



SNS COLLEGE OF TECHNOLOGY
An Autonomous Institution
Coimbatore-35



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Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT308-WIRELESS TECHNOLOGIES FOR IoT

III YEAR/ VI SEMESTER

**UNIT 4 – PROTOTYPING AND DESIGNING SOFTWARE FOR IOT
APPLICATIONS**

**TOPIC – Programming
Embedded Device Arduino Platform using IDE**

Introduction to Arduino

- ❑ Arduino is an **open-source electronics platform** based on **easy-to-use hardware and software**.
- ❑ Arduino boards are **able to read inputs** - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.
- ❑ You can **tell your board what to do** by sending a set of instructions to the microcontroller on the board.
- ❑ To do so you use the **Arduino programming language** (based on **Wiring**), and the **Arduino Software (IDE)**, based on **Processing**.



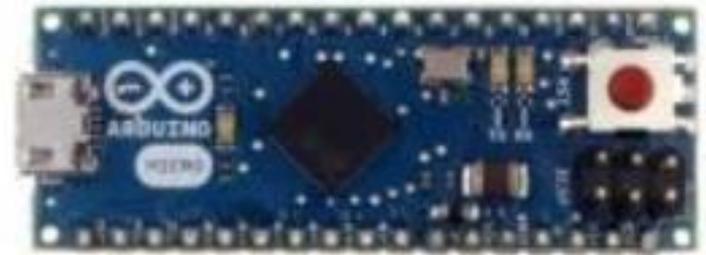
Why Arduino?

- ❑ Arduino is an open source product, software/hardware which is accessible and flexible to customers.
- ❑ Arduino is flexible because of offering variety of digital and analog pins, SPI and PWM outputs.
- ❑ Arduino is easy to use, connected to a computer via a USB and communicates using serial protocol.
- ❑ Inexpensive, around 500 rupees per board with free authoring software.
- ❑ Arduino has growing online community where lots of source code is available for use, share and post examples for others to use too, too!.
- ❑ Arduino is Cross-platform, which can work on Windows, Mac or Linux platforms.
- ❑ Arduino follows Simple, clear programming environment as C language.

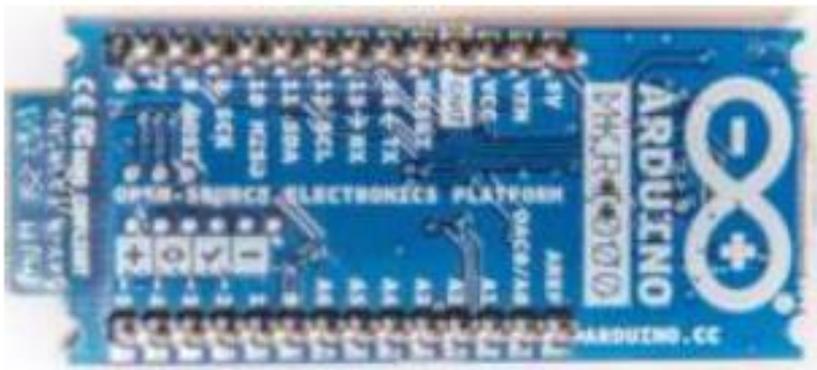
Which Arduino?



