Contents

Arduino UNO

Summary

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
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

Digital Input/Output Pins. Connect signal pins of sensors, lights, etc here.

Plug in the USB cable here to connect to your computer.

Connect to a 9V battery here if you have an adapter

Provides 5V power to a circuit

Either of these will ground the circuit

Analog pins, for sensors that measure a continuum.
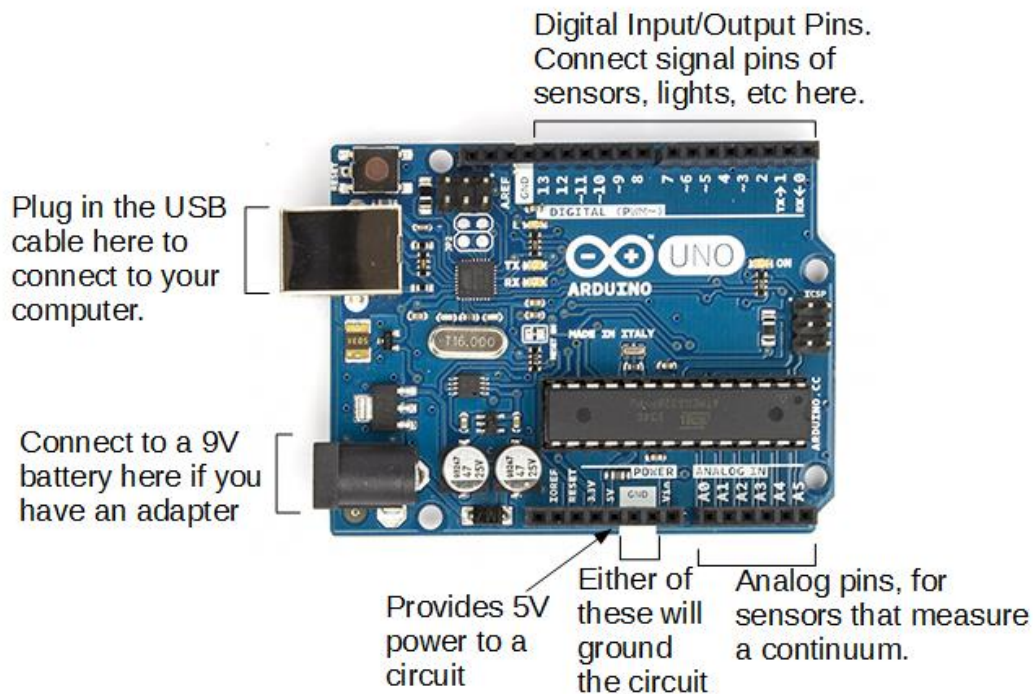
Syntax examples

C language syntax	Description	Arduino syntax	Description
Initializing			
int a; int a=0;	*Initializing integers.*	pinMode(13,OUTPUT);	*Set pin 13 to output.*
char a; char a='A';	*Initializing characters.*	pinMode(13,INPUT);	*Set pin 13 to input.*
char a[10]; char a[5]={'a','b','c'};	*Initializing array.*	digitalWrite(13,LOW/HIGH);	*Turn pin 13 to 1or 0.*
Arithmetic operators		digitalRead(13);	*Read pin 13's value either 1 or 0.*

a++;
a=a+1;
a=a+b;
a--;
a=a-1;
a=a-b;
a=b*c;
a=b/c;
a=b%c;
	Add 1 in "a".
	Add 1 in "a".
	Store sum in "a".
	Subt. 1 from "a".
	Subt. 1 from "a".
	Store diff. in "a".
	Store product in "a".
	Store division in "a".
	Store remndr. in "a".
		analogWrite(3,250);
		
		analogRead(A0);
			Write PWM on pin 4 with 0-255 level.
			
			Read analog value at "A0", between 0-1023.

comparision operator		delay(1000);	*Wait for 1 sec before executing next statement.*

a==b;
a!=b;
a<b;
a>b;
a<=b;
a>=b;
	Equal.
	Not equal.
	Less than.
	Greater than
	Less than equal to
	Greater than equal to
		delayMicroseconds(10);
		
		Serial.begin(9600);
			Wait for 10 us before executing next statement.
			
