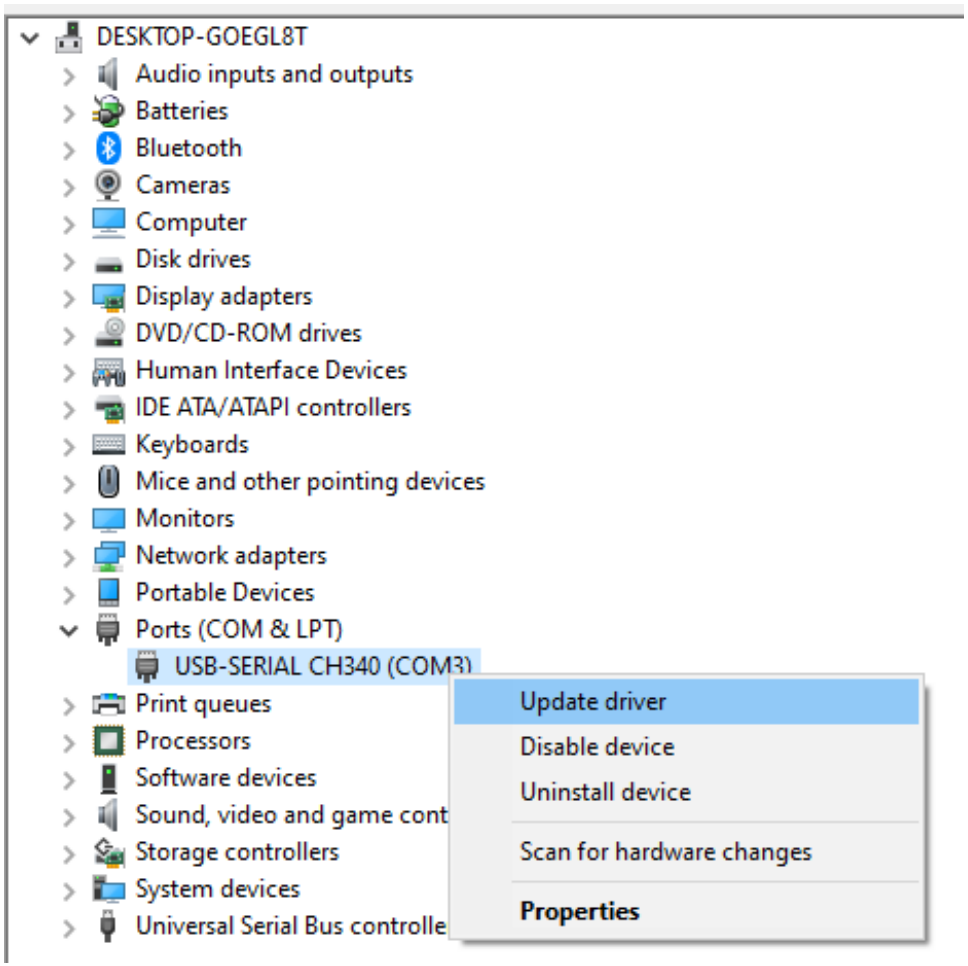
Software Installation

- Open Source
- Free
- Available on-line with resources at:

