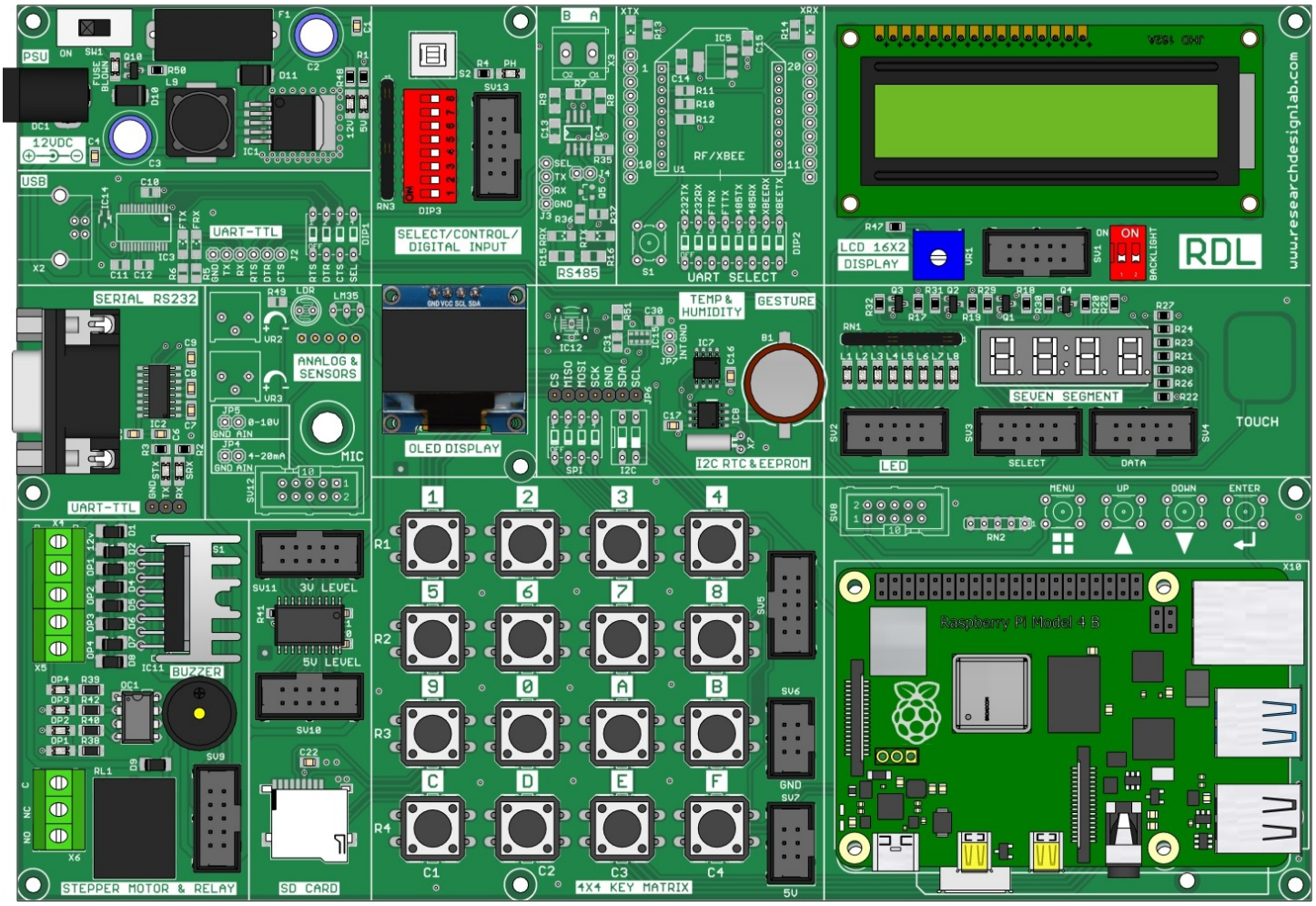
