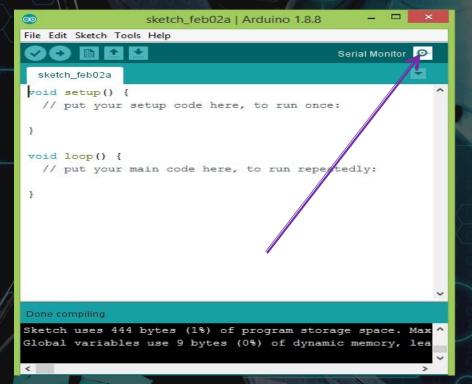


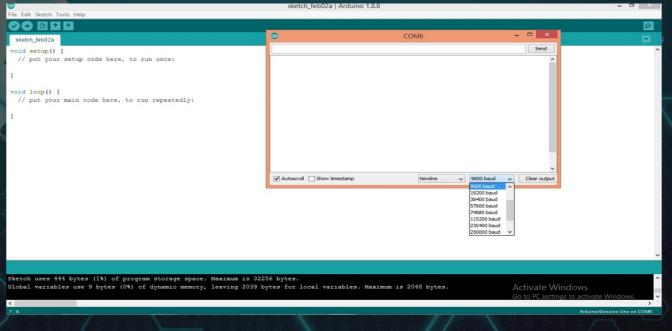


Serial monitor

Serial monitor: is the link between the computer and your arduino.

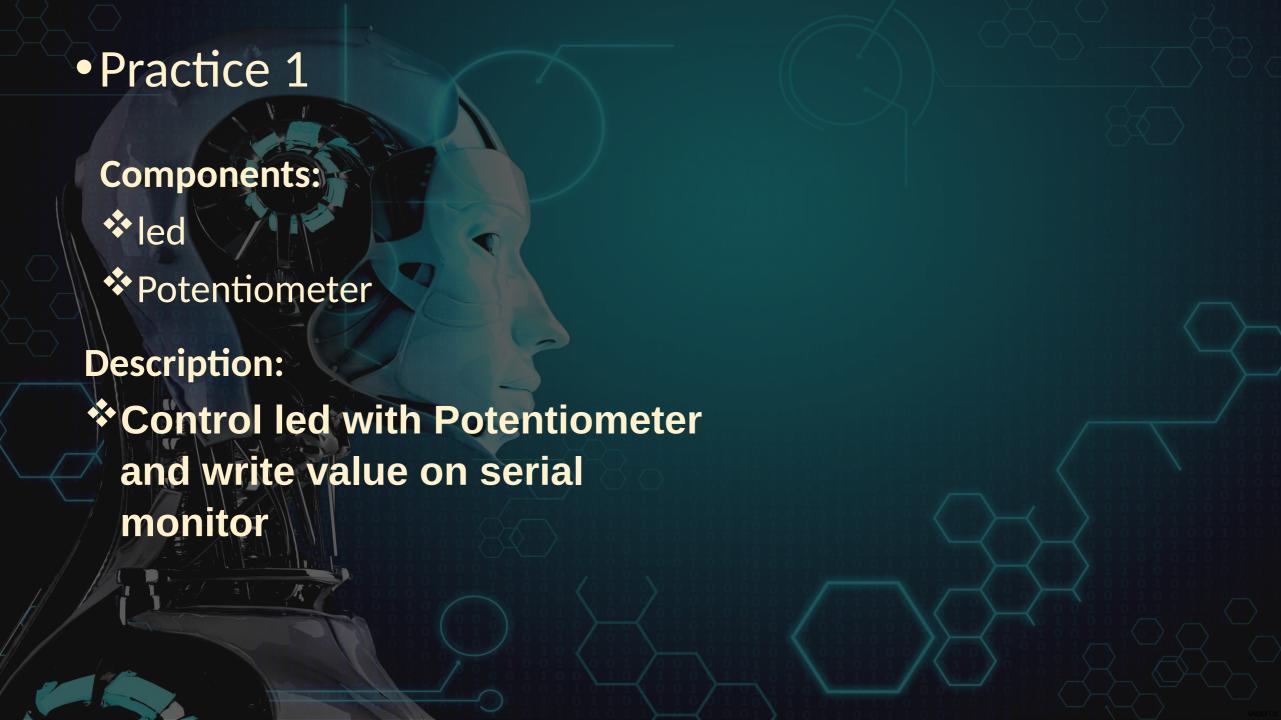
Purpose of the serial is make you send and receive text messages to control the arduino and debugging.