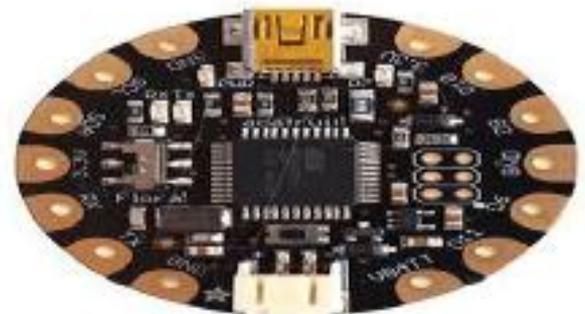
Arduino Mega



Arduino Micro



ArduinoMKR1000



Flora

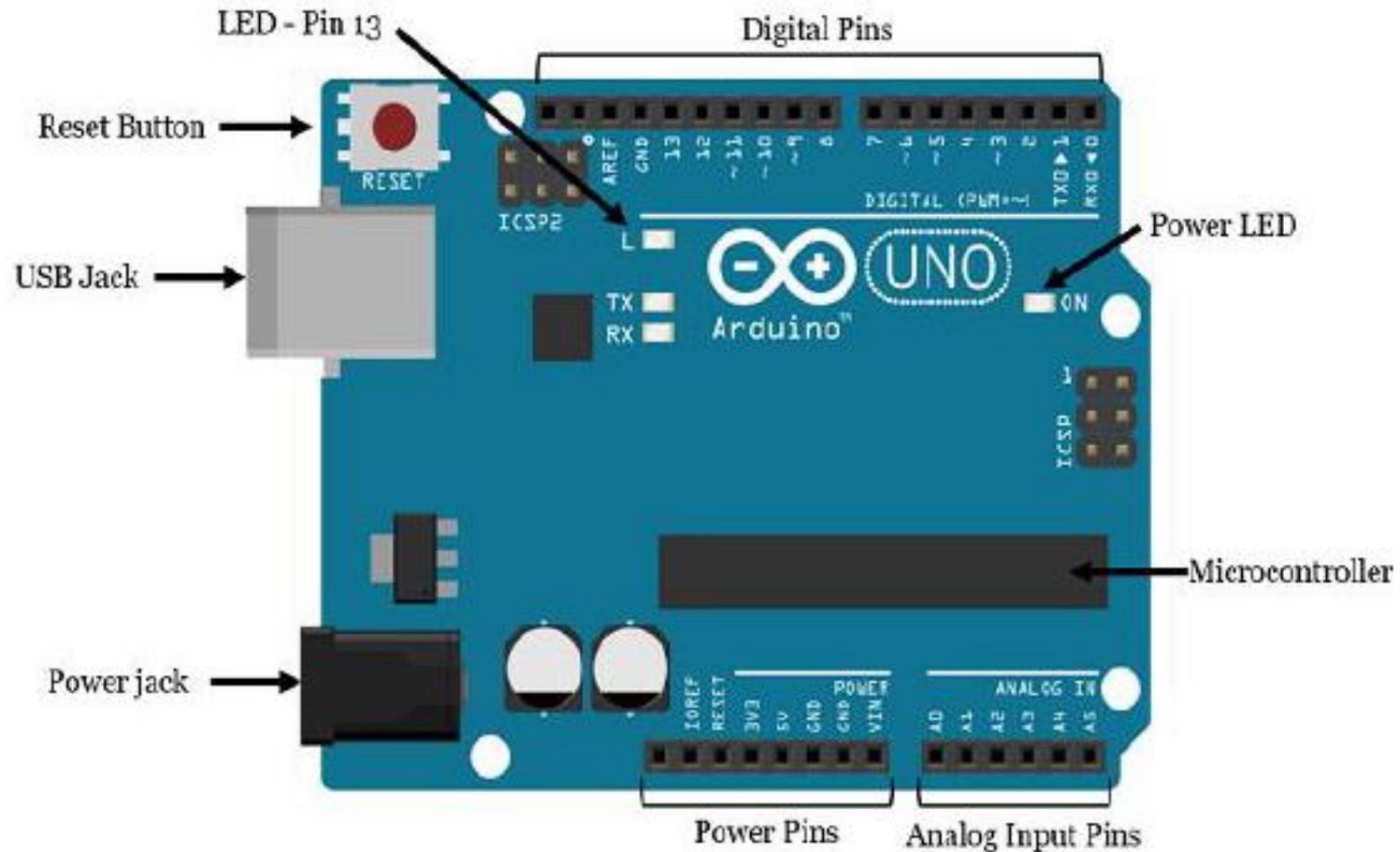
Which Arduino?

In the ten years since Arduino was released, hundreds of “Arduino boards” are available in the market serving every kind of purpose. Among all in this book we focus on popular Arduino UNO which is used in almost 99% of projects use.



