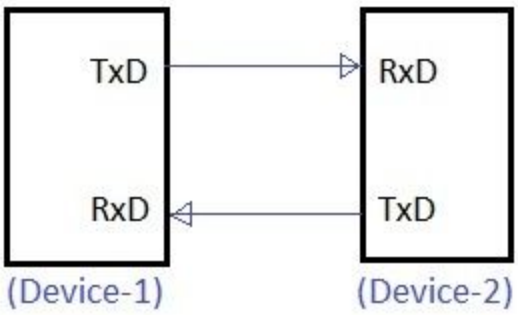
Technocrats

Communication

UART, SPI ,I2C

UART(Universal Asynchronous Receiver/Transmitter)



UART Interface Diagram

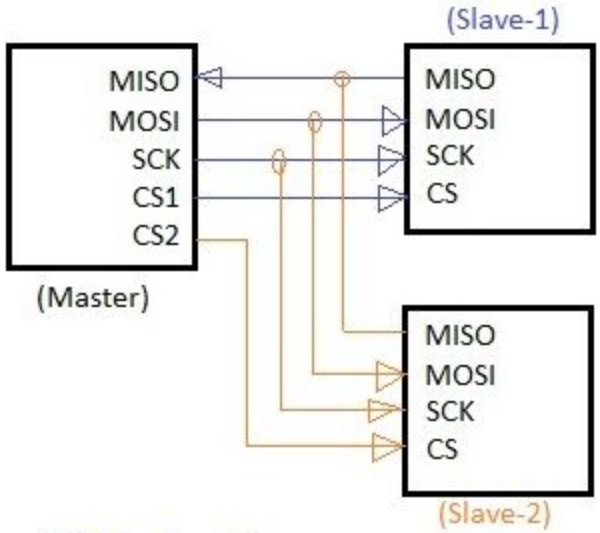
UART is generally between two devices.These devices are connected through Rx and Tx pins.Rx and Tx pins are receiver and transmitter for the particular device.Receiver of one is connected to the transmitter of other and vice versa.Also there is concept of baud rate which is,rate at which device is searching the input and providing the output.Usually baud rate is 9600, which means every 1/9600th of sec input is detected.Disadvantage of using UART is that it is fixed to two devices only and also the baud rate for two devices should be same so that they can receive or send data.UART is asynchronous communication meaning that whenever one task finishes then the other is started.UART models are used in gps,modems bluetooth and in many other devices.Advantage of UART is that it is simple and most popular and also available in all the devices due to UART support.

SPI(Serial peripheral interface)

SPI is quite different type of communication as it uses different line for data along with the clock that are perfectly synced with each other.Clock is oscillating signal that tell when to take the input from the data provided.SPI can be used to connect more than two receivers at a same time.SPI communication is based on three main pins,that are the SCLK , MOSI ,MISO.SCLK is serial clock pin that is use to provide with the clock signal for data transmission. MOSI is Main Out Slave In which is transfer of data from main to the slave device. MISO is Main In Slave Out ,it is use to

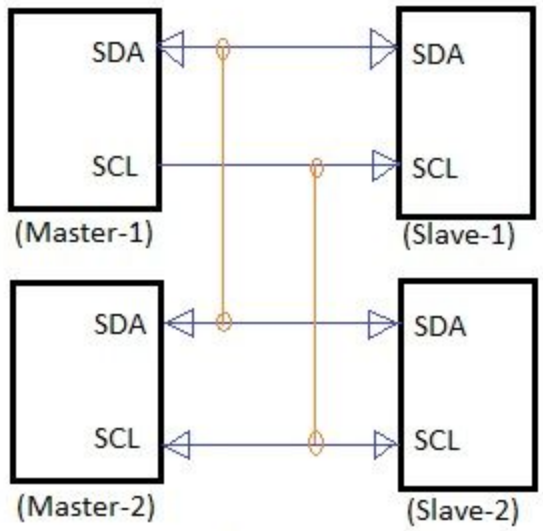
transfer data from slave to the main device.Also,there is SS (Slave select) pin which is for every slave device that is connected to the main so that particular slave gets low value whenever data

has to shared with that slave devices.Example of the devices using SPI are SD cards digital potentiometer.Advantage of the SPI over other models is that it is used for fast transfer through various of the slaves devices.Disadvantage is that it can be worked for long distance for transmission,it can be done if we reduce the serial clock signal of the main device.