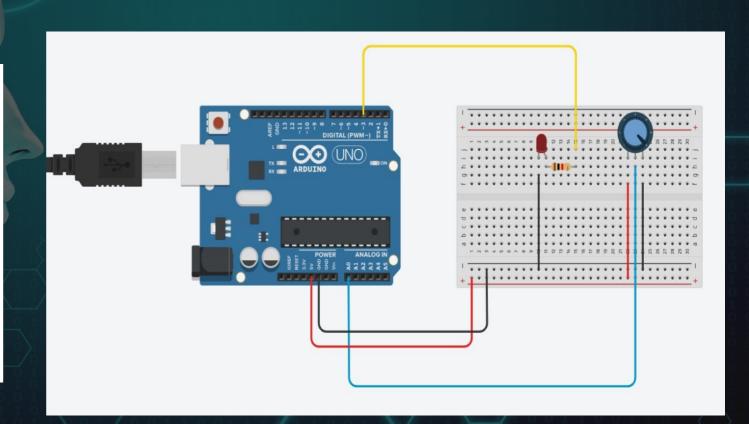
Serial monitor functions

- 1. begin(baud rate)
 - Sets the data rate in bits per second (baud rate) for serial data transmission.
 - > ex : begin(9600);
- 2. Print() or println()
 - Print String, number or variable
 - ex: Serial.print("RoboTech");
 Serial.print(123);
- 3. available()
 - Returns number of char if the data is received.
 - ex: int num = Serial.available();
- 4. read()
 - Read out the first available byte from the serial receive buffer.
 - ex: char c = Serial.read();



```
void setup() {
    // put your setup code here, to run once:
        Serial.begin(9600);
    pinMode(3, OUTPUT);
    pinMode(A0, INPUT);

}
void loop()
{
    int value = analogRead(A0);
    int MapValue = map(value, 0, 1023, 0, 255);
    Serial.println(MapValue);
    analogWrite(3, MapValue);
}
```





Communication Protocols

- * Communication : Communication means exchanging information from one place to another.
- Protocol: set of rules and guidelines for communicating data.
- Types of electronic communication
 - One-Way communication: Simplex communication, information travels from source to destination through one-way only.
 - Example: RADIO.
 - * Two-Way communication
 - Half Duplex
 - Full Duplex

Con.Communication Protocols

- Half Duplex
 - Only one can transmit or receive at a time

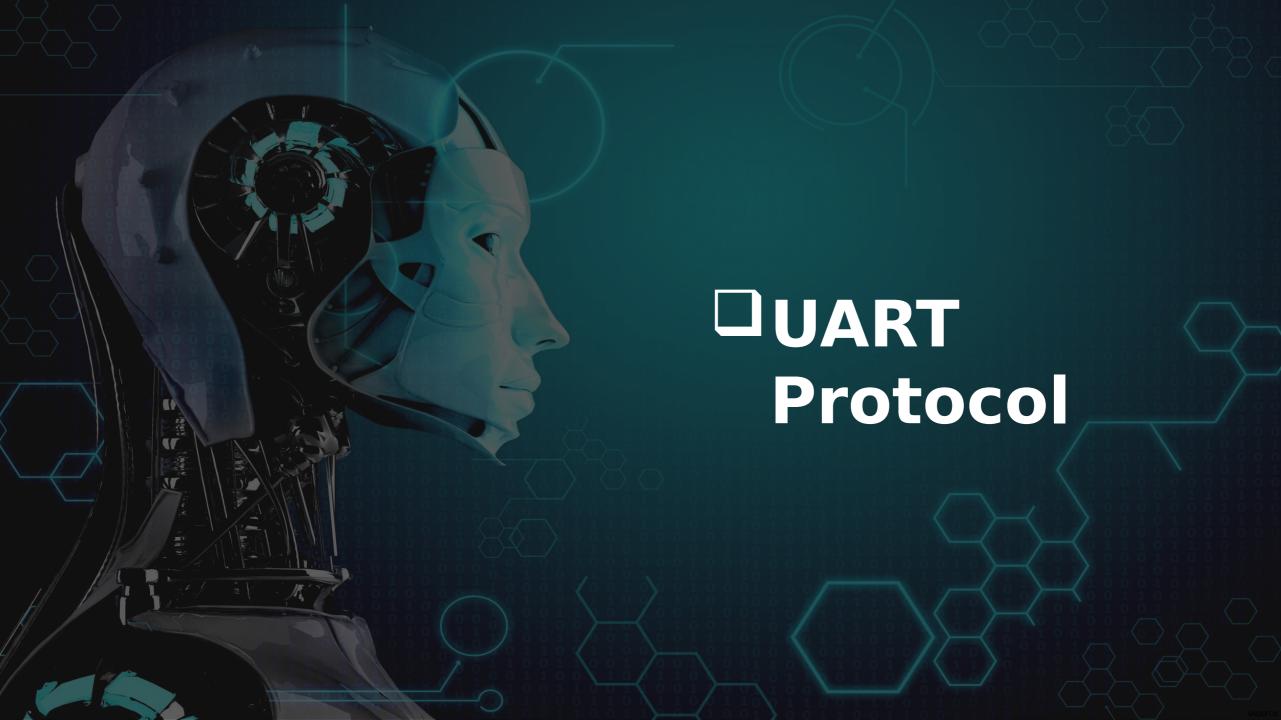
Example: Walkie-talkie, Two-way radio that has a push-to-