Arduino Uno

Exploring the Arduino Uno



Exploring the Arduino Uno

- ✓ **Microcontroller:** the **ATmega328p** is the Arduino brain. Everything on the Arduino board is meant to support this microcontroller.
- ✓ **Digital pins:** Arduino has 14 digital pins, labeled from 0 to 13 that can act as inputs or outputs.
- ✓ When set as inputs, these pins can read voltage. They can only read two different states HIGH or LOW. When set as outputs, these pins can apply voltage. They can only apply 5V (HIGH) or 0V (LOW).
- ✓ **PWM pins:** These are digital pins marked with a ~ (pins 11, 10, 9, 6, 5 and 3). PWM stands for “pulse width modulation” and allows to make digital pins output “fake” varying amounts of voltage. You’ll learn more about PWM later.
- ✓ **TX and RX pins:** digital pins 0 and 1. The T stands for “transmit” and the R for “receive”. Arduino uses these pins to communicate with the computer. Avoid using these pins, unless you’re running out of pins.

Exploring the Arduino Uno

- ✓ **LED attached to digital pin 13:** This is useful for an easy debugging of the Arduino sketches.
- ✓ **TX and RX pins:** these pins blink when there are information being sent between the computer and the Arduino.
- ✓ **Analog pins:** the analog pins are labeled from A0 to A5 and are most often used to read analog sensors. They can read different amounts of voltage between 0 and 5V. Additionally, they can also be used as digital output/input pins like the digital pins.
- ✓ **Power pins:** The Arduino has 3.3V or 5V supply, which is really useful since most components require 3.3V or 5V. The pins labelled as “GND” are the ground pins.
- ✓ **Reset button:** when you press that button, the program that is currently being run in your Arduino will start from the beginning. You also have a Reset pin next to the power pins that acts as reset button. When you apply a small voltage to that pin, it will reset the Arduino.

Exploring the Arduino Uno

- **Power ON LED:** will be on since power is applied to the Arduino.
- **USB jack:** a male USB A to male USB B cable is how you upload programs from your computer to your Arduino board. This also powers your Arduino.
- **Power jack:** The power jack is where you connect a component to power up your Arduino (recommended voltage is 5V). There are several ways to power up your Arduino: rechargeable batteries, disposable batteries, wall-warts and solar panel.

Things that Arduino can do?

- ✓ The simplest thing you can control with your Arduino is an LED.
- ✓ You can also display a message in a display, like the LCD display.
- ✓ You can also control DC or servo motors.
- ✓ You can also Read data from the outside world
- **Motion sensor:** The motion sensor allows you detect movement.
- **Light sensor:** this allows you to “measure” the quantity of light in the outside world.
- **Humidity and temperature sensor:** this is used to measure the humidity and temperature.
- **Ultrasonic sensor:** this sensor allows to determine the distance to an object through sonar.

