Dr. Akhilesh Das Gupta Institute of Technology and Management, New Delhi

WORKSHOP ON BASIC ELECTRONICS AND ARDUINO INTERFACING

ORGANIZED BY ECE DEPARTMENT

Student Coordinators :
Sumneet Kaur
Devjot Singh
Maninder Singh
Aman Puri
Bhaskar Dutt
Pranav Gupta
Zorawar Singh

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HEAD OF DEPARTMENT:
Prof. (Dr.) Rajiv Sharma

EVENT COORDINATOR:
Asstt. Prof. Divya Arora

DAY 1

OVERVIEW

- Resistance
- Capacitance
- Microprocessor vs Microcontroller
- Arduino Basics
- LED interfacing
- Buzzer
- Digital Switch

RESISTANCE

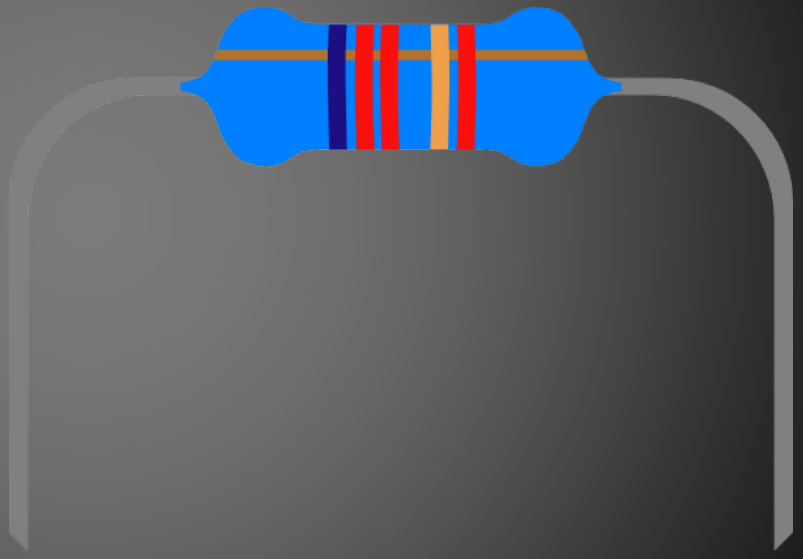
- Resistors are used as safety devices to avoid breakdown.
- Used for Voltage dropping
- Used to form Voltage Dividing circuits
- Colour codes are used to rate resistances

Colour Code

Color	1st	2nd	Multiplier	Tolerance
Black	0	0	1	
Brown	1	1	10	±1%
Red	2	2	100	±2%
Orange	3	3	1,000	
Yellow	4	4	10,000	
Green	5	5	100,000	±0.5%
Blue	6	6	1,000,000	±0.25%
Violet	7	7	10,000,000	±0.1%
Gray	8	8	100,000,000	±0.05%
White	9	9	1,000,000,000	
Gold			0.10	±5%
Silver			0.01	±10%
None				±20%

