ELECTRONICS & PROTOTYPING

A WORLD OF LEARNING, APPLYING, TESTING AND PROTOTYPING

Who am I ?

- FINAL YEAR, ELECTRONICS AND COMMUNICATION ENGINEERING,

   COLLEGE OF ENGINEERING CHENGANNUR

- NUMEROUS ELECTRONICS PROJECTS ON VARIOUS PLATFORMS

- EX RAS SECRETARY OF IEEE SB CEC 2019-2020

- PLACED IN TCS IOT AND EIS DEPARTMENT

LINKEDIN PROFILE - www.linkedin.com/in/thushar-tom

GMAIL - thushartom@gmail.com

WHAT HAVE YOU ALREADY LEARNED

WHY DO WE NEED PROGRAMMING IN ELECTRONICS ?

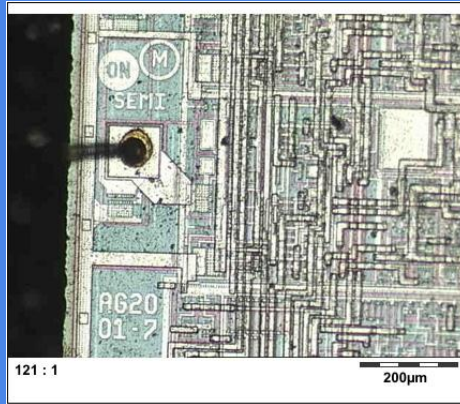YOU PROBABLY HAVE HEARD OF ARDUINO BOARD, WHY IS IT FAMOUS ?
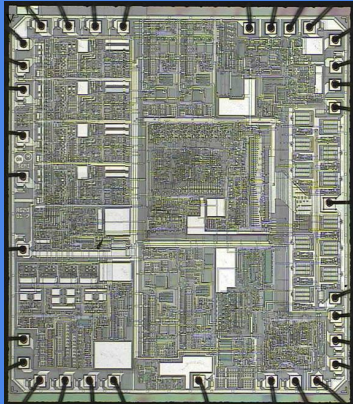
WHAT DOES PROTOTYPING REALLY MEAN ?

HOW DO WE ENGAGE WITH ELECTRONICS AND HOW TO LEARN THEM ?

INTEGRATED CIRCUITS

An *integrated circuit* is a special component that contains an entire electronic circuit, complete with transistors, diodes, and other elements, all photographically etched onto a tiny piece of silicon

Some manufacturers

Underneath the hood
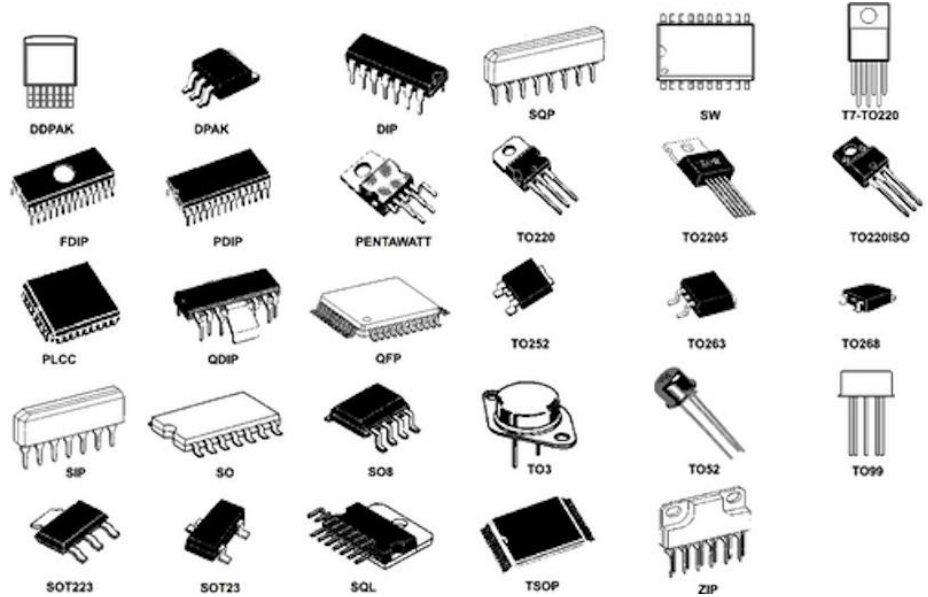
MICRO PROCESSORS AND MICRO CONTROLLERS