SPI Interface Diagram

I2C(Inter-Integrated circuit)



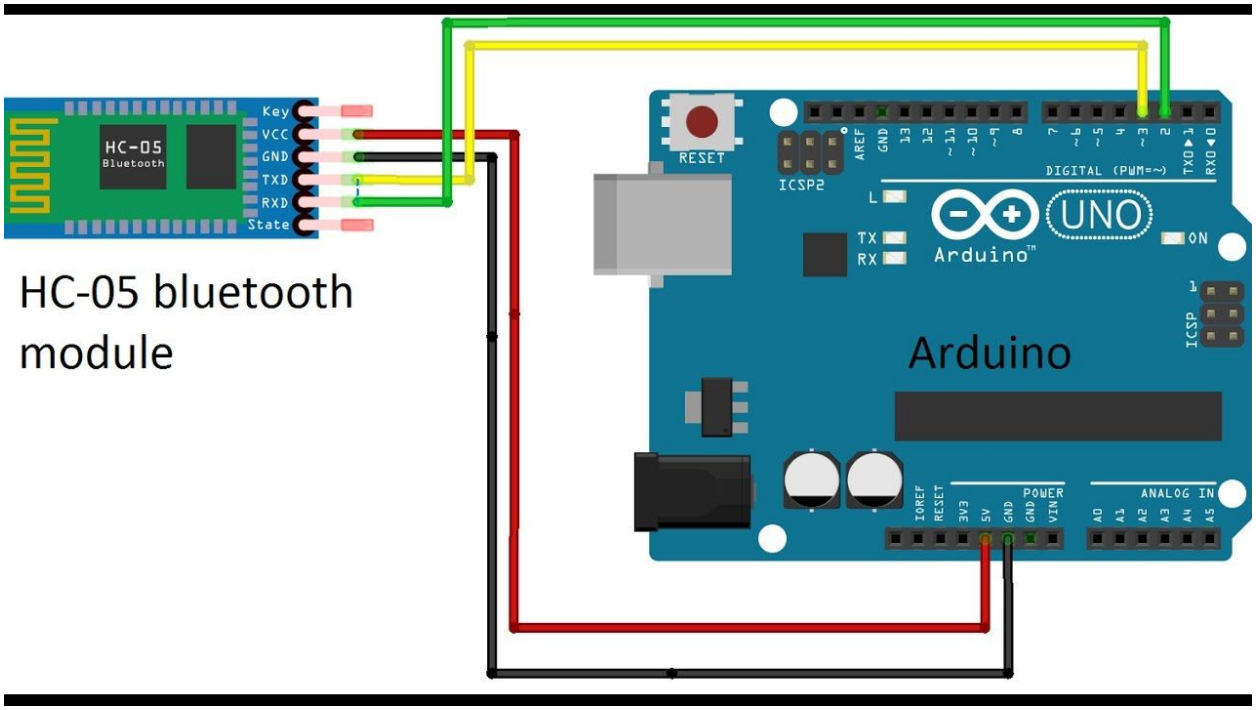
I2C Interface Diagram

I2C is a serial protocol that is based on a two wire system in which all the main and slave devices are connected.In I2C communication we can have more than one main devices along with the various slave devices.Every slave device has a particular address which is used to transfer the data to that particular slave device.In this way every slave is connected in serial manner to the

main device.I2C consist of two wire that are SCL and SDA.SCL is serial clock wire and SDA is serial data wire.There are I2C level shifters which can be used to connect two I2C buses having different voltages.In normal state both SDA and SCL are in high condition.The communication is initiated by the main device.It will start checking the address of the slave device if it get the bit as 0 it will move on till it gets the required slave device and then at that slave device it reads or write the all bit and then provides a stop condition and move on to the next slave device for reading or writing the data.I2C is a flexible and can operate with both of slow and high speed device.