Things to consider while buying a Resistor

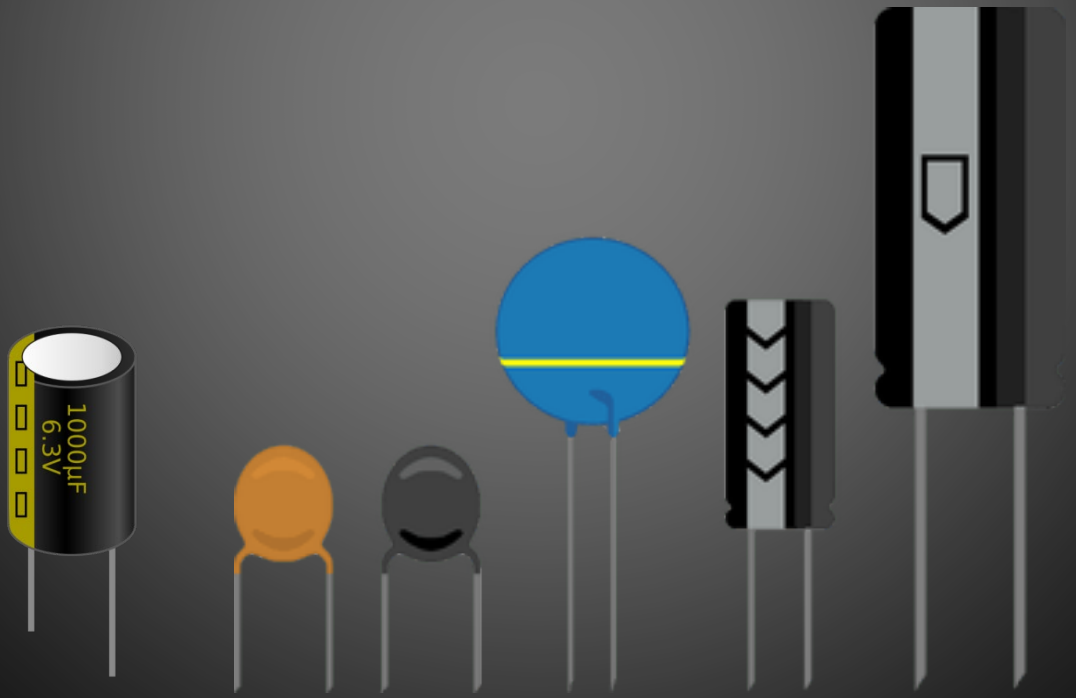
- Application
- Tolerance
- Wattage



- Proceed with VOLTAGE DROPPING

CAPACITANCE

$$X_C = \frac{1}{2\pi Fc}$$



Usage

- Since we work on DC, the value of f_c is 0.
- Since f_c is 0, X_c is ∞
- Therefore, capacitors block DC current.
- Capacitors are used to avoid jittering and voltage spikes
- Also used for noise reduction
- Also used if DC motors with high current specifications are used

Types of Capacitors

ELECTROLYTIC CAPACITORS	CERAMIC CAPACITORS
These are polar in nature	These are non polar in nature
They are of the order of 10^{-6} F	They are of the order of 10^{-12} F
Used for voltage filtration	Used for high frequency circuits
Can store large amounts of charge and are a little big in size	Can store small amounts of charge and are flat, spherical and small in size