MICRO-PROCESSORS

1. Microprocessor is an IC which has only the CPU inside them
2. These microprocessors don't have RAM, ROM, and other peripheral on the chip
3. Microprocessor find applications where tasks are unspecific like developing software, games, websites, photo editing, creating documents etc

MICRO-CONTROLLERS

1. Microcontroller has a CPU, in addition with a fixed amount of RAM, ROM and other peripherals all embedded on a single chip
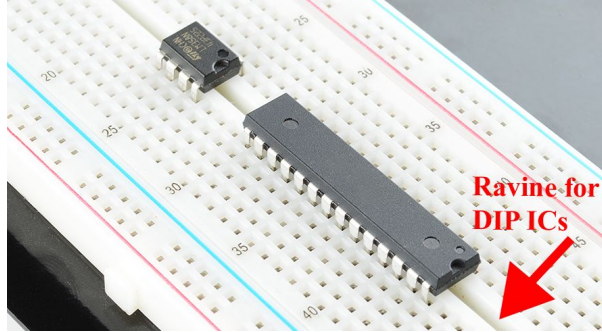2. Microcontrollers are designed to perform specific tasks

Unique dimensions, mounting types and pin counts

TWO MOUNT TYPES

DIP - DUAL INLINE PACKAGE

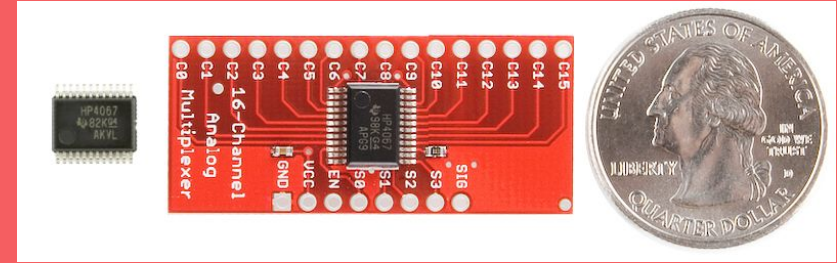- 0.1" (2.54mm) - Breadboard size
- 4 - 64 pins
- Notch to

Ravine for DIP ICs

SMD/SMT - SURFACE MOUNT PACKAGE

SOP - SMALL OUTLINE
- Cousin of DIP

Quad Flat Packages

- 32-300+
- 0.4-1mm

Ball Grid Arrays
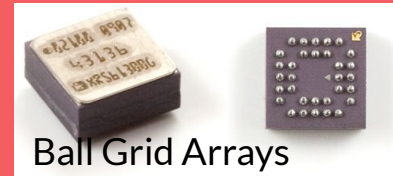
What's in them?