Bluetooth

The most common bluetooth module is HC 05.Bluetooth module can receive and transmit data from a host system using host controller interface(HCI).



HC 05 contains six pin in which four are required to make it work.The four pins are Rx,Tx,Vcc and ground.Rx is receiver pin and is connected to the transmitter of the arduino and Tx is the transmitter pin connected to the receiver of the arduino pin. Vcc is to connect to the voltage source and ground is for making common ground of arduino.

#code for turning the LED on or off

```
char get = 0;   //Variable for storing received data

void setup()
```

```
{
Serial.begin(9600);        //Sets the data rate in bits per second (baud)
pinMode(x, OUTPUT);        //Sets digital pin x as output pin
}
void loop()
{
if(Serial.available() > 0)  // Send data only when you receive data:
{
get= Serial.read();      //Read the incoming data and store it into variable data
Serial.print(get);       //Print Value inside data in Serial monitor
Serial.print("\n");       //New line
if(get == '1')           //Checks whether value of data is equal to 1
digitalWrite(x, HIGH);  //If value is 1 then LED turns ON, x is here pin number
else if(data == '0')      //Checks whether value of data is equal to 0
digitalWrite(x, LOW);   //If value is 0 then LED turns OFF,x is here pin number
}
}
```

RF module (Radio frequency module)

RF module consists of transmitter and a receiver part that is used for the communication. As the name suggest it uses radio frequency for transmission of the data.One of the common RF module is 437MHz transmitter and receiver module.RF module consist of two part receiver and transmitter that are connected to two different arduino that requires connection between them.Following is the code for working of the receiver and transmitter.

#code for transmitter

```
#include <RH_ASK.h>  // radioHead library
```

```
#include <SPI.h>

RH_ASK driver;

void setup()
{
    Serial.begin(9600);      // Initialisation
    if (!driver.init())
         Serial.println("init failed");
}

void loop()
{
    const char *msg = "Hello World!"; // sending the msg to receiver
    driver.send((uint8_t *)msg, strlen(msg));
    driver.waitPacketSent();
    delay(1000);
}
```