talk button

- Full Duplex
 - Which can transmit and receive at a time

Example: Telephone

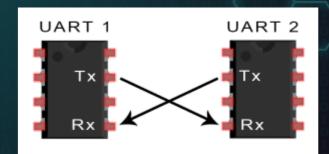




UART protocol

- UART protocol: stands for universal asynchronous receiver / transmitter.
- The main purpose is transmit and receive serial data.

Wires Used	2
Maximum Speed	Any speed up to 115200 baud, usually 9600 baud
Synchronous or Asynchronous?	Asynchronous
Serial or Parallel?	Serial
Max # of Masters	1
Max # of Slaves	1

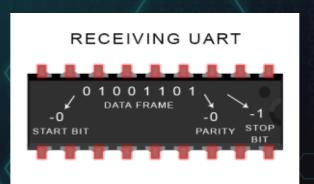


How to transfer data



Steps of transfer data:

1. Send start bit to start communicating with receiver



con. UART protocol

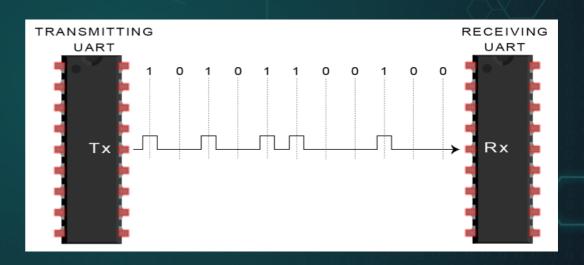
2. Send data (8 bits):

3. Parity bit is a way to check errors

Parity is 0 when the number of 1's is even

Parity is 1 when the number of 1's is odd

How to check errors?



After the receiving UART reads the data frame, it counts the number of bits with a value of 1 and checks if the total is an even or odd number.

If the parity bit is a 0 (even parity), the 1 bits in the data frame should total to an even number. If the parity bit is a 1 (odd parity), the 1 bits in the data frame should total to an odd number. When the parity bit matches the data, the UART knows that the transmission was free of errors. And opposite.

the UART knows that bits in the data frame have changed.

con. UART protocol

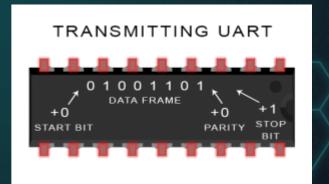
4. Stop bit for stopping sending for new start sending another byte.