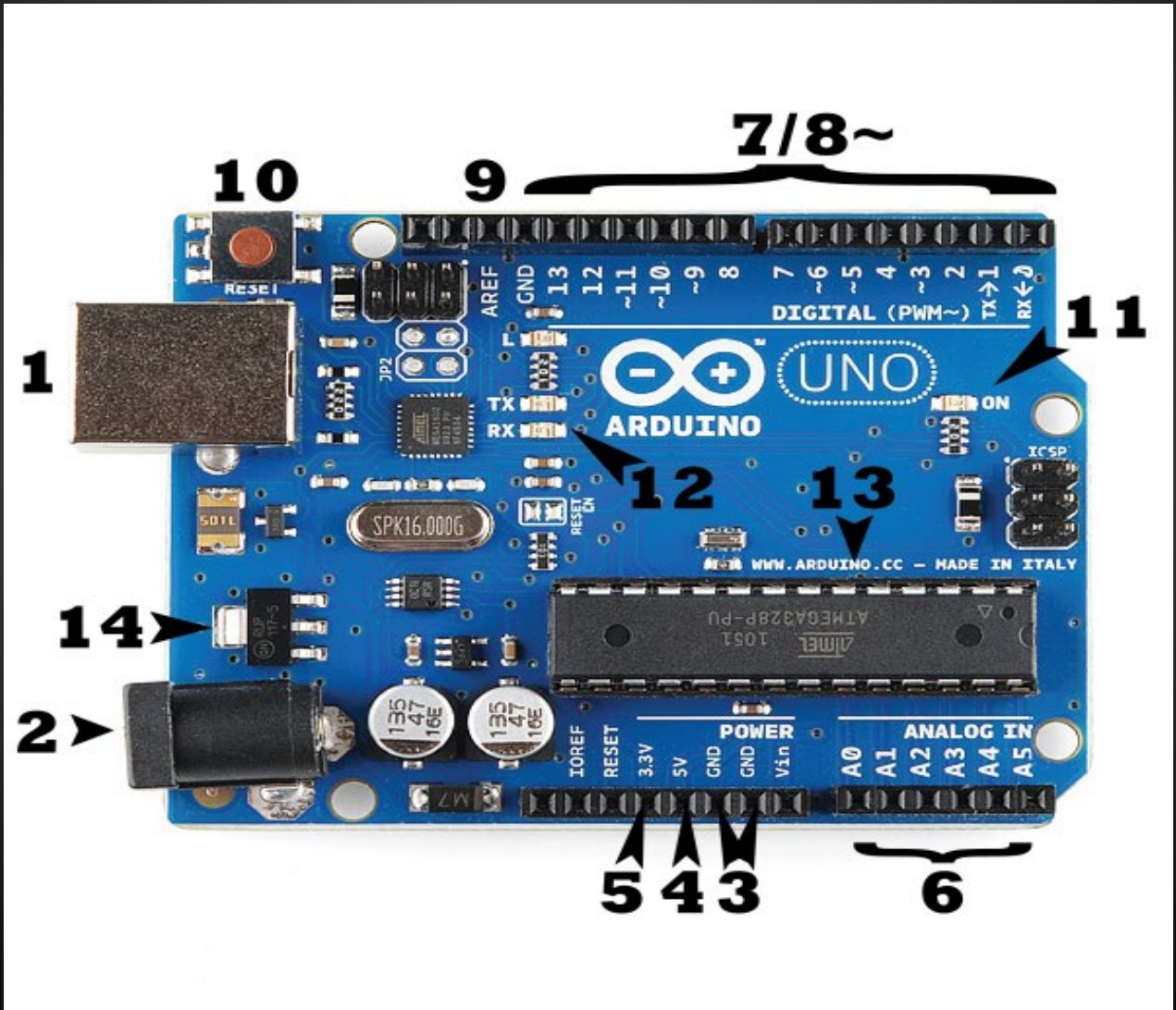
Microprocessor vs Microcontroller

MICROPROCESSOR	MICROCONTROLLER
Used for processing	Used for controlling or a dedicated function
It has higher RAM varying in GBs	It has very low RAM varying up to a few KBs
It has a working OS	It has a firmware
Operating frequency is in GHz	Operating frequency is a few MHz

Arduino

- Open source platform
- IDE freely available
- The pricing is sweet
- Analog and Digital GPIO pins
- User friendly coding
- A gigantic User base for you to get inspired from

Layout


7/8~
10
9
1
11
12
13
14
2
5
4
3
6
RESET
AREF
GND
DIGITAL (PWM~)
TX
RX
ON
ICSP
UNO
ARDUINO
SPK16.000G
WWW.ARDUINO.CC – MADE IN ITALY
POWER
ANALOG IN
IOREF
RESET
3.3V
5V
GND
GND
Vin
A0
A1
A2
A3
A4
A5

Topics covered using the IDE

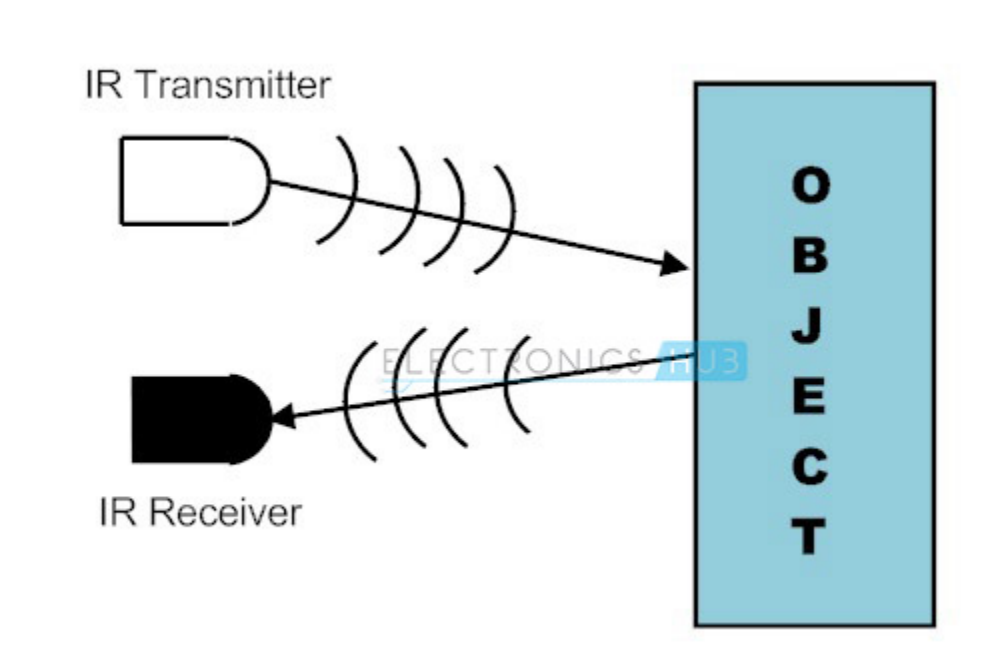
- Void Setup()
- Void Loop()
- Pin Declaration methods
- pinMode
- digitalWrite/Read
- analogWrite
- Global Variables