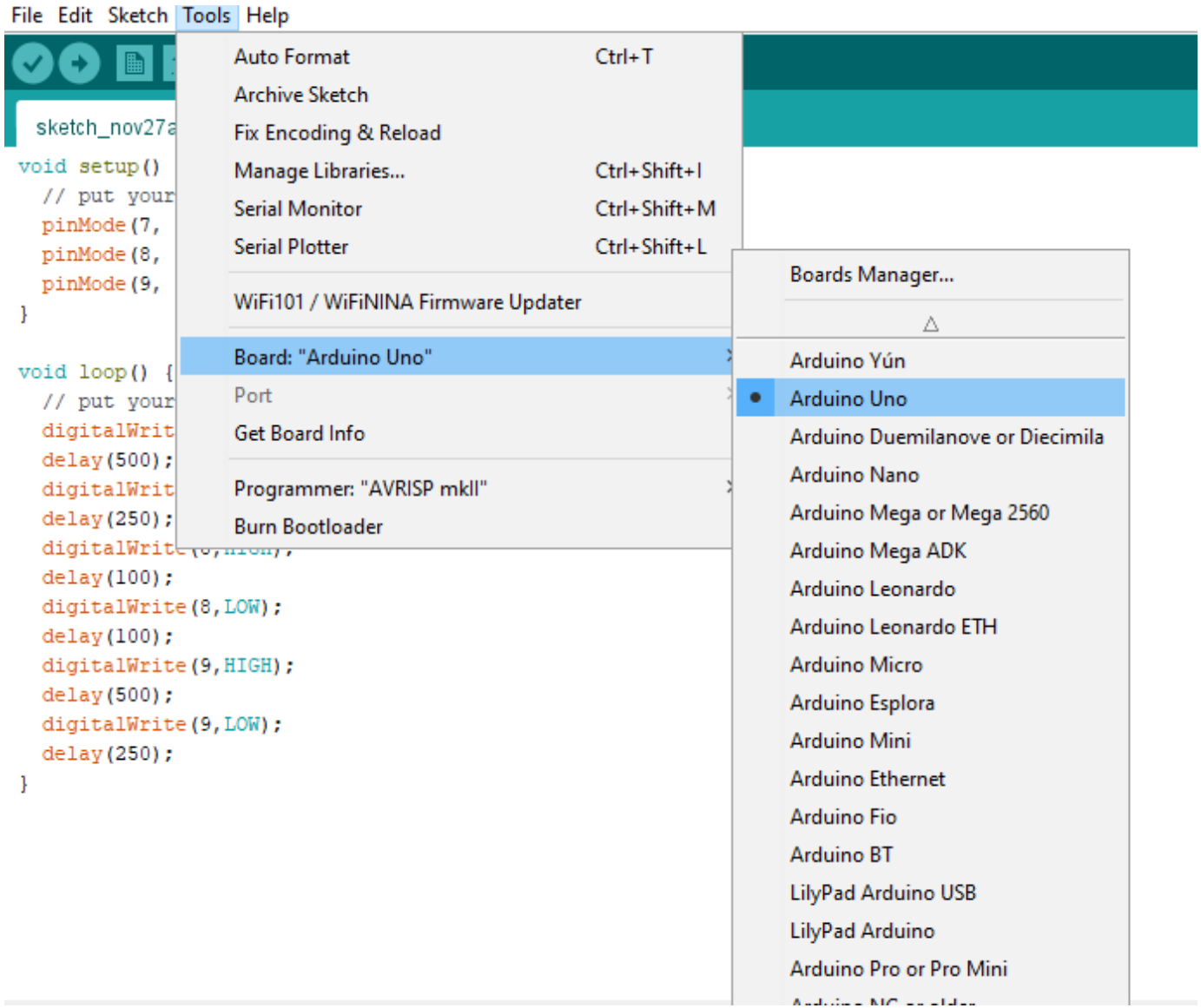
www.arduino.cc

Setup Board (Device Manager – after Device plugged-in)