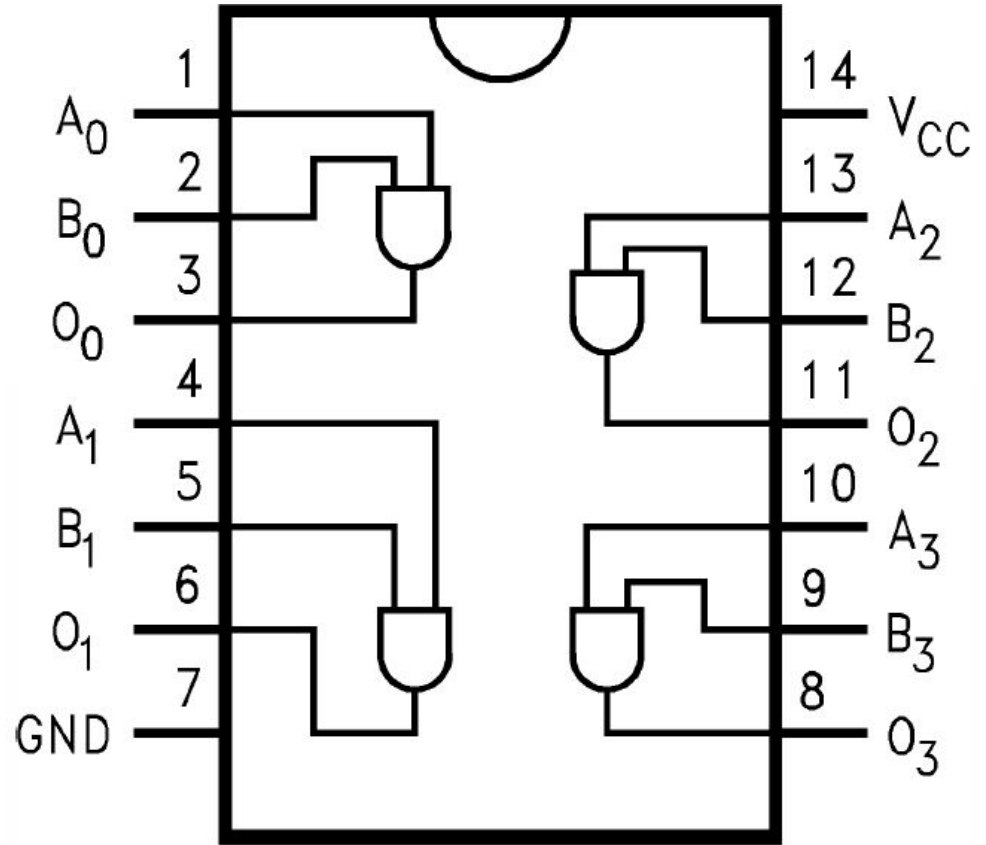Logic gates - Basic Functional Block
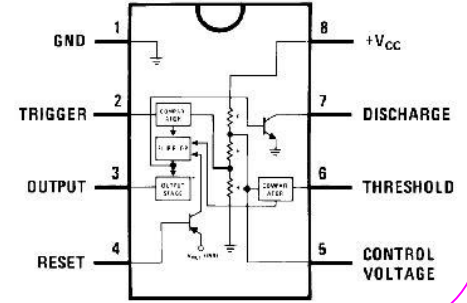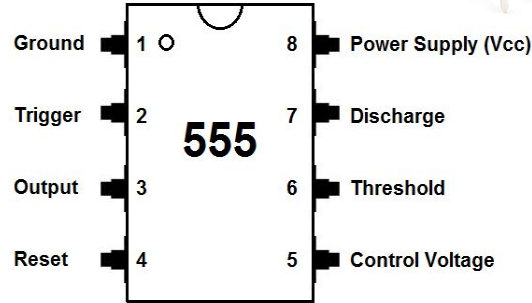
- AND
- NAND
- OR
- NOR
- NOT etc

A group of which can make up

- Timers
- Shift Registers
- Latches
- Counters

Some examples

- 555 Timer IC

- 741 and LM324 op-amps

Applications - Constant Current Sources, Schmitt Trigger, Inverting, Non inverting and Summing amplifiers, Voltage followers, Integrators, Differentiators etc
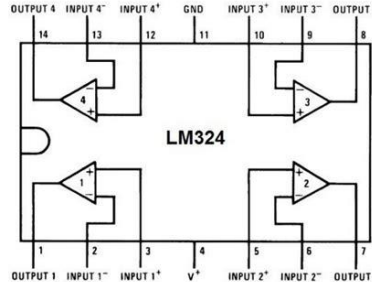
- 78XX Voltage Regulators
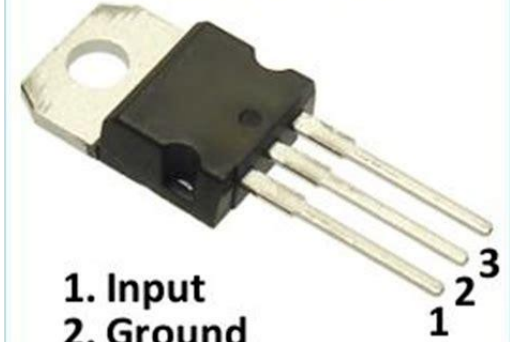
So why do we need programming ?

Not all IC's are programmable, say 555 - It is controlled by the Resistors and capacitors with it.