Activities

- Interface an LED that glows for 3 seconds and then stops.
- Design a multi LED system where the first LED glows, then it stops, followed by glowing the second LED, it stops too and finally both the LEDs glow.
- Blink Sketch
- Try LED interfacing with analogWrite.

IR sensor

- It sends an IR ray and once it strikes an object, the reflected ray collides with a Photodiode and produces an output.



DAY 2

Serial Monitor

- Used for Serial Communication with the Arduino
- Works as a terminal, can be used for feedback
- Initialized with Serial.begin()
- Baud rate can be manually set in BPS
- Serial.print(“Message”);
- S = Serial.readString();

Ultrasonic Sensor HC-SR04

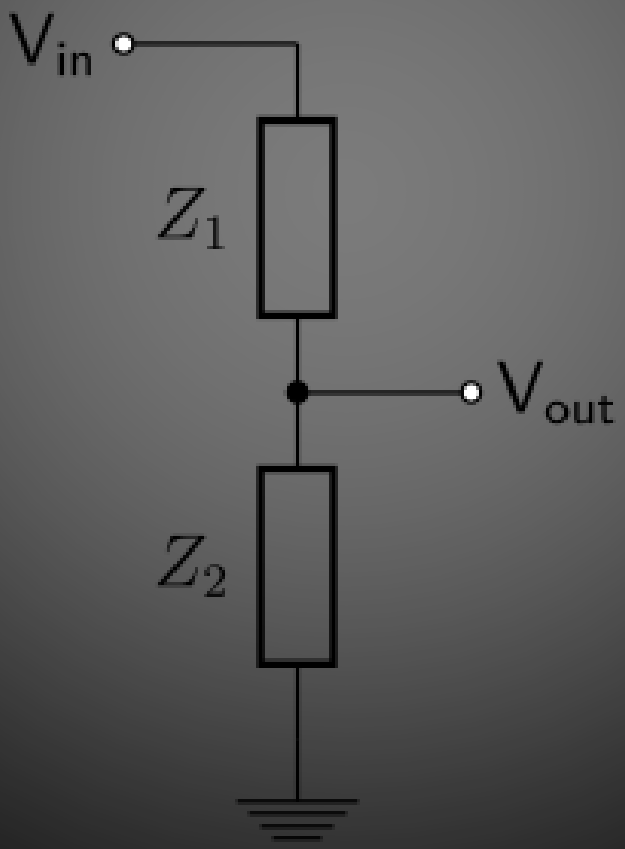
- Uses sonar to determine the distance to an object
- The Transmitter sends a high frequency sound
- When the signal finds an object, it reflects and the Receiver receives it

Relay Switch

- Electromechanical devices shifts between NO and NC
- Used for switching between High and Low Power circuits, ideal for home automation