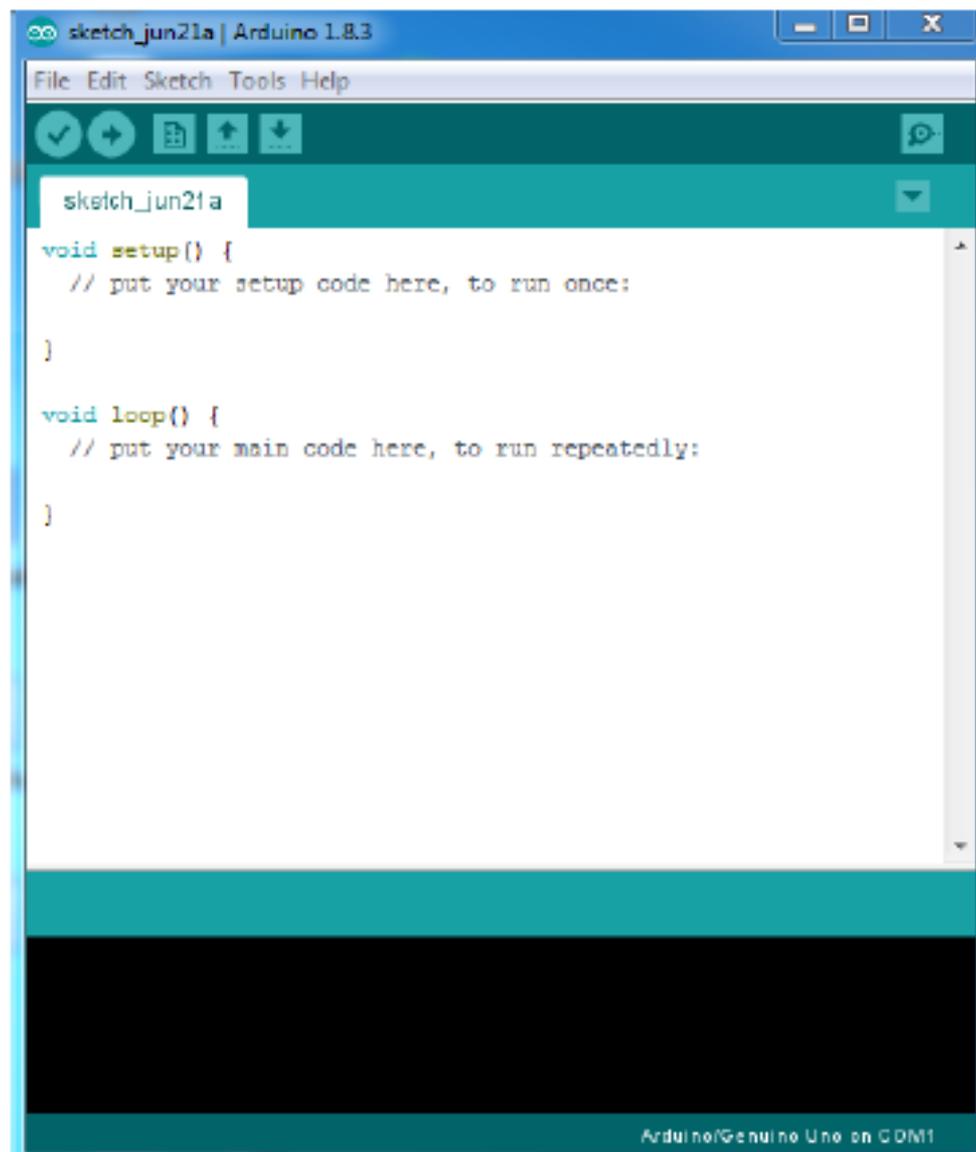
Shields – an extension of the Arduino

- Shields are boards that will expand the functionalities of your Arduino. You just need to plug them over the top of the Arduino. There are countless types of shields to do countless tasks.

Installing the Software (Arduino IDE)

- The Arduino IDE (Integrated Development Environment) is where you develop your programs that will tell your Arduino what to do.
- You can load new programs onto the main chip, the ATmega328p, via USB using the Arduino IDE.
- To download your Arduino IDE, browse on the following link: <https://www.arduino.cc/en/Main/Software>.
- Select which Operating System you're using and download it.
- We won't go into much detail on how to install this software, since the official Arduino web site does a great job explaining how to do it in all three Operating Systems – Windows, Mac and Linux.

Installing the Software (Arduino IDE)