But we can use programming to accomplish many tasks such as PWM wave generation easily.

We need programming when

- there is Intelligence in the project - water heater
- process the information gathered from various sensors, etc

What do we need to program them ?

- This is what made Arduino Famous

Arduino

What is a Arduino ?

- Arduino - open-source electronics platform - easy-to-use hardware and software - cross platform.

- 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.
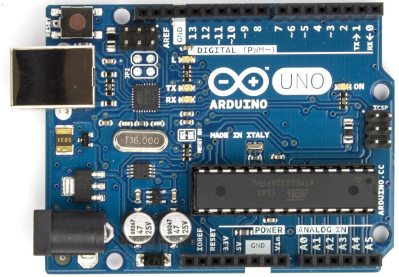
Arduino Environment
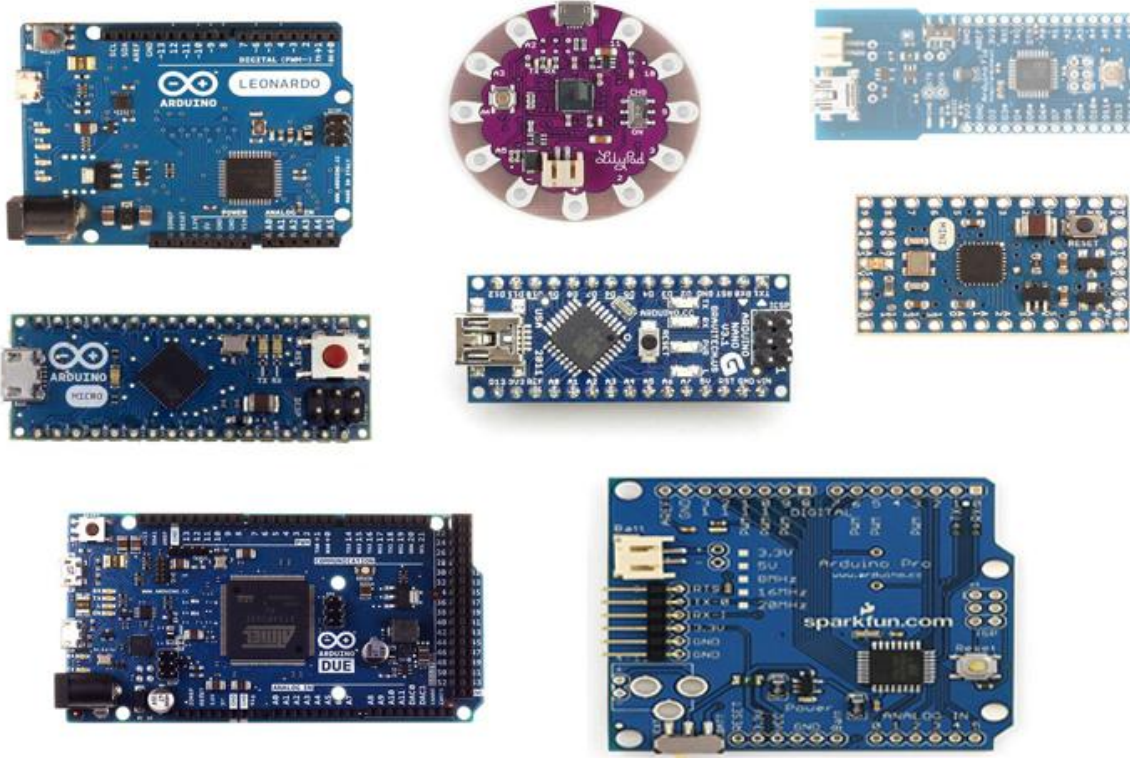
What made arduino Famous ?

- Arduino revolutionized DIY(Do it Yourself).
- Easy-to-use for beginners, yet flexible enough for advanced users
- Get started with programming and robotics
- They made it very easy to program and upload code
- Cross Platform - IDE (Integrated Development Environment)
- Took a step from coding in assembly and embedded C to more advanced C/C++ with support on Sensor libraries
- Open source and Extensible Hardware and Software support
- Huge supporting community etc
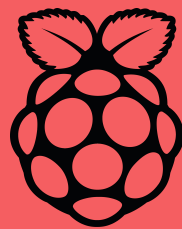
RASPBERRY PI

What is a Raspberry pi?