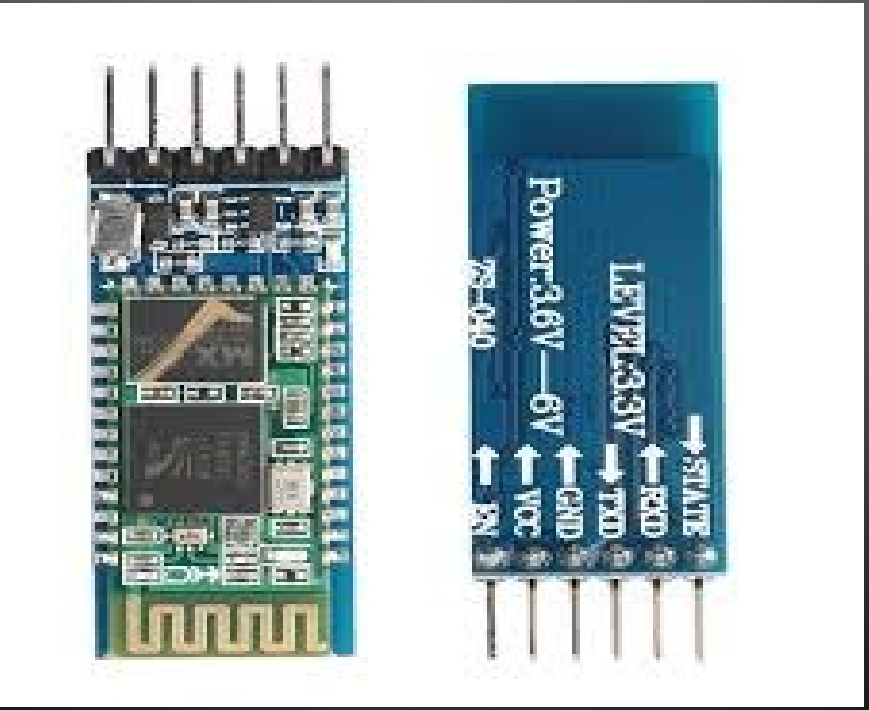
Voltage Divider

$$V_{out} = \frac{Z2 * Vin}{Z1 + Z2}$$



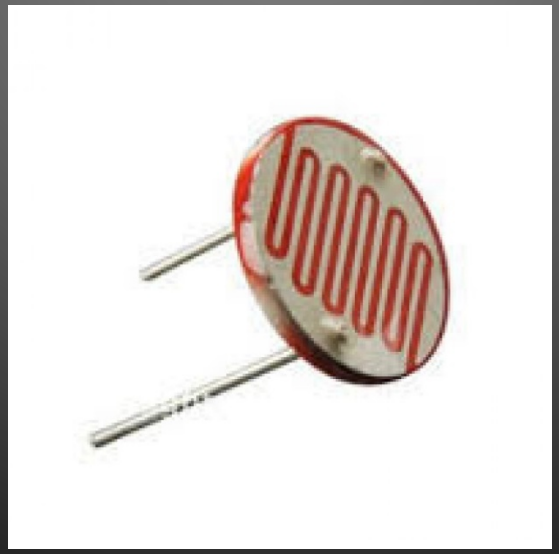
HC05 (Bluetooth)

- 10 mtr range
- Can work with the Master Slave configuration
- Has application with Smartphone Connectivity



LDR

- Light Dependent Resistor
- The resistance value changes with light intensity on the resistor.
- Realize the circuit using analogRead.



DAY 3

ACTIVITY

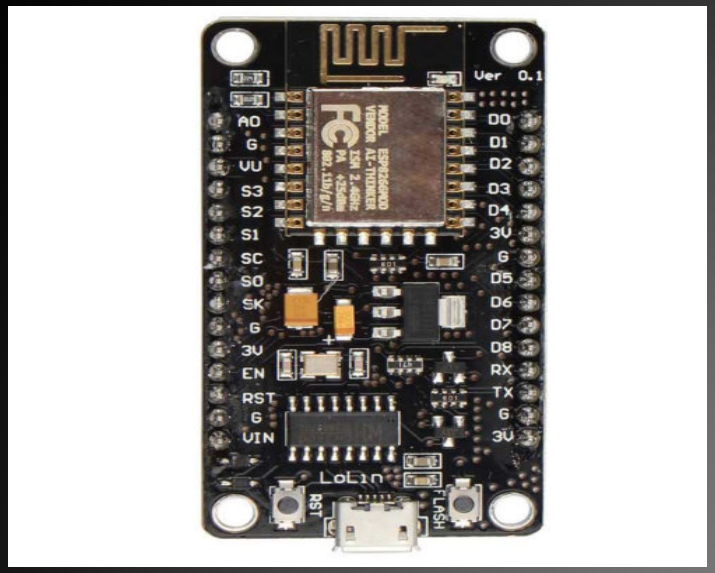
- Using all the concepts taught, make a mini project and explain its application in various domains.
- The topic will be provided by the educators, please get your circuits and codes checked before simulating them.

COMMUNICATION

- Arduino Nano and Pro Mini can be programmed by using Arduino UNO.
- We serially connect the two devices to communicate with each other.
- An alternate method can be using the FPGA converters.