Pins in Arduino :-

TX:\1

RX: 0

Advantages	Disadvantages
 Only uses two wires No clock signal is necessary Has a parity bit to allow for error checking The structure of the data packet can be changed as long as both sides are set up for it 	 The size of the data frame is limited to a maximum of 9 bits Doesn't support multiple slave or multiple master systems The baud rates of each UART must be within 10% of each other



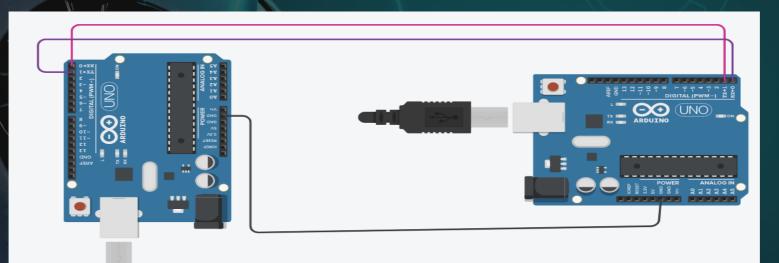
Communication using UART

We can connect two arduino together using UART Protocol?

Example:

Send Word with first arduino and display this word in Serial with Second Arduino

Communication using UART



```
//Transmitter
void setup() {
    Serial.begin(9600);
}

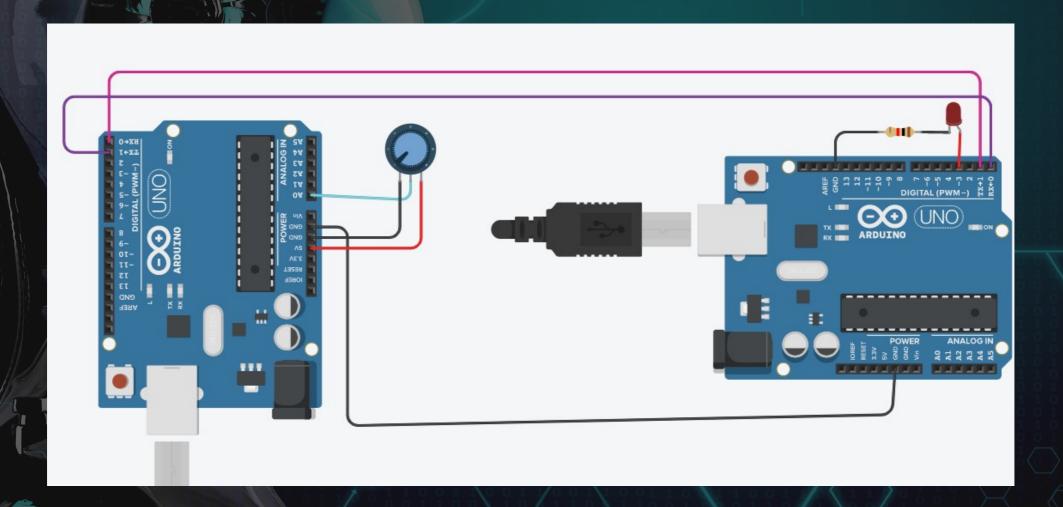
void loop() {
    Serial.print("Hello");
    delay(100);
}
```

```
//Reciever
String x;
  void setup() {
    Serial.begin(9600);
    Serial.setTimeout(5);
}

  void loop() {

    if (Serial.available()) {
        x = Serial.readString();
        Serial.println(x);
    }
}
```

Practice 2 **Components:** led Potentiometer 💠 2 arduino Description Control Led which connect with first arduino with Potentiometer which connect with second arduino



```
//Transmitter
int x ;
void setup() {
    Serial.begin(9600);
}

void loop() {
    x = analogRead(A0);
    int y = map(x , 0 , 1023, 0 ,255);
    Serial.print(String(y));
    delay(100);
}
```

```
//Reciever
String x= "";
  void setup() {
    Serial.begin (9600);
    Serial.setTimeout(5);
    pinMode(3,OUTPUT);
  void loop() {
    if (Serial.available()) {
      x = Serial.readString();
      int y = x.toInt();
       analogWrite(3,y);
```



Bluetooth Module

There are android apps used with Bluetooth module

You can download them from Play Store.

