ARDUINO FAMILY

1) ARDUINO UNO

Micro controller : ATmega328P (16 MHz / 8 Bit Micro cntl)

operating voltage : 5V (can operate from USB supply)

Flash mem : 32KB

SRAM : 2KB (Data that can be stored in mem)

EEPROM : 1KB

2) ARDUINO Mega 2560

- To control more motors, Connect more serial devices
- 4 Serial UART interface (UNO has only one Serial UART interface.)
- Micro controller: ATmega 2560 (16MHz) 8 Bit (Same as UNO)
- operating V : 5V (Same as UNO)
- Flash mem: 256KB ; SRAM: 8KB ; EEPROM: 4KB
- more digital I/O pins (54 vs 14 on UNO)
  Analog ips (16 vs 6 on UNO)
- E ⟹ We can upgrad from UNO to MEGA without having to worry about code

3) ARDUINO Duad Due

- faster computational capacity
- More memory (512KB / 96 KB)
- MC: 32 Bit ARM based, 84 MHz (AT91SAM3X8E ~~ATmega 2560~~)
- operating Volt: 3.3V (use MICRO USB) (have to adjust Hardware devices & Software) (5V devices can damage MC)
- Same pins & interfaces as MEGA
- Has Digital to analog Converter pins (In built)

DAC

× Digital to Analog Converter (DAC) ~~pins~~ Can Create analogue signals from digital machine.

× Makes it possible for ~~MB~~ MP3 / CD devices to produce high-fidelity audio

× Can Create arbitary Wave forms

(We can include DAC in UNO/Mega with external hardware)

---

4) ARDUINO ZERO

- Same as UNO, but uses 32 bit MC (48MHz)
- 0V : 3.3V (micro USB) Mem: 256 KB / 32 KB (SRAM)
- Software Not Compatible with UNO
- Has additional tiny MC, to connect & debug in Real time (EDBG chip)

~~(Production grade Board~~

~~UNO)~~

---

5) ARDUINO 101

- Same as UNO, but has integrated Sensors & Bluetooth Connectivity
- MC: Intel Curie MC. 32 MHz
- IOV: 3.3V (But can connect 5V peripherals to its headers)
- m

(thats why you can see extra chips next to headers)

Converts 3.3 → 5

NTE

- When MC changes, the underlying software / libraries can become incompatible
- Connecting 5V devices to 3.3V MC can damage the MC

---

3) ARDUINO Pro MINI (completely compatible with UNO)

Same ① Same MC (ATmega 328P) as UNO

but it is Fixed to board (SMD)

=> Surface mounted device

=> Looks smaller, ~~But Speed => 8~~

=> Can't pull it out like UNO MC

② : NO USB
To communicate with PC we have to purchase another serial bridge

③ No headers.
We have to solder components

④ Used when we want a Compact version of Arduino UNO Circuit

=> No worries about software / hardware compatabilities

=> has both 3.3V & 5V versions.
(speed 8 MHz) (16 MHz)
↳ suitable for apps that depend on battery

ARDUINO Compatable boards

⇒ Not Arduino board

⇒ But we can we use ARDUINO IDE to program the MC

Eg: ADUANCED DEVICES.

Once we are Comfortable with Programming Arduno, we can program other gadgets like.

1) particle Electron (2G/3G)

⇒ Small Board with place for SIM slot

⇒ can use cellular network for Communication without relying on external wifi

2) Freetronix Leostick (ATmega 32U4 16MHz
⇒ Fully compatible with UNO

Same as arduno mini, but comes with USB integrated bridge

(⇒ Dont have to purchase a Separate bridge)

3) Digispark Pro

=> Smaller than Arduino mini

=> Comes with integrated micro USB

=> Completly compatible with UNO / mini

4) Node MCU ESB 2866 (Very popular)

=> Very cheap. (10 $)

=> Same size as Arduino min.

=> Integrated wifi

=> Has ESP2866 MC

32 bit 18 MHz RISC CPU

=> Can overclock to 180 MHz

=> ~~Can use~~ In addition to C++/ can also use LUA / to micro python program

---

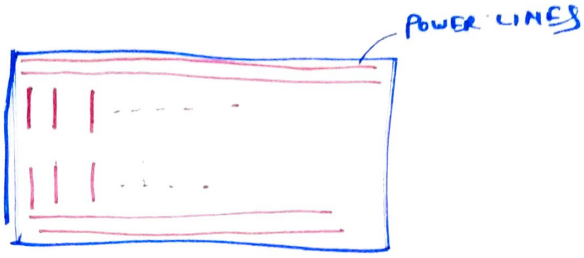
In the first level, we'll just work with ARDUINO UNO

(Can also use ARDUINO Mega) as it is both hardware & software compatible

(Note: for mini, how we connect would change)

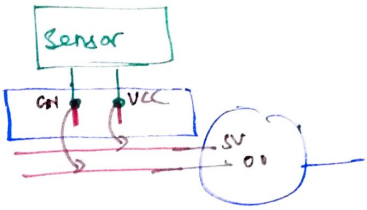
Prototyping Basics Tools

1) Bread board connection



- Ground pin : 0V (-)
- VCC pin : 5V (+) (for certain ultrasonic sensor)

Connecting a sensor's Ground & VCC



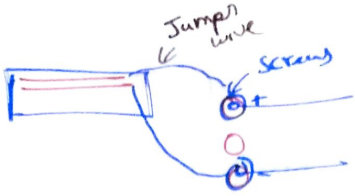
How do we supply power to BB?