			Initialize serial monitor.

loops		Serial.print("abc");	*Print "abc" on serial monitor.*

for(i=0;i<15;i++)
{//statements}
 	
while(a>b)
{//statement}
	Execute statement 15 times.
	
	Execute repeatedly until condition is true.
		Serial.println("abc");	*Same as above syntax but jumps to next line.*

If/else			

If(a==b)
{//statements}
else
{//statement}
	Execute until condition is true,
	Otherwise execute "else"(optional).		

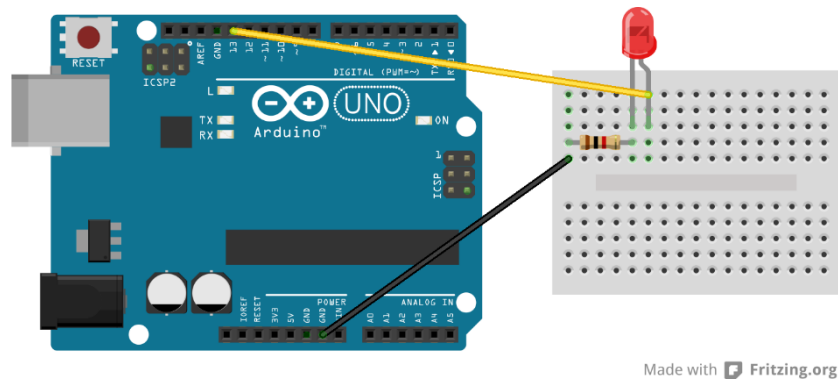**Electronics Projects Maker**
www.facebook.com/electronicsprojectsmaker

PRACTICALS

Practical 1

Object: to learn the function of digitalWrite() with a LED.

Circuit:

- use 1k ohm resistor in series with LED.

Made with **Fritzing.org**

S NO.	ALGORITHM	PROGRAM
		void setup()
		{
1	//set pin 13 as output	pinMode(13,OUTPUT);
		}
		void loop()
		{
2	//turn on the led	digitalWrite(13,HIGH);
3	//wait for 500ms	delay(500);
4	//turn off the led	digitalWrite(13,LOW);
5	//wait for 500ms	delay(500);
		}

Task 1: make one way traffic signal to control the traffic.

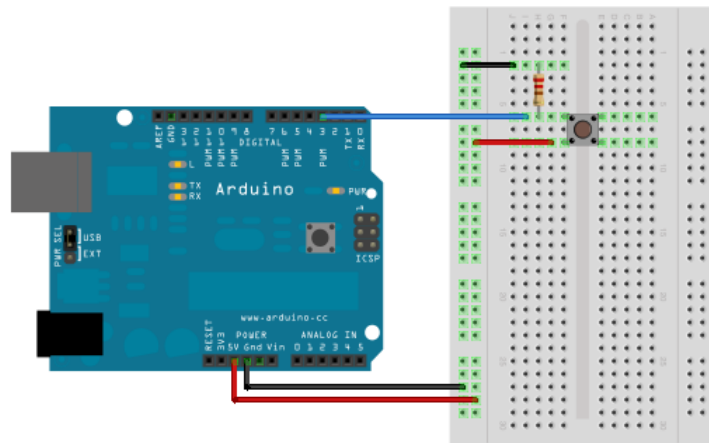Hint: use 3 leds(red,green,yellow), connect each to a different output.

Task 2 : show 0-9 no.s on 7-segment display.

Compiled by : Hassam Mohiuddin

Practical 2

Object: to learn the function of digitalRead() with a switch.

Circuit:

- use 10K ohm resistor to
  ground the switch.