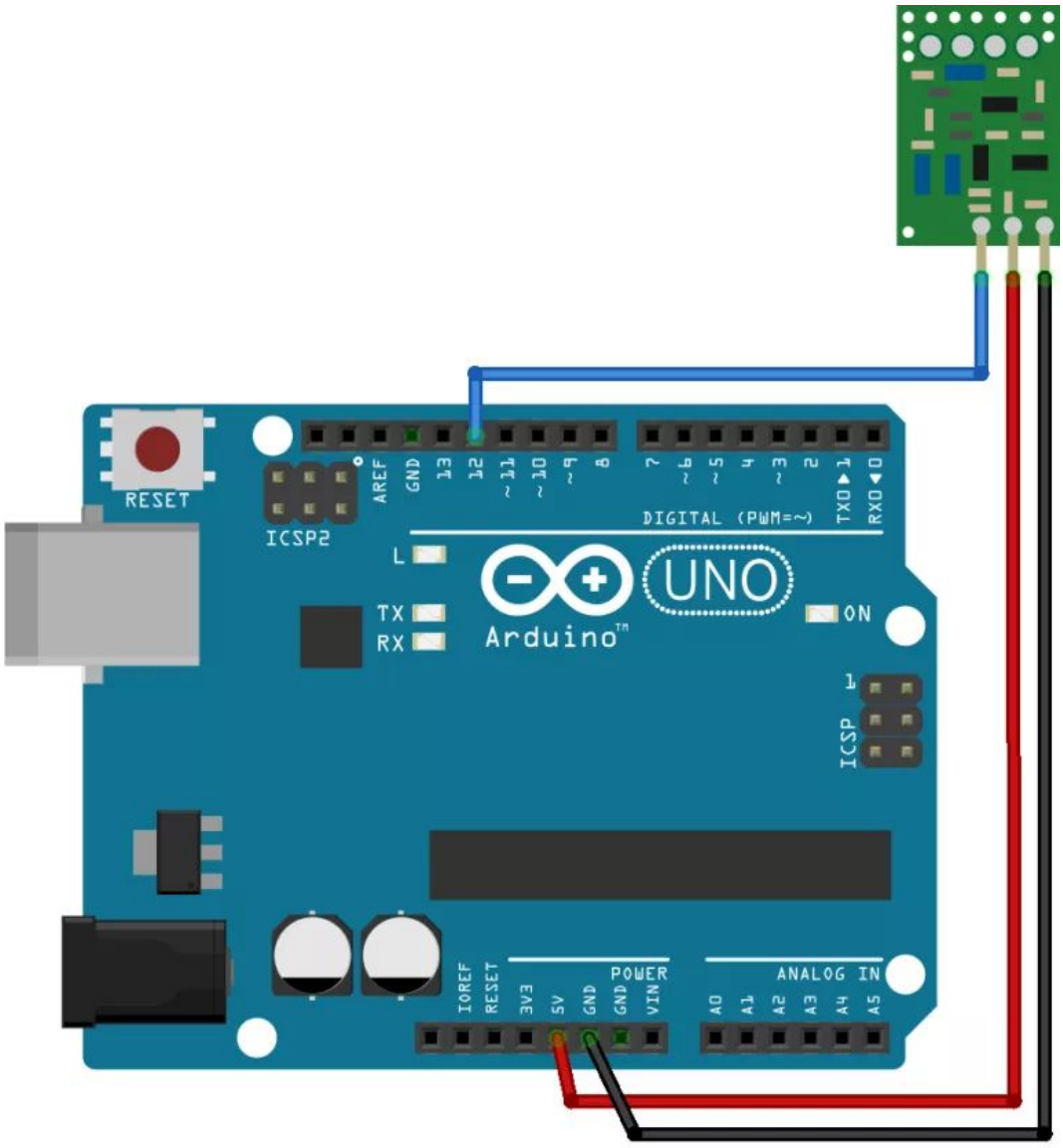
#code for receiver

```
#include <RH_ASK.h>
#include <SPI.h>
```