- The Raspberry Pi is a low cost, **credit-card sized computer** that plugs into a computer monitor or TV, and uses a standard keyboard and mouse.

- How is it different from an arduino?

  The main difference between them is Arduino is microcontroller board while raspberry pi is a mini computer.

Different types of Pi

If you wanna know more about them Log onto
https://www.raspberrypi.org/
Updates, News, Creative Projects, Support
Libraries relating to raspberry pi are available
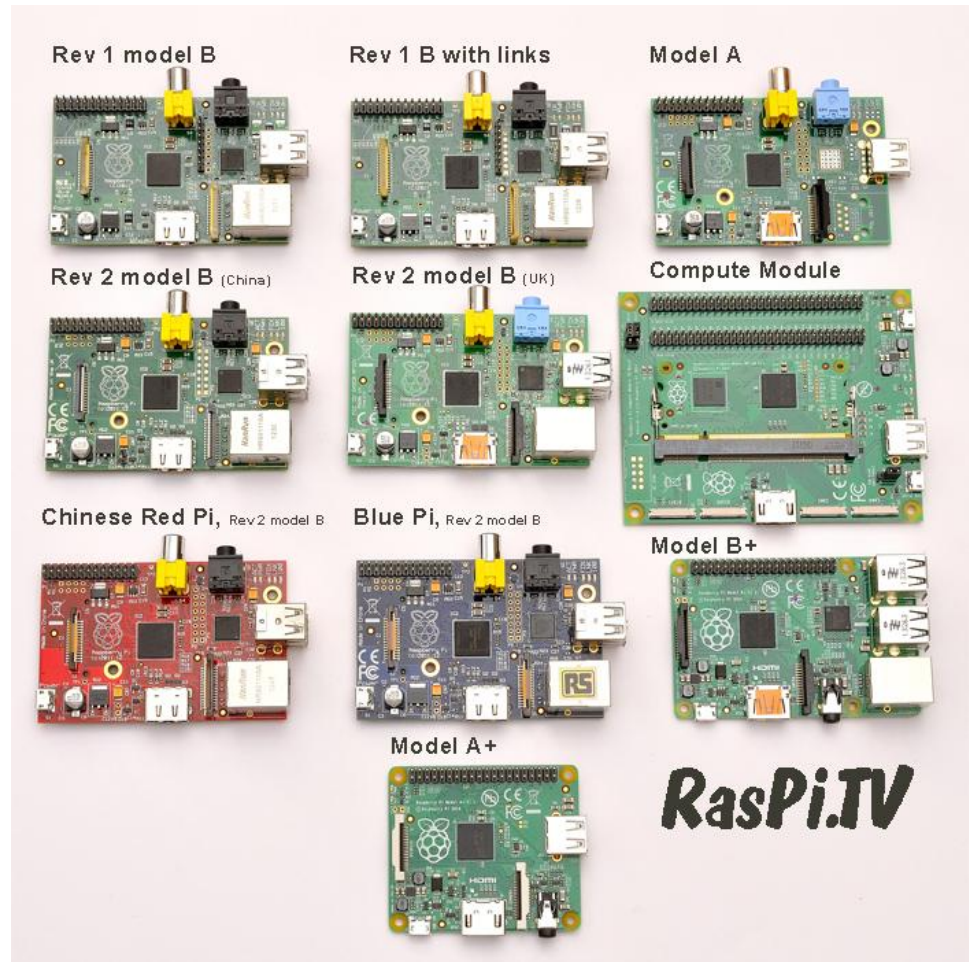
Different parts of Pi 3 Model B+