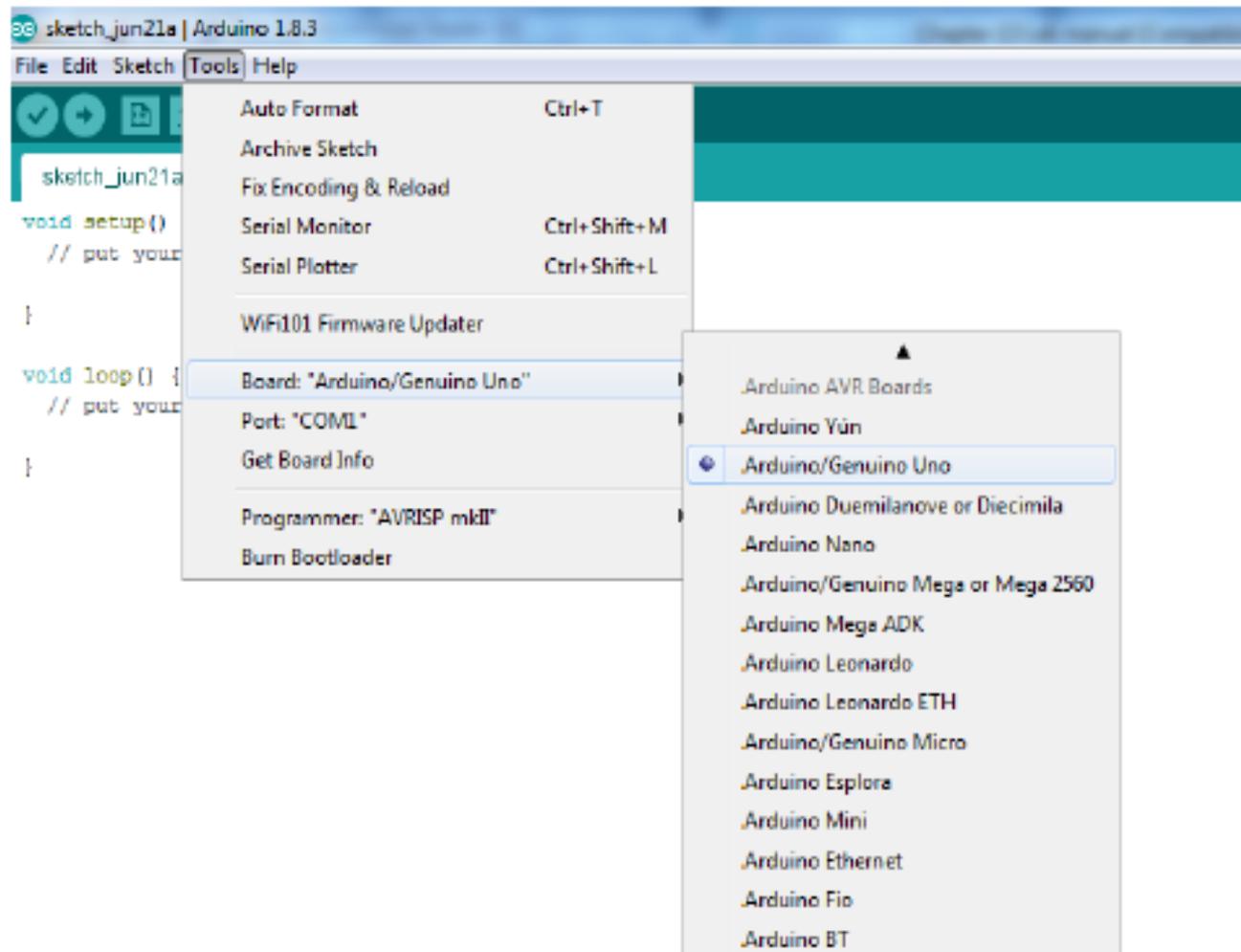
The screenshot displays the Arduino IDE window titled "sketch_jun21a | Arduino 1.8.3". The menu bar includes "File", "Edit", "Sketch", "Tools", and "Help". The toolbar contains icons for saving, undo, redo, and other functions. The main editor area shows the following code:

```
sketch_jun21a
void setup() {
  // put your setup code here, to run once:
}

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

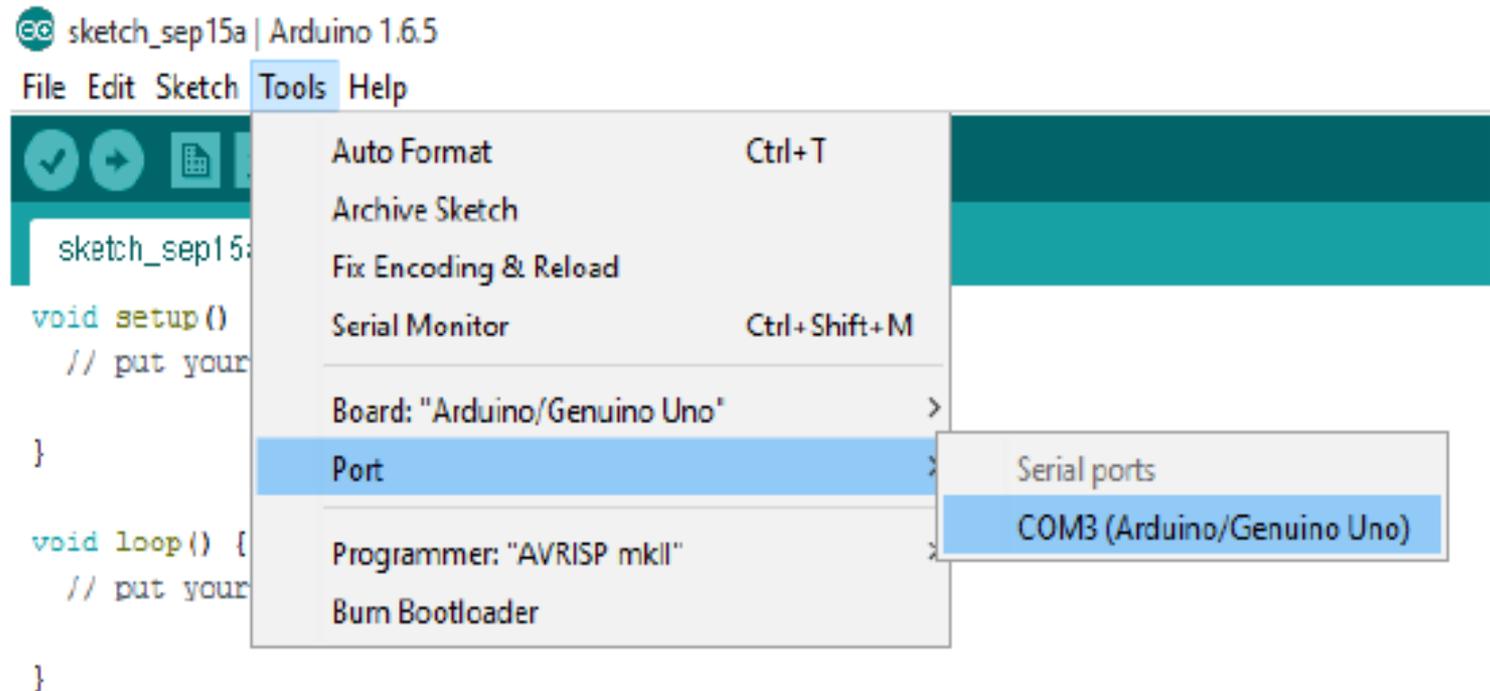
At the bottom of the window, the text "Arduino/Genuino Uno on COM1" is visible.

Connecting Arduino Uno Learning Board



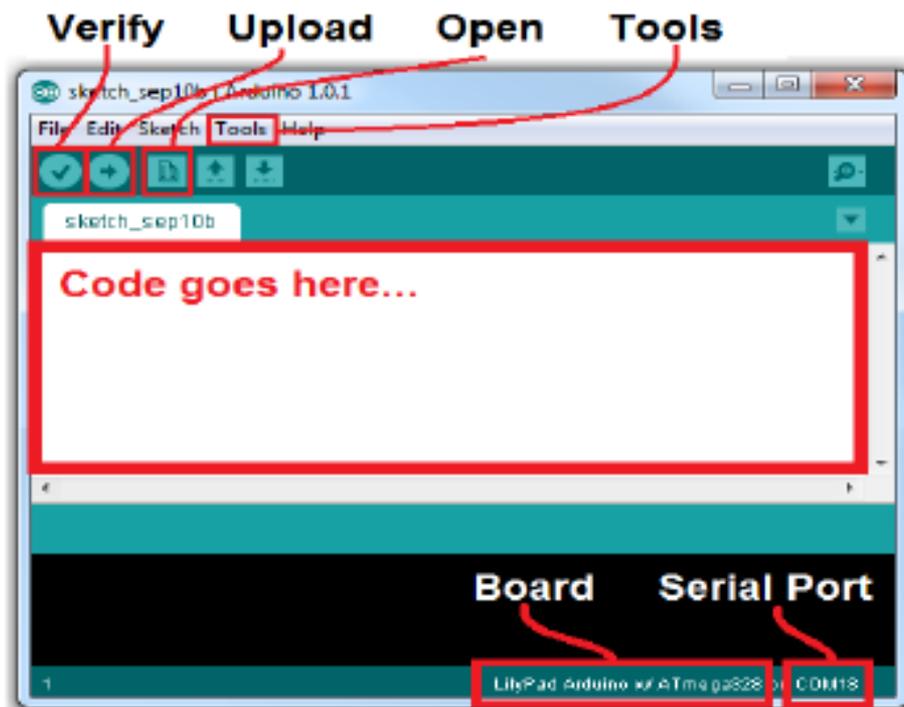