S NO.	ALGORITHM	PROGRAM
1	//integer to store switch state	int a=0;
		void setup()
		{
2	//set pin 3 as input	pinMode(3,INPUT);
	//set pin 13 as output	pinMode(13,OUTPUT);
		}
		void loop()
		{
3	//store switch state in "a"	a=digitalRead(3);
4	//check for switch condition	if(a==1)
		{digitalWrite(13,HIGH);}
5	//otherwise	else
		{digitalWrite(13,LOW);}
		}

Task: use 2 leds, control them through switch in such a way that one is "onn" and other is "off" at "high" state. similarly alter the condition for "low" state.
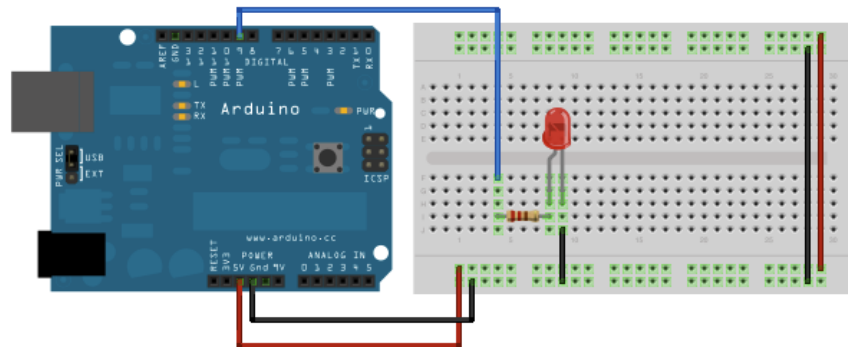
Hint: set one to "high" and other to "low" in very next line.

Practical 3

Object: to learn the function of analogWrite() with a LED.

Circuit:

- use 1k ohm resistor in series with LED.

S NO.	ALGORITHM	PROGRAM
		void setup()
		{
1	//set pin 9 as output	pinMode(9,OUTPUT);
		}
		void loop()
		{
2	//turn on the led with 50 level	analogWrite(9,50);
3	//wait for 500ms	delay(500);
4	//turn on the led with 255 level	analogWrite(9,255);
5	//wait for 500ms	delay(500);
		}

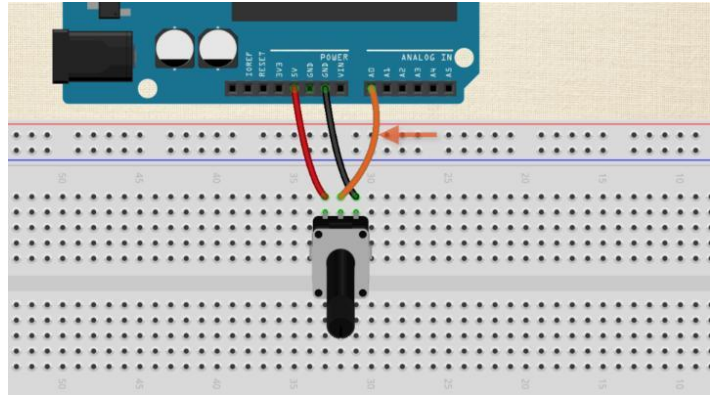Task: glow led in such a manner that level start from 0 and go to 255 Using "for loop".

Hint: set loop from 0 to 255 and use loop integer in place of constant level value.

Practical 4

Object: to learn the function of analogRead() with a VR.

Circuit:

- use 10K ohm VR
- Extream legs are for vcc and ground
- Connect mid leg to "A0" pin of Arduino.