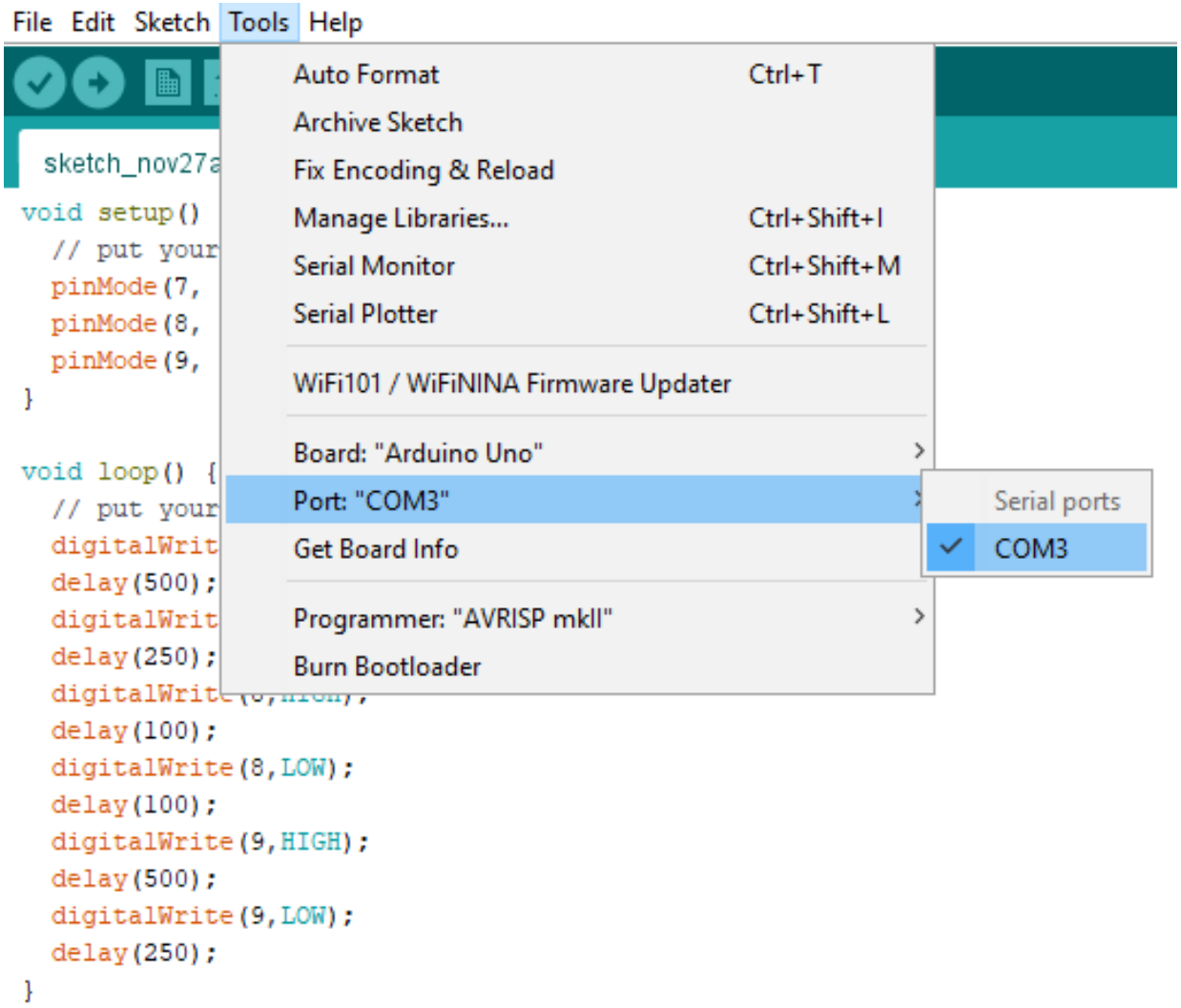




Setup Board (Arduino – Tools)



Setup Board (Arduino – Tools)



Arduino – Kit

Programming – Structure

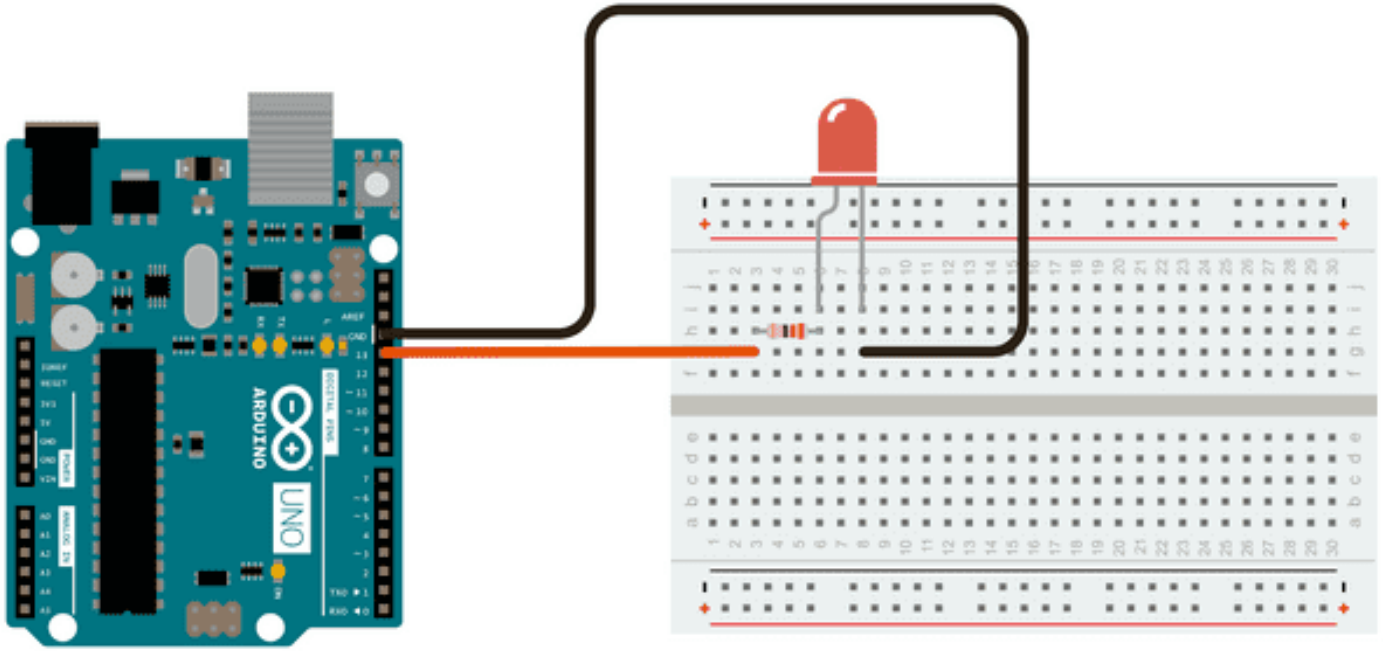
```
void setup() {
  // put your setup code here, to run once:

}

void loop() {
  // put your main code here, to run repeatedly:

}
```