2) Bread board power supply

(A)

- a chip that clings with power lines of a Bread board.
- This chip can be connected to power (USB / Barrel connector) has some ports which
- We can select the voltage to pass (3.3 or 5) (using jumper switch)

(b) * use an external power supply



(or) Jumper wires directly to arduino

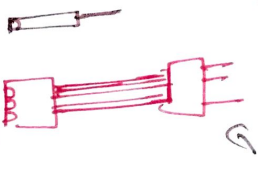
3) Jumper wires

Types

A1) Both ends have a pin extended out (male to male

(For Arduino to BB)

A2) Female to male jumper wire (For Sensor to BB / Arduino)



- It usually comes in bunches, where we can remove or refit the wire

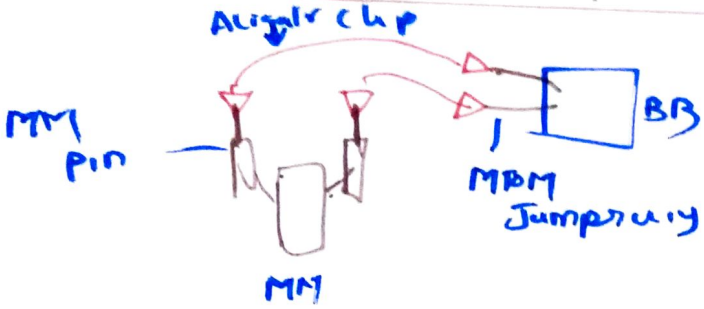
A3) Female to Female jumpers

- Not used in arduino
- used in RS pi which has male headers.

AG) Crocodile clips or Spring clips

- Two ends have clips

- used for connecting multimeter to BB



Aesthetics

use FLat/SOLID Jumper wires

- They dont are rigid
- Easy to see circuitry

Precision Screw drivers

used to calibrate devices

Eg: a) Change sensitivity of Sound sensor
(By rotating potentiometer)

b) Change sensitivity of motion sensor
(again By rotating potentiometer)

Tweezers

- To manipulate, adjust pick electronic components / wires (used mainly in micro electronic components)

- Particularly useful ~~for~~ to ~~touch~~ while adjust wires when power supply is ON

- when manipulating microchips, (
use ESD-safe tweezers
has anti electrostatic properties

They are also antimagnetic
⇒ So that they don't stick to components

6) **Wire Cutters**

- Trim pins, parts of resistors, transistors
- ~~trim~~ soldered parts

7) **Power supply** — look for 7-12V supply

- Arduino barrel jack size: 2.1 mm ID (center positive), 5.5 mm OD
- Any adapter ~~with spec~~ providing more than 7V upto 12V
- Arduino has internal voltage regulator that will regulate voltage to 5V

TYPES:

a) ~~Ether~~ Electric charging

b) Battery Supply

~~AA~~ ⇒ 2.

Battery types review

AA ⇒ 2400 mAH capacity

AAA ⇒ 1200 mAH capacity

of 1.5V battery is used

buy a battery supply with ~~6-8~~ slots

4-6 slots

4×1.5 = 6V ⇒ 9V

8) Multimeters

* There are a variety of multimeters which can do different thing:

* Your multimeter should be able to at least

  × measure voltage
  × Current
  × Resistance
  × Continuity ⇒ check if two parts of circuit are electrically connected (even if they are remote)

× Difference between cheaper and expensive MM
  ⇒ Ability to detect range in which your are measuring

  ⇒ Expensive MM can detect
  ⇒ Expence MM can detect Range automatically
  small current & accurate measurement

a) Using a MM to measure Voltage

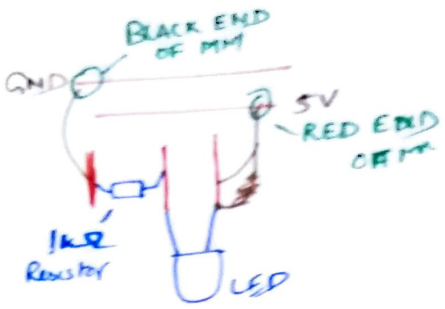
× Select the range.