1. 40 GPIO- General purpose I/O
2. ARM CPU/GPU- Quad core
3. RCA- Allows connection of analog TV
4. Audio Out
5. LED's
6. USB
7. HDMI
8. Power - 5V (2A preferred)
9. SD card slot - 8-32GB
10. Ethernet
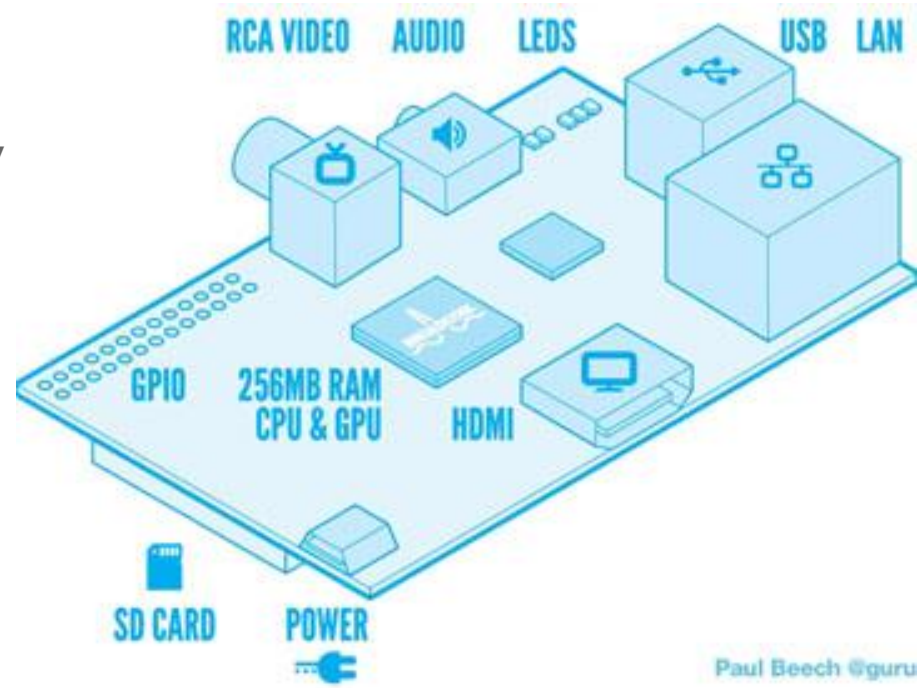
Booting up

OS - RASPBIAN

BOOTING UP

THERE ARE TWO WAYS

- With NOOBS (New Out of the Box Software) Installer
- Normal linux distro bootable

INSTALLING WITH NOOBS

Download NOOBS installation files from https://www.raspberrypi.org/downloads/raspbian/

Follow the instructions on the raspberry pi documentation page

https://projects.raspberrypi.org/en/projects/raspberry-pi-setting-up/3

INSTALLING WITHOUT NOOBS

Download raspbian from

https://www.raspberrypi.org/downloads/raspbian/

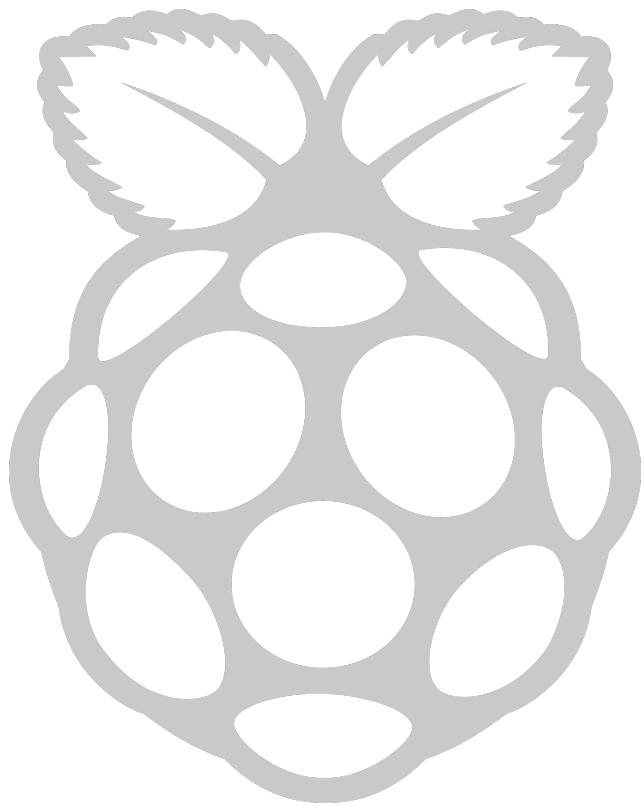Then follow instructions from

https://www.raspberrypi.org/documentation/installation/installing-images/README.md

Who needs a fully wired raspberry pi with monitor, keyboard and a mouse the whole time.