NodeMCU vs ESP8266

- NodeMCU is a microcontroller which can directly be programmed to connect to the Wi-Fi networks.
- ESP8266 is a module that can be connected to the Arduino for WEB CONNECTIVITY.
- Ethernet shields also exist.


Ver 0.1
A0
G
VU
S3
S2
S1
SC
SO
SK
G
3V
EN
RST
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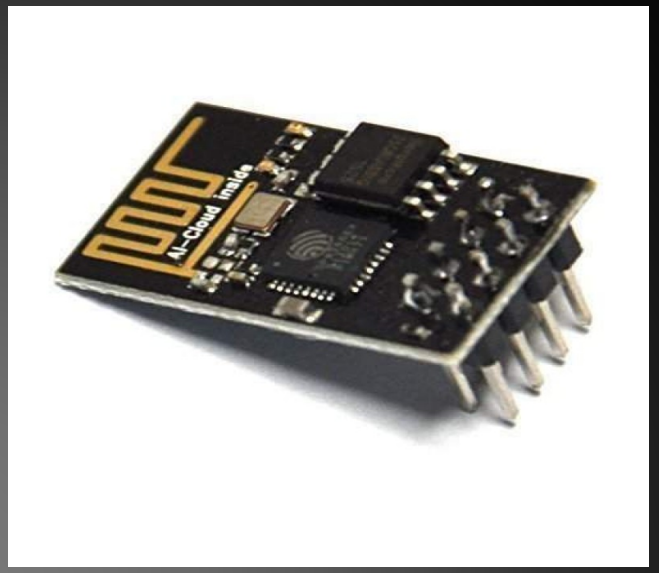
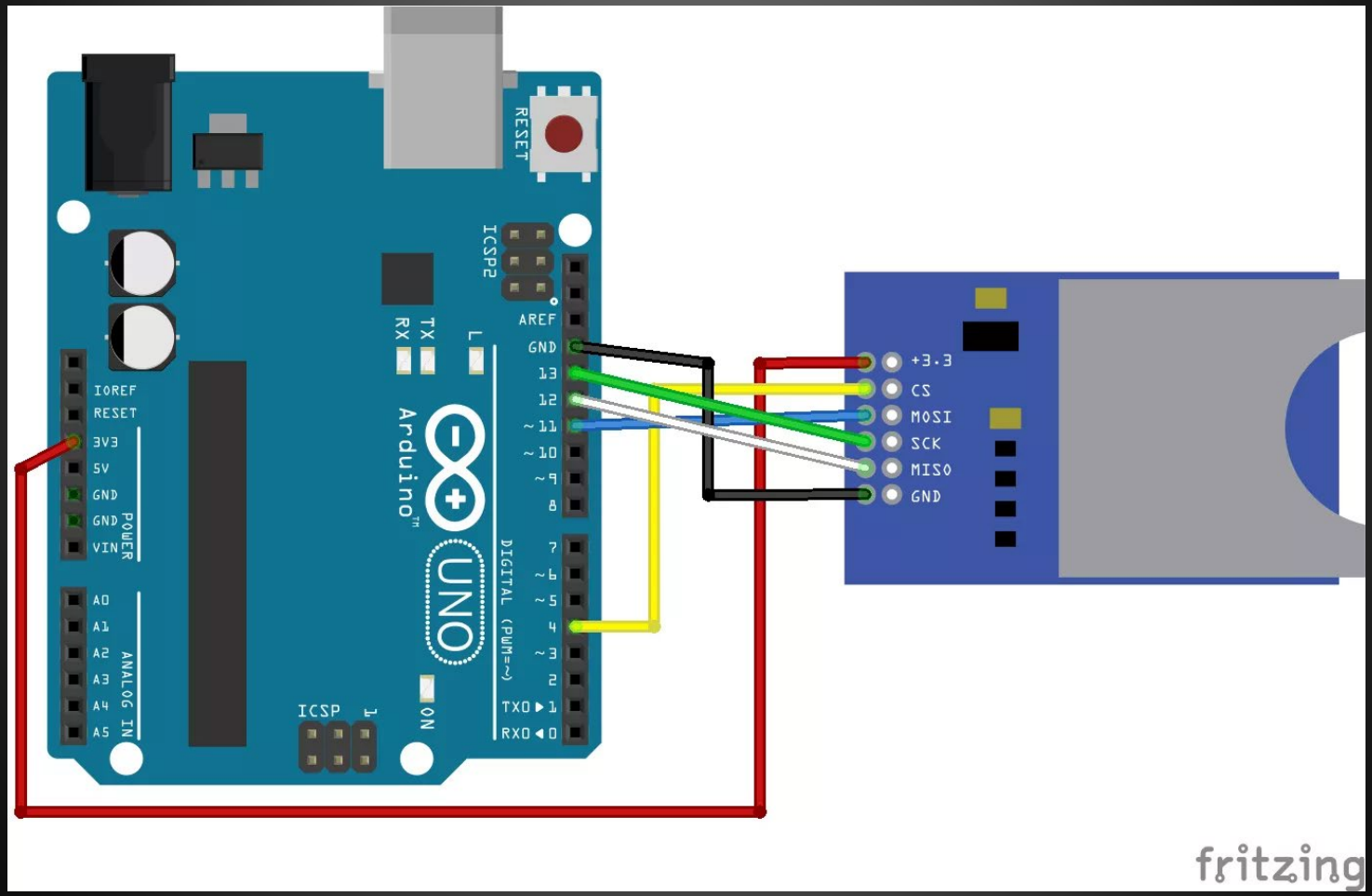
RX
TX
G
3V
LoLin
RST
FLASH