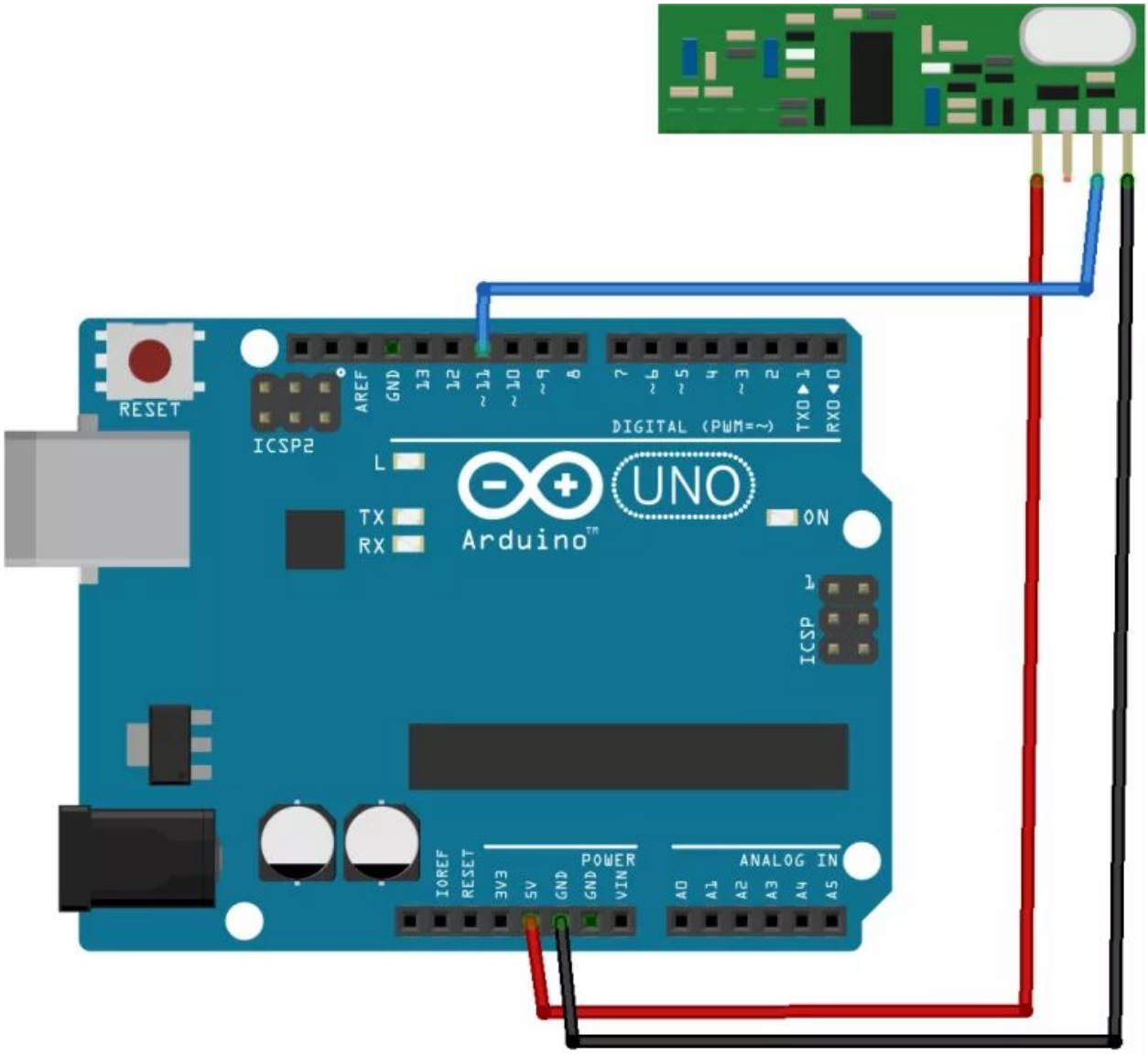
```
RH_ASK driver;


void setup()
{
    Serial.begin(9600);    // initialisation
    if (!driver.init())
         Serial.println("init failed");
}


void loop()
{
    uint8_t buf[12]; // setting the limit of the max len of msg
    uint8_t buflen = sizeof(buf);
    if (driver.recv(buf, &buflen)) // built in function for receiving
the data
    {
      int i;
```

```
        Serial.print("Message: ");

        Serial.println((char*)buf); printing the msg

    }

}
```