EX:



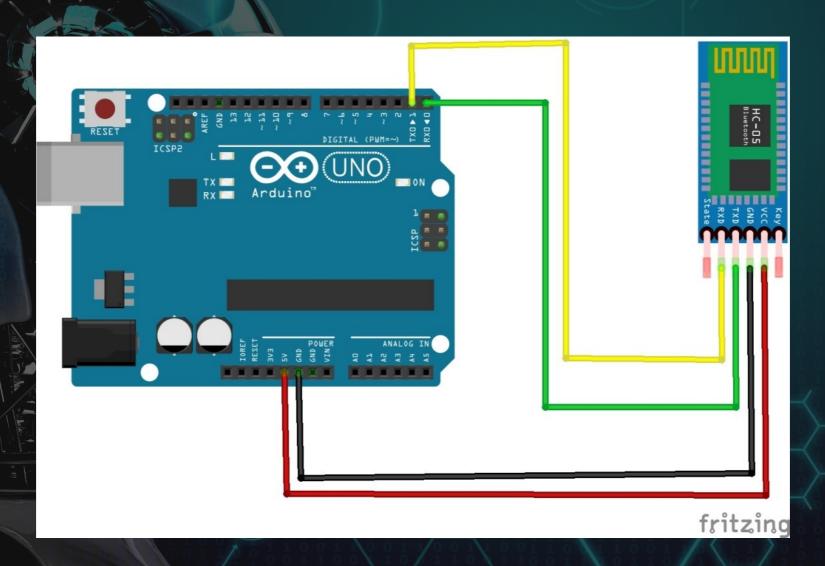
Arduino Bluetooth RC car





Arduino Bluetooth Control

Bluetooth Module



Connection & Code

File Edit Sketch Tools Help sketch_nov19a§ char Incoming value = 0; //Variable for storing Incoming value void setup() Serial.begin(9600); //Sets the data rate in bits per second (baud) for serial data transmission pinMode(13, OUTPUT); //Sets digital pin 13 as output pin void loop() if(Serial.available() > 0) Incoming value = Serial.read(); //Read the incoming data and store it into variable Incoming value Serial.print(Incoming value); //Print Value of Incoming value in Serial monitor Serial.print("\n"); //New line if (Incoming value == '1') //Checks whether value of Incoming value is equal to 1 digitalWrite(13, HIGH); //If value is 1 then LED turns ON else if (Incoming value == '0') //Checks whether value of Incoming value is equal to 0 digitalWrite(13, LOW); //If value is 0 then LED turns OFF





LCD types:

Character LCD



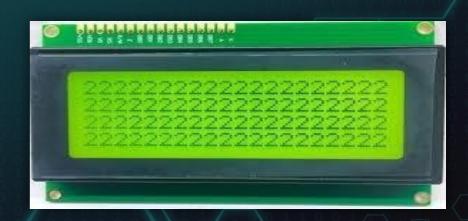


LCD Sizes

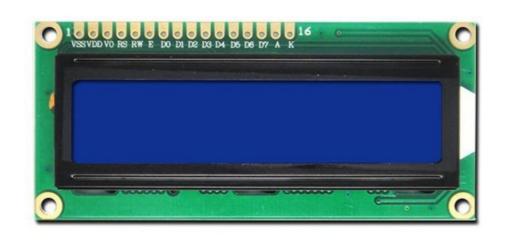
16*2 LCD 16 columns & 2 rows

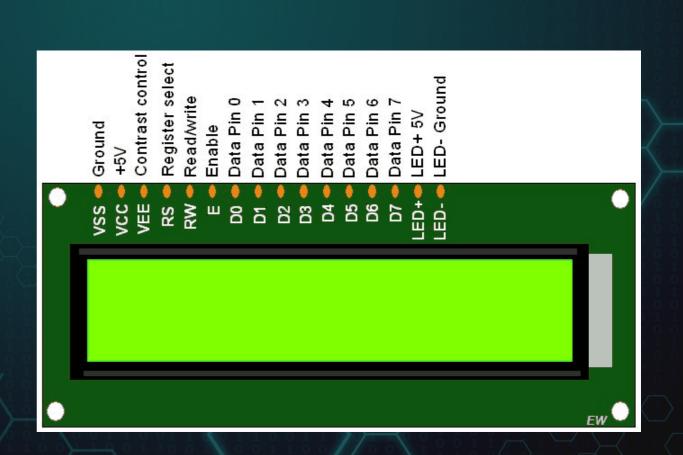
20*4 LCD 20 columns & 4 rows

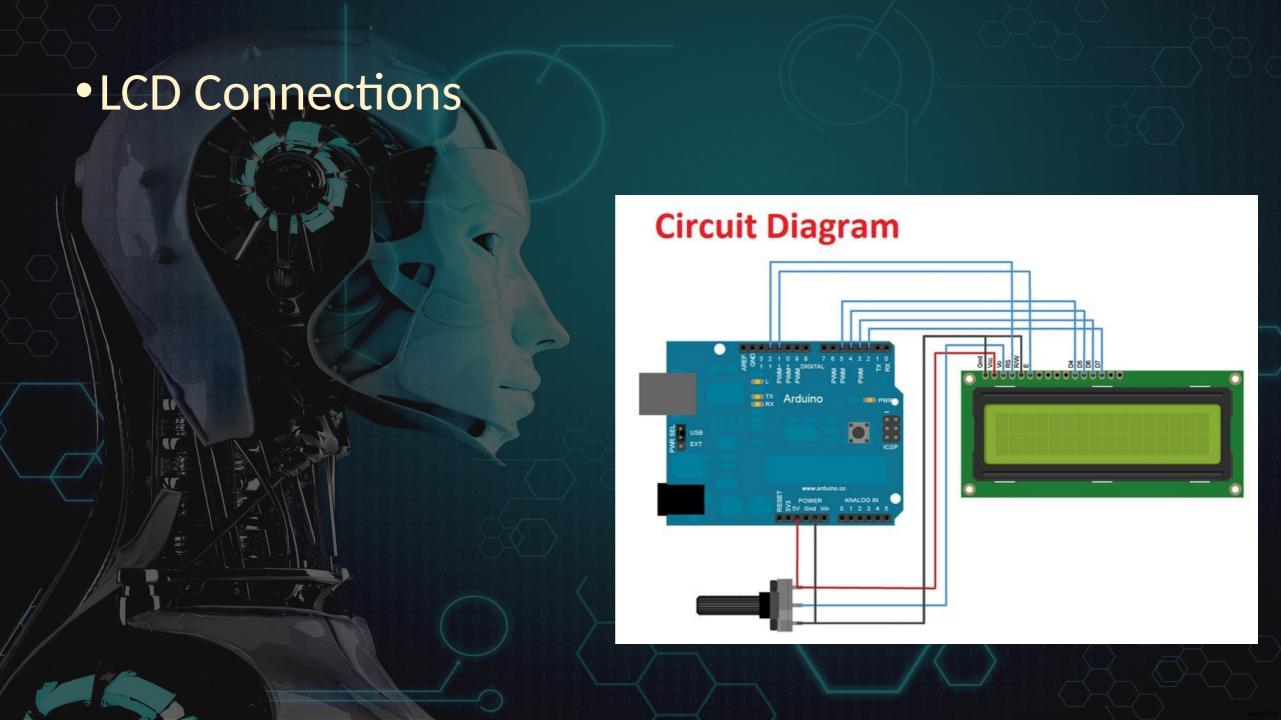




LCD(Liquid Crystal Display)







LCD functions

- LiquidCrystal LCD_Name(RS_Pin, EN_Pin, D4_Pin, D5_Pin, D6_Pin, D7_Pin);
- LCD_Name.begin(columns, Rows);
- LCD_Name.clear();
- LCD_Name.setCursor(col, row);
- LCD_Name.write(character);
- LCD_Name.print(Text);
- ICD_Name.scrollDisplayRight();
- ICD_Name.scrollDisplayLeft();

Components:

- LCD
- Potentiometer
- Push Button

Description:

Write "Button is On" When Button is Pressed otherwise clear the LCD

```
Upload
  sketch_jul29a §
#include <LiquidCrystal.h>
// initialize the library by associating any needed LCD interface pin
// with the arduino pin number it is connected to
const int rs = 2, en = 3, d4 = 4, d5 = 5, d6 = 6, d7 = 7;
int pb_pin=8;
int pb read;
LiquidCrystal lcd(rs,en,d4,d5,d6,d7);
void setup() {
 // put your setup code here, to run once:
lcd.begin(16, 2);
void loop() {
 // put your main code here, to run repeatedly:
lcd.setCursor(1, 0);
pb_read=digitalRead(pb_pin);
if (pb read==1) {
 lcd.print("button is on");
 else{
  lcd.clear();
```