selecting the right Board

Connecting Arduino Uno Learning Board



selecting the right port

Connecting Arduino Uno Learning Board



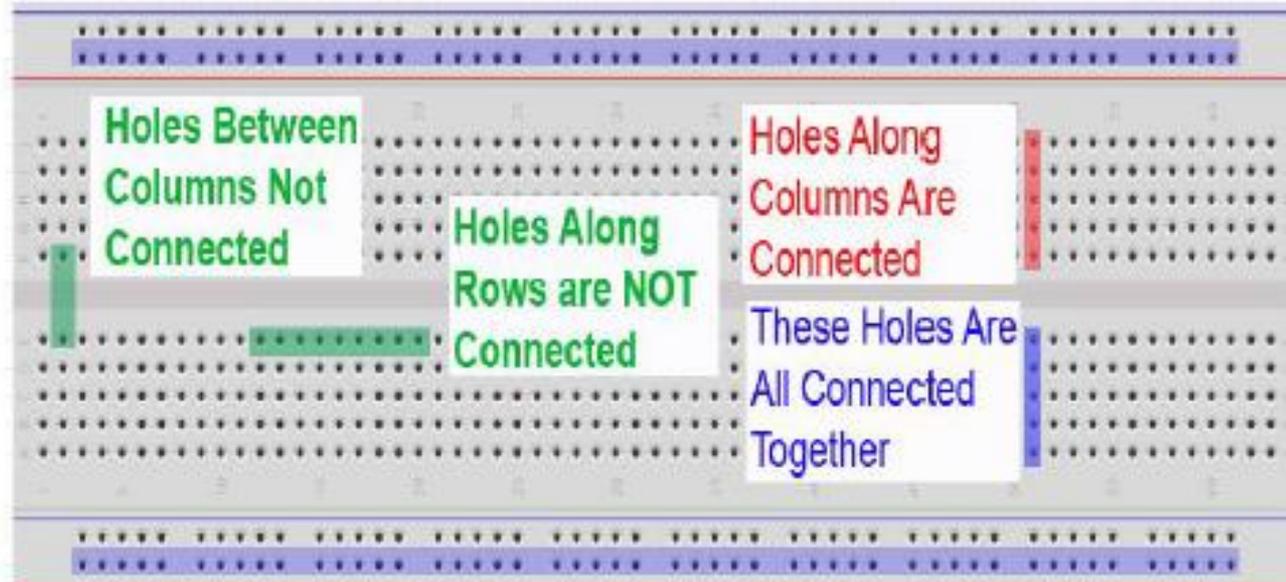
Layout of Arduino Uno IDE

Connecting Arduino Uno Learning Board

Verify/Compile	Checks the code for errors
Stop	Stops the serial monitor, or un-highlights other buttons
New	Creates a new blank Sketch. enter a name and a location for your Sketch
Open	Shows a list of Sketches in your sketchbook
Save	Saves the current Sketch
Upload	Uploads the current Sketch to the Arduino. You Need to make sure that you have the correct board and port selected (in the Tools menu) before uploading.
Serial Monitor	Displays serial data being sent from the Arduino
Verify/Compile	Button is used to check that your code is correct, before you upload it to your Arduino.
Stop button	Will stop the Serial Monitor from operating. If you need to obtain a snapshot of the serial data so far examined.

Toolbar options in Arduino IDE

Breadboard for prototyping Arduino Uno Circuits



Breadboard for prototyping Arduino Uno circuits

Technical Specifications of Arduino Uno

Technical Specifications:	ATmega328P
Microcontroller Arduino UNO	
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz

Technical Specifications of Arduino UNO