Transmitter circuit-->

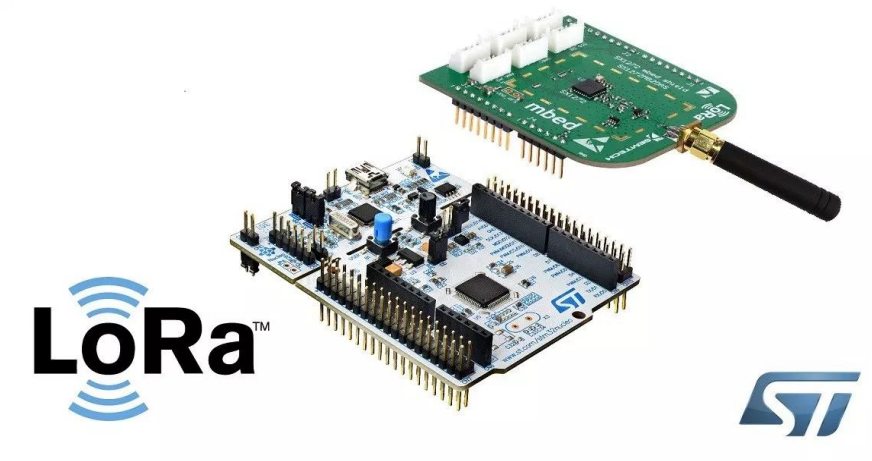


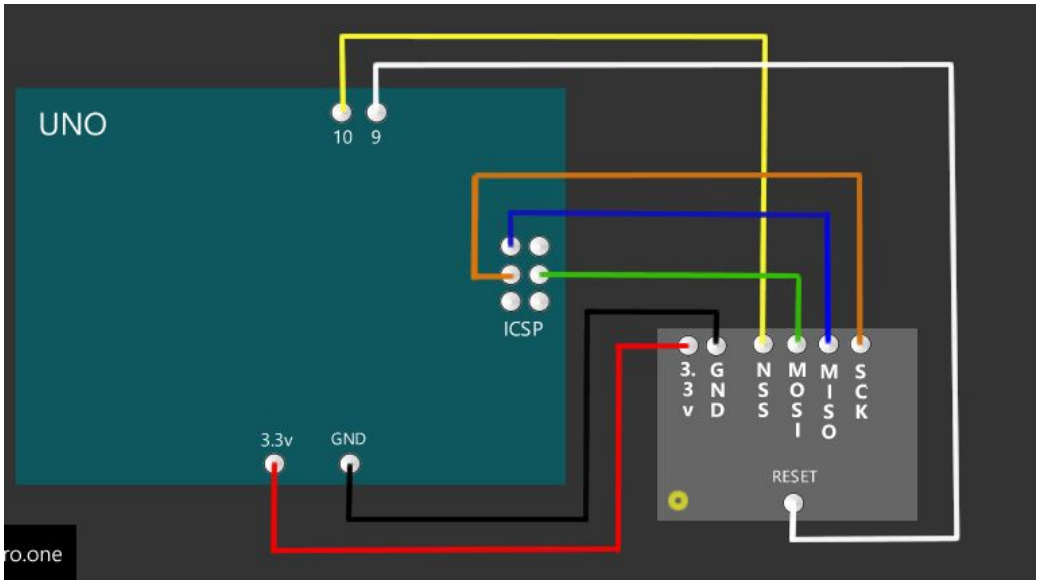
Receiver circuit-->



Lora (short for long range)

Lora is prefered for long range communication where bluetooth, wifi can’t works.also, we can use cellular network for IoT devices as it is not battery efficient so Lora is used as it requires very less battery power to transfer data.LoRaWAN is long range wide area network that is basically network protocol for Lora.LoRaWAn can be used for networking the whole city.LoRaWAN network server manages the data rate for each device individually by means of ADR that is adaptive data rate scheme which expands the battery life of the remote end devices up to 10 years also increases the overall network extent capacity.





For better understanding:https://www.smart-prototyping.com/blog/Sending-and-Receiving-Weather-Data-with-a-LoRa-Module

PS2 controller

Although each button can be configured to perform a specific and distinctive action, they all work on the same principle. Each button has a tiny curved disk attached to its bottom. This disk is very conductive. When the button is depressed, the disk is pushed against a thin conductive strip mounted on the controller's circuit board. If the button is pressed lightly, the bottom part of the curved disk is all that touches the strip, increasing the level of conductivity slightly. As the button is pressed harder, more of the disk comes into contact with the strip, gradually increasing the level of conductivity. This varying degree of conductivity makes the buttons pressure-sensitive!

PS2 controllers also have two analog joysticks. These joysticks work in a completely different way from the buttons described above. Two potentiometers, variable resistors, are positioned at right angles to each other below the joystick. Current flows constantly through each one, but the amount of current is determined by the amount of resistance. Resistance is increased or decreased based on the position of the joystick. By monitoring the output of each potentiometer, the PS2 can determine the exact angle at which the joystick is being held, and trigger the appropriate response. In games that support them, analog features such as these allow for amazing control over gameplay.