Programming

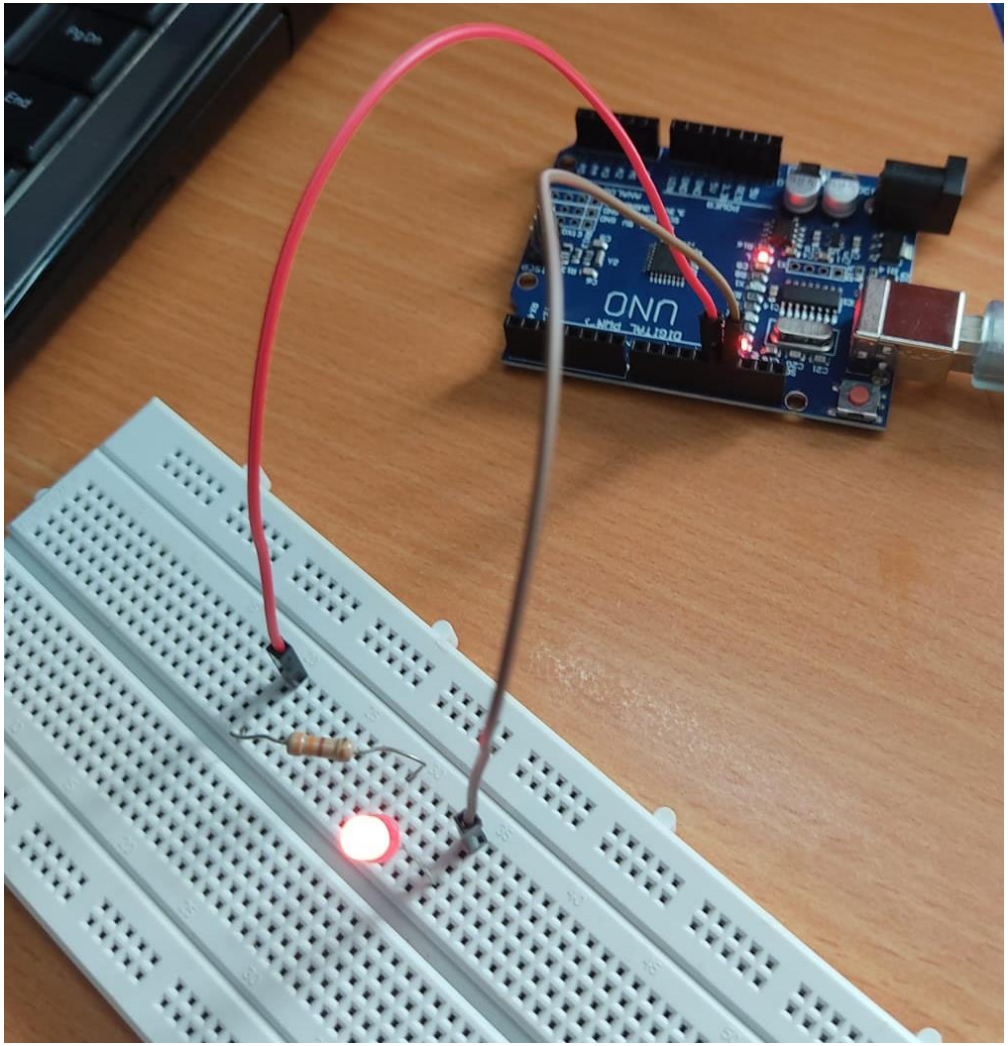
Programming – LED Blinking

```
void setup() {
  // put your setup code here, to run once:
  pinMode(13, OUTPUT);
}

void loop() {
  // put your main code here, to run repeatedly:
  digitalWrite(13,HIGH);
  delay(500);
  digitalWrite(13,LOW);
  delay(250);
}
```