  (ie) if Range = 200 milli Volt
  your multimeter can detect voltage between
  0 - 200 mV

× For our project, set Range = 20V

Measuring Voltage

Consider this simple circuit



MM should show ~5V Volt diff

b) Measuring Current using MM

* Recall ohms law

$$I = \frac{V}{R}$$

* For our circuit, current should be

$$\approx \frac{5}{1000} \approx 5mA$$

(usually 3 - 10 mA)

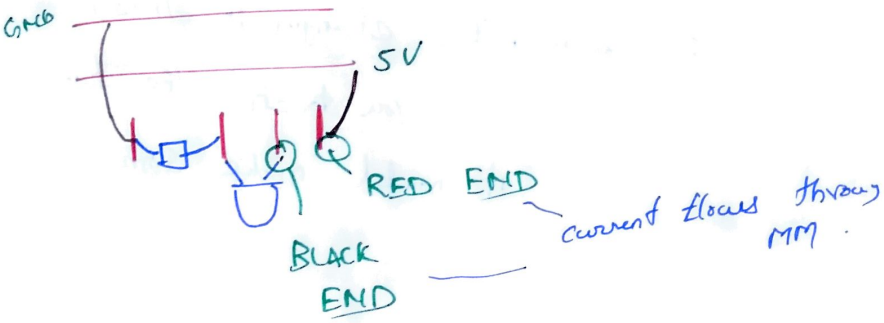
* With this guess, Set the Current range in MM

Say ± 20mA

NOTE: Sometimes cheaper MM can't measure current less than 10mA

To measure Current

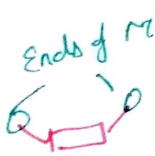
- MM end points should close the Circuit
- In other words ⇒ MM should be placed in SERIES with the circuit



c) Measuring Resistance

~~Place~~ · Set the Range

· place the MM at both ends of Resistor after it is disconnected from Circuit



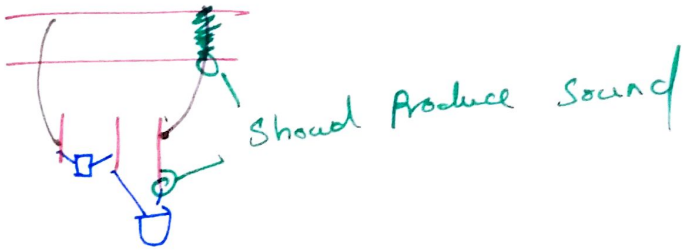
d) Measuring Continuity

⊗ Check if two parts of Circuit are Connected.
(By checky if it has very little resistance)

⊗ Set MM to the point that looky like this

⊗  (like a Wifi signal)

⊗ ~~When~~ After changing to this,
When you touch the two probes
it should make some noise



4) Soldering Iron kit (20-25 watt)

USE CASE (1)

- Most peripheral components (like accelerometer, camera) are shipped with headers separate & not attached
- we have to solder them manually

USE CASE (2)

- To make the connections in bread board Semi-permanant, we can switch to (a) (OPTIONAL) protoboards ~~or perma board~~
- Proto boards are same like bread board, but can be soldered at the back

Adafruit perma board looks just like bread board

NOTE: (TOOLS NEEDED)

- (b) ~~LED~~ Lead solder has lower melting point than non-lead
- But lead-solder ~~has~~ poses health issues. So if you use lead, wash your hands after Solder & ~~wash your~~ dont touch your eyes
- (c) wear glasses while soldering
- ~~A~~ Diameter of solder wire is measured in gauge. use 18-22 gauge

Before Soldering

- (d) clean the component's solder part with micro fiber cloth
- (e) (OPTIONAL) If the board is old, use No flux

If soldering is wrong

- Remove the solder with (f) De-soldering pump
- Heat the part to be removed & suck it with De-solder

Extra:

- (g) OPTIONAL Soldering station (To adjust the solder temperature) for better solder
- (h) Soldering helping hands with magnifying glass
- (i) (OPTIONAL) fume extractor fan (can also use a CPU fan)
- (j) Soldering iron stand

Maintanance

- To protect tip of soldering iron, from getting oxidized
  - => use (k) OPTIONAL tip tinner after finished soldering
  - => clean tinner with (l) OPTIONAL copper sponge wire

How to Solder

- To fix header,
  - Place header in the holes.
  - use bread board or tape to hold the header on other side (if no tension to hold by itself)
  - Heat the header pin first, & then place the lead.

Soldering Bridge

* Some times two adjacent excess lead solders join with to form a bridge
* Reheat the excess lead & remove with soldering pump

---

10) **Proto board**

(*) To switch from bread board to a reliable project

(x) Ada-fruit perma board looks just like bread board. with same soldering lines.

(x) other proto boards, you'll have to build a Solder bridge for power lines manually

(x) Arduino prototypy shield (fit on top of arduno)