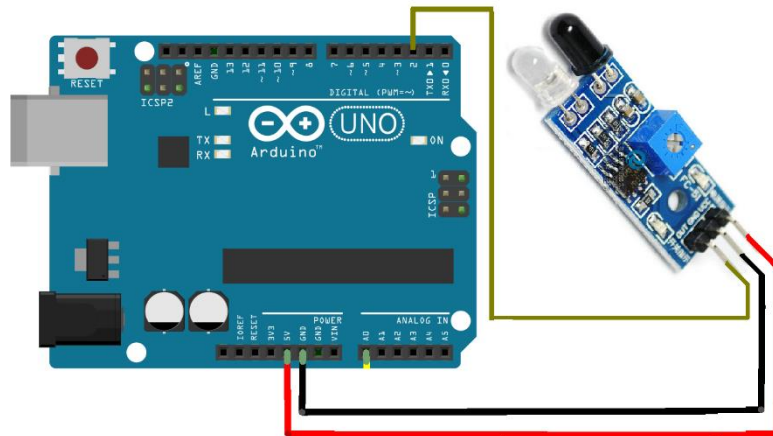| S NO.	ALGORITHM	PROGRAM
1	//integer to store VR value	int a=0;
		void setup()
		{
2	//set pin 13 as output	pinMode(13,OUTPUT);
3	//initialize serial monitor	Serial.begin(9600);
		}
		void loop()
		{
4	//store VR value in "a"	a=analogRead(A0);
5	//print value of "a" on screen	Serial.println(a);
6	//check for VR condition	if(a>500)
		{digitalWrite(13,HIGH);}
7	//otherwise	else
		{digitalWrite(13,LOW);}
		}

Task: control led brightness through VR.

Hint: simply use "a" value in analogWrite().

Practical 5

Object: to display the readings of IR sensor on serial monitor.

Circuit:

- Connect signal pin to pin 2 of Arduino.

S NO.	ALGORITHM	PROGRAM
1	//integer to store VR value	int a=0;
		void setup()
		{
2	//initialize serial	Serial.begin(9600);
		}
		void loop()
		{
3	//store VR value in "a"	a=digitalRead(2);
4	//print value of "a" on screen	Serial.println(a);
		}

Task: turn onn the led when detects any object.

Hint: use if / else
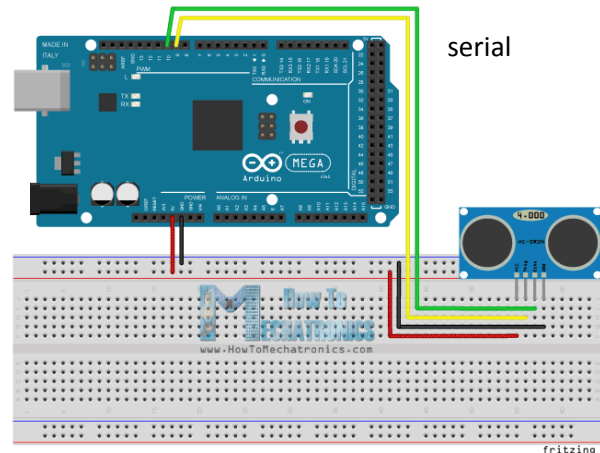
Practical 6

Object: to display the readings of ultrasonic sensor on   serial
monitor.

Circuit:

- Connect trigger pin to pin 9 of Arduino.
- Connect echo pin to pin 10 of Arduino.

S NO.	ALGORITHM	PROGRAM
1	//long int to store time	long duration;
2	// int to store distance calculated	int distance;
		void setup()
		{
3	//set pin 9 to output	pinMode(9,OUTPUT);
4	//set pin 10 to input	pinMode(10,INPUT);
5	//initialize serial	Serial.begin(9600);
		}
		void loop()
		{
6	//turn pin 9 to low	digitalWrite(9,LOW);
7	//wait for 2 micro sec	delayMicroseconds(2);
8	//turn pin 9 to high	digitalWrite(9,HIGH);
9	//wait for 10 micro sec	delayMicroseconds(10);
10	//turn pin 9 to low	digitalWrite(9,LOW);
11	//store received value in duration	duration= pulseIn(10, HIGH);
12	//conversion	distance=duration*0.034/2;
13	//print value of distance on screen	Serial.print(distance);
14	//print "cm" after value	Serial.println(" cm");
		}

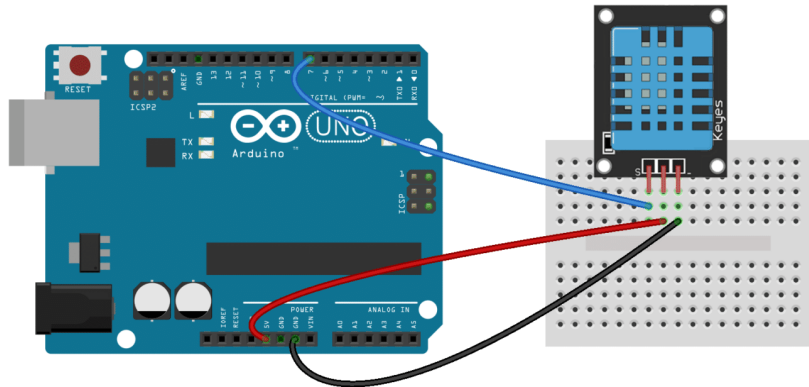Task: turn on LED when distance is less than 20cm.