Programming – LED Blinking – Wiring



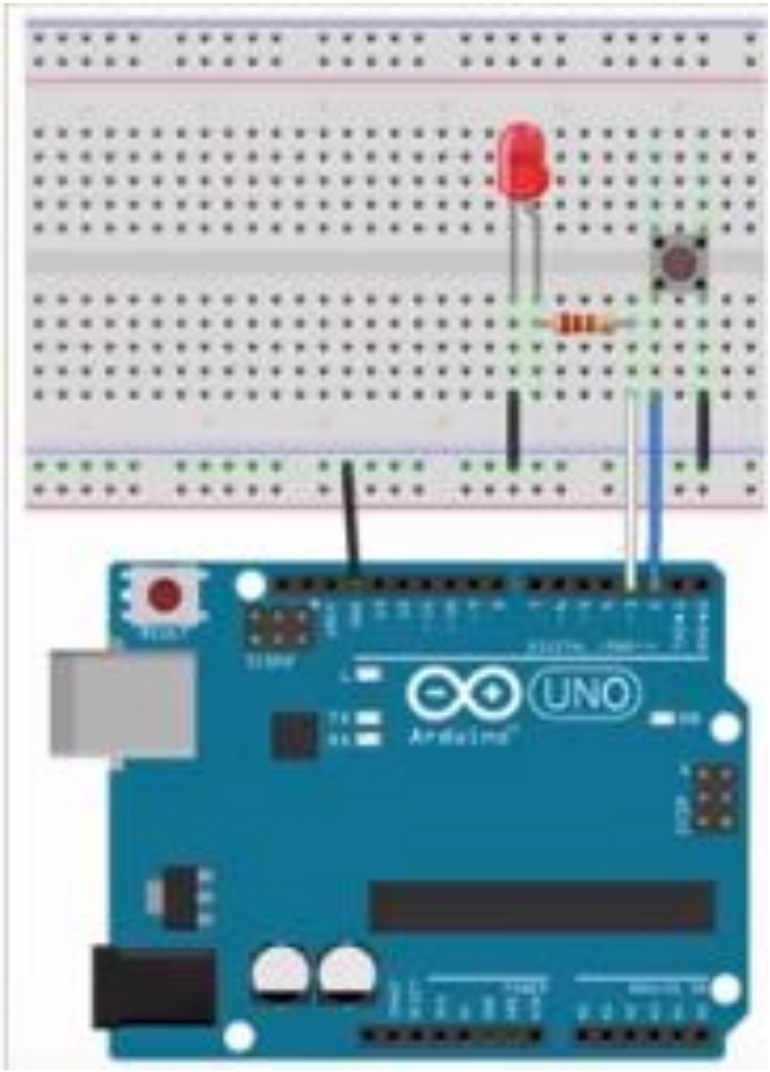
Programming – LED Blinking – Demo



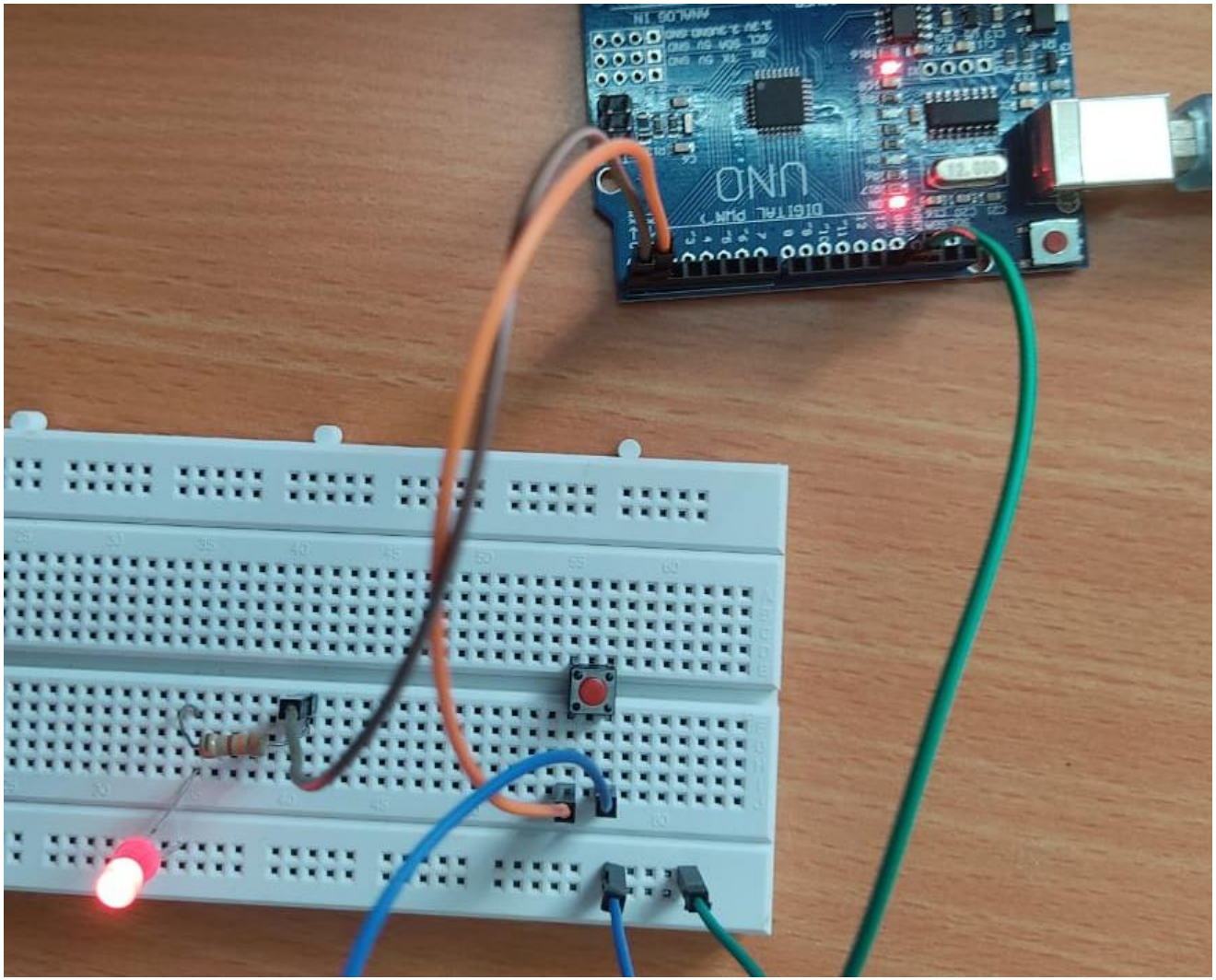
Programming – Using Variables

```
int ledPin = 0;
int switchPin = 1;

void setup() {
  pinMode(ledPin,OUTPUT);
  pinMode(switchPin,INPUT_PULLUP);
  }

void loop() {
  int buttonState = digitalRead(switchPin);
  digitalWrite(ledPin,buttonState);
  }
```

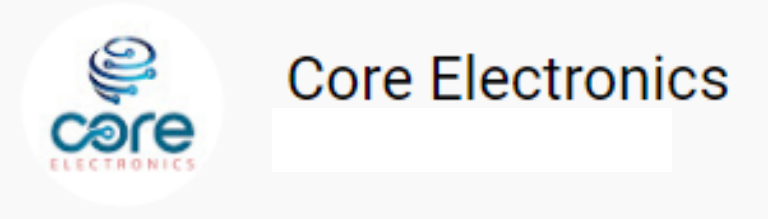
Programming – Using Variables – Wiring



Programming – Using Variables – Demo



More on Arduino Programming



Core Electronics: Arduino Workshop for Beginners

https://youtube.com/playlist?list=PLPK2l9Knytg5s2dk8V09thBmNl2g5pRSr