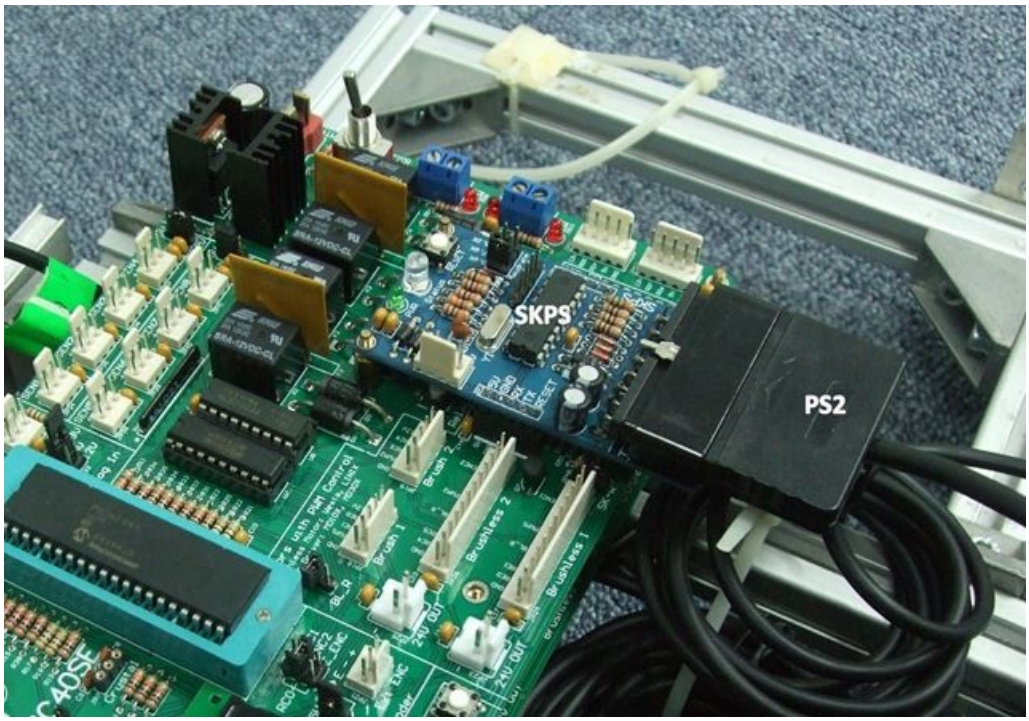
Reference for working of PS2 controller:https://electronics.howstuffworks.com/ps23.htm

How to control four wheeled bot using PS2 controller?

Ans. We can control the bot by controlling the motors of the four wheel.We can do so by assigning the buttons of the controller for particular command. We can use a controller and a remote control which in our case could be cytron's MC40SE controller and a PS2 remote control.Just a brief on the MC40SE features:

- Comes with PIC16F887, you can utilize the 8MHz internal oscillator on it and obtain 2 more I/O pins.
- Uses UIC00B to load program.
- Comes with connector for UC00A/B for UART communication to computer.
- Changeable Crystal, you have options to remove external crystal or change to other speed of crystal.
- Comes with 2×8 character LCD, you can now display menu and information.
- Two-brush motor ports for start/stop and direction control, up to 10A each motor.
- Eight digital input ports, you can connect photoelectric sensor, fiber optic sensor, limit switches, etc.
- One analog input with selectable power of 3.3V, 5V and 12V.
- Socket ready for Cytron's SK board include SKPS, SKXBee and SKKCA-21.

SKPS offers simple and ready socket to connect to SONY PS2 DualShock 2 controller, and our controller can communicate with it via simple and commonly used UART standard. Not only we can check the status of each digital input and analog joystick on SKPS, we can even control the vibrator motor on it.if everything is correctly done and nicely connected; the SKPS should be working with PS2 DualShock Controller. Pressing any digital button of PS2 will make super bright LED (Blue) on SKPS to illuminate with higher density.The SKPS should be set to 9600 baud rate as the sample source code is using that speed.Below we can see the connection of SKPS with PS2 to the MC40SE and all the other component.



Buy link: MC40SE:https://www.cytron.io/p-advance-mobile-robot-controller

Buy link:SKPS:https://www.cytron.io/p-ps2-controller-starter-kit

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