Hint: use if/else.

Practical 7

Object: to display the readings of DHT11 sensor on serial monitor.

Circuit:

-   Connect signal pin to pin 7 of Arduino.

S NO.	ALGORITHM	PROGRAM
1	//include dht library	#include <dht.h>
2	//declare dht	dht DHT;
3	//sig pin connected to 7	#define DHT11_PIN 7
		void setup()
		{
4	//initialize serial	Serial.begin(9600);
		}
		void loop()
		{
5	//read values from sensor	int chk = DHT.read11(DHT11_PIN);
		Serial.print("temp = ");
6	//print temp value	Serial.println(DHT.temperature);
		Serial.print("humidity = ");
7	//print humidity value	Serial.println(DHT.humidity);
8	//wait for 1 sec	delay(1000);
		}

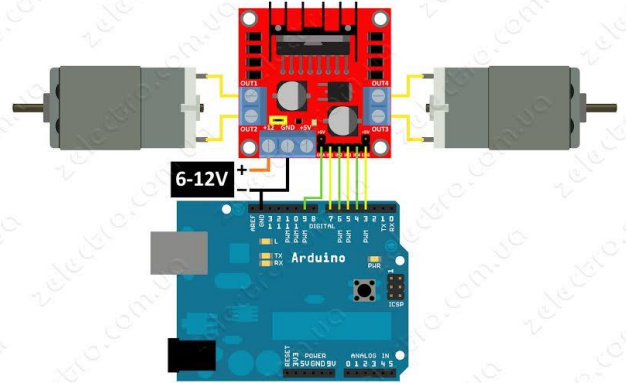Task: turn on fan/led when temp is above 40 degree

Hint: if/else

caution: do not connect any fan directly to Arduino without motor driver !

Practical 8

Object: to control a dc motor with suitable driver and vary the speed.

Circuit:

- Connect "EnA" with pin 9 of Arduino.
- Connect "1" to pin 7 of Arduino.
- Connect "2" to pin 6 of Arduino.

S NO.	ALGORITHM	PROGRAM
		void setup()
		{
1	//set pin 6 to output	pinMode(6,OUTPUT);
2	//set pin 7 to output	pinMode(7,OUTPUT);
3	//set pin 9 to output	pinMode(9,OUTPUT);
		}
		void loop()
		{
4	//turn pin 6 to low	digitalWrite(6,LOW);
5	//turn pin 7 to high	digitalWrite(7,HIGH);
6	//control pwm/speed on pin 9	analogWrite(9,100);
		}

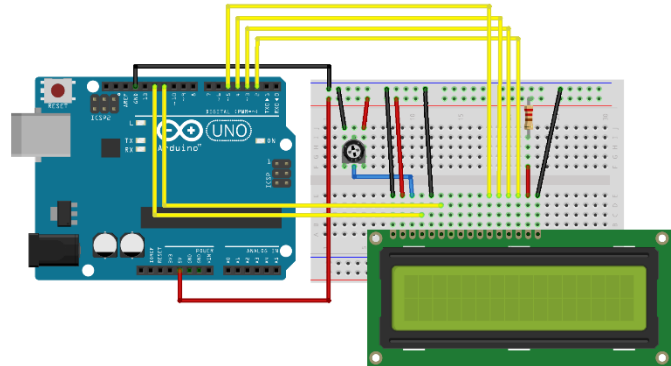Task: now operate both motors by using EnB pin also.

Hint: same work for another motor just change pin no.s .

Practical 9

Object: write your name and roll no. on 16x2 lcd.