REMOTE ACCESS

Enable remote access - `sudo raspi-config`

SSH and VNC

- Connect to a common network
- Terminal command- `sudo ifconfig`
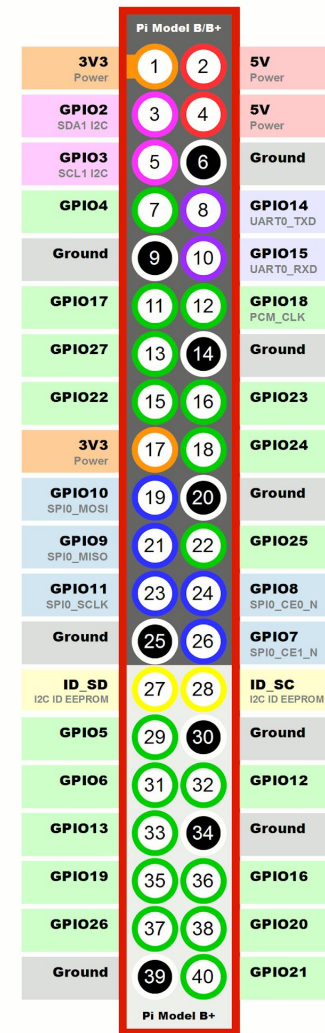- Open VNC chrome extension and type in the ip address

_____

Navigating through linux commands.

Commands

- pwd
- Cd
- Cd~
- Cd ..
- ls
- mkdir
- Sudo
- Wget
- Rm -r

Expansion

- Print working directory
- Change directory
- Change directory
- Change directory
-
- List
- Make directory
- Super user do
- Web get
- Remove recursively

Description

- Prints the current directory
- It lets you change your current directory
- Go back to the root
- Go back a single directory
- List the things in a directory
- Make a directory for you
- Give the Root user authorisation
- Helps to download files
- Helps to remove a directory

.

GPIO Pinout

Lets see if we can blink an led with this.

- Sudo idle
- Make all the necessary connections on a breadboard
- Run the code
- See the magic happen

- **Be Very careful when you use GPIO pins because VCC and Ground pins are really close and more current drawn from the Raspberry pi may cause it to fail**

| Pi Model B/B+		
3V3 Power	1 / 2	5V Power
GPIO2 SDA1 I2C	3 / 4	5V Power
GPIO3 SCL1 I2C	5 / 6	Ground
GPIO4	7 / 8	GPIO14 UART0_TXD
Ground	9 / 10	GPIO15 UART0_RXD
GPIO17	11 / 12	GPIO18 PCM_CLK
GPIO27	13 / 14	Ground
GPIO22	15 / 16	GPIO23
3V3 Power	17 / 18	GPIO24
GPIO10 SPI0_MOSI	19 / 20	Ground
GPIO9 SPI0_MISO	21 / 22	GPIO25
GPIO11 SPI0_SCLK	23 / 24	GPIO8 SPI0_CE0_N
Ground	25 / 26	GPIO7 SPI0_CE1_N
ID_SD I2C ID EEPROM	27 / 28	ID_SC I2C ID EEPROM
GPIO5	29 / 30	Ground
GPIO6	31 / 32	GPIO12
GPIO13	33 / 34	Ground
GPIO19	35 / 36	GPIO16
GPIO26	37 / 38	GPIO20
Ground	39 / 40	GPIO21

Pi Model B+

www.raspberrypi-spy.co.uk

Interfacing Pi-Camera

- Sudo raspi-config -- Enable Picam
- Sudo nano picamtest.py
- Sudo apt-get install python-picamera
- Sudo apt-get install python3-picamera
- Python picam