AI-Cloud inside

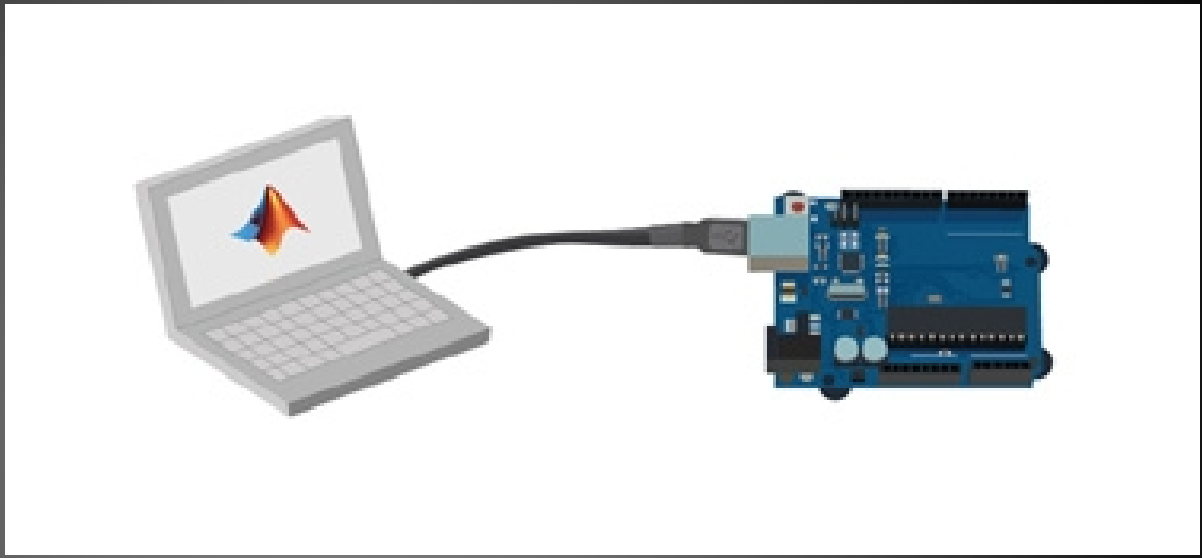
BOOTING VIA INTERNET

- Connect your Arduino to the Wi-Fi network.
- Connect your programming device to the same Wi-Fi network.
- Choose Arduino UNO Wi-Fi under boards.
- Upload the code and boom!

DATABASE (SD CARD)



MATLAB



MATLAB

GOOGLE SHEETS

Microsoft Excel

- Yes, data can be stored to MS Excel as well.

APP DEVELOPMENT

- What if you could design an App without programing?
- MIT App Inventor is a great way to develop Apps to submit complete projects.

FIREBASE 

- FIREBASE a Google product that has no limits.
- It’s a database system we often use.
- Applications
  - App Notifications
  - Cloud Linkage
  - Real time Management

AWS and Microsoft Azure

Thank You