Circuit:

- LCD RS pin to digital pin 12
- LCD Enable pin to digital pin 11
- LCD D4 pin to digital pin 5
- LCD D5 pin to digital pin 4
- LCD D6 pin to digital pin 3
- LCD D7 pin to digital pin 2

S NO.	ALGORITHM	PROGRAM
1	//include lcd library	#include <LiquidCrystal.h>
2	//defining pins	LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
		void setup()
		{
3	// lcd size	lcd.begin(16,2);
4	//print name on lcd	lcd.print("Hassam Mohiuddin");
5	//set cursor to column=1, row=2	lcd.setCursor(0,1);
6	//print roll no. on lcd	lcd.print("Roll # EL-107);
7	//initialize serial	}
		void loop()
		{
		}

Task: run your name on lcd from right to left.Also practice different lcd syntaxes.
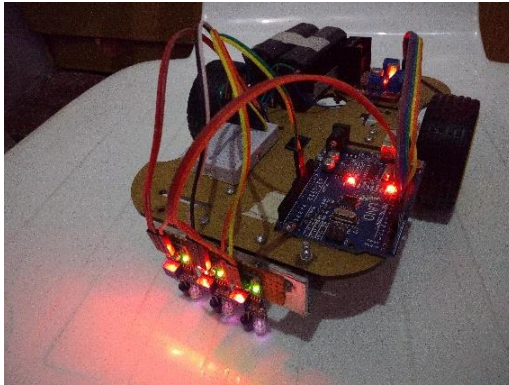
Hint: use lcd.autoscroll();

EXTRA PROJECTS TO TRY

- Serial monitor interface
- Servo motor control
- Android linkage through bluetooth
- Make counter using IR module and LCD
- Make counter using IR module and 7 segment
- Use relay module
- Gesture switch using IR
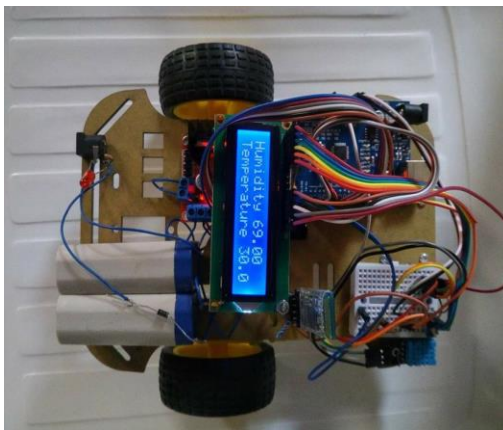- hex keypad interfacing

Final Project

LFR or BT controlled robot

Line Following Robot

BT Controlled Android Robot

REFERENCES

Download Arduino IDE :

https://www.arduino.cc/en/Main/Donate

About Arduino uno SMD :

https://www.arduino.cc/en/Main/ArduinoBoardUnoSMD

Basic Arduino Syntax :

https://www.arduino.cc/en/Reference/HomePage

C-language Syntax:

https://en.wikipedia.org/wiki/Operators_in_C_and_C%2B%2B

Class 1 :

https://www.arduino.cc/en/Reference/DigitalWrite

Class 2 :

https://www.arduino.cc/en/Reference/DigitalRead

Class 3 :

https://www.arduino.cc/en/Reference/AnalogWrite

Class 4 :

https://www.arduino.cc/en/Reference/AnalogRead

Class 5 :

http://blog.circuits4you.com/2016/04/arduino-ir-proximity-sensor-interfacing.html

Class 6 :

http://howtomechatronics.com/tutorials/arduino/ultrasonic-sensor-hc-sr04/

Class 7 (dht library) :

http://www.circuitbasics.com/how-to-set-up-the-dht11-humidity-sensor-on-an-arduino/

Class 7 :

http://www.circuitbasics.com/wp-content/uploads/2015/10/DHTLib.zip}

Class 8 :

http://www.instructables.com/id/How-to-use-the-L298-Motor-Driver-Module-Arduino-Tu/

Class 9 :

https://www.arduino.cc/en/Tutorial/HelloWorld