Projects
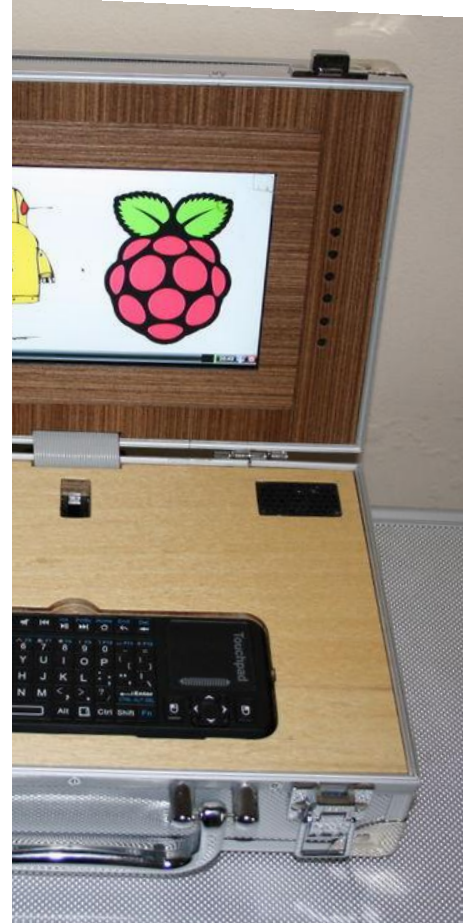
So What do we do with the Developer boards
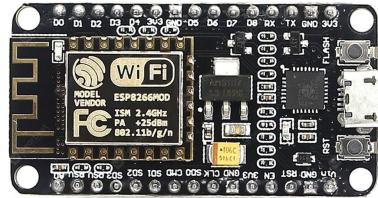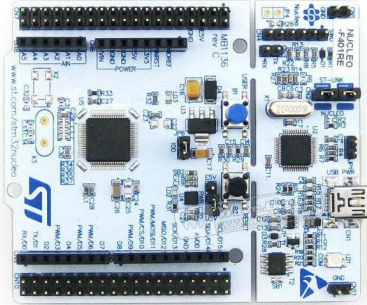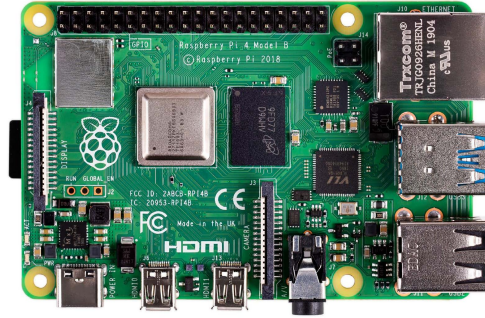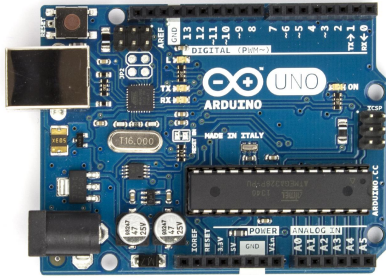
We build Prototypes with them

Things Beyond the scope of this webinar

- Protocols - UART, USART, CAN, SPI, I2C etc

- Various Architectures

- Technical Details - Clock speed, response time etc

- GPIO pins - Digital and Analogous

- Interrupts

- Coding for Peripheral Libraries in C language

- Driver IC's

- Various Sensors and their Interfacing
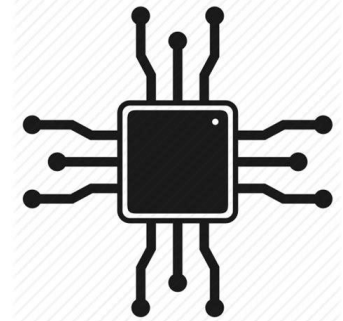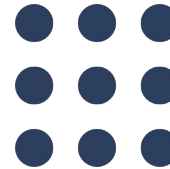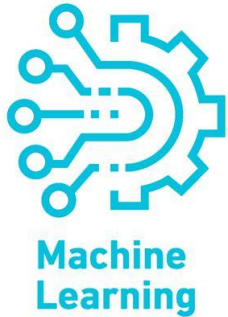
Why do we need to study this ?

How to Learn Them ?

FUTURE SCOPE – INDUSTRY 4.0

CLOUD COMPUTING

BIG DATA ANALYTICS

Machine Learning

VLSI & EMBEDDED SYSTEMS

THANK YOU

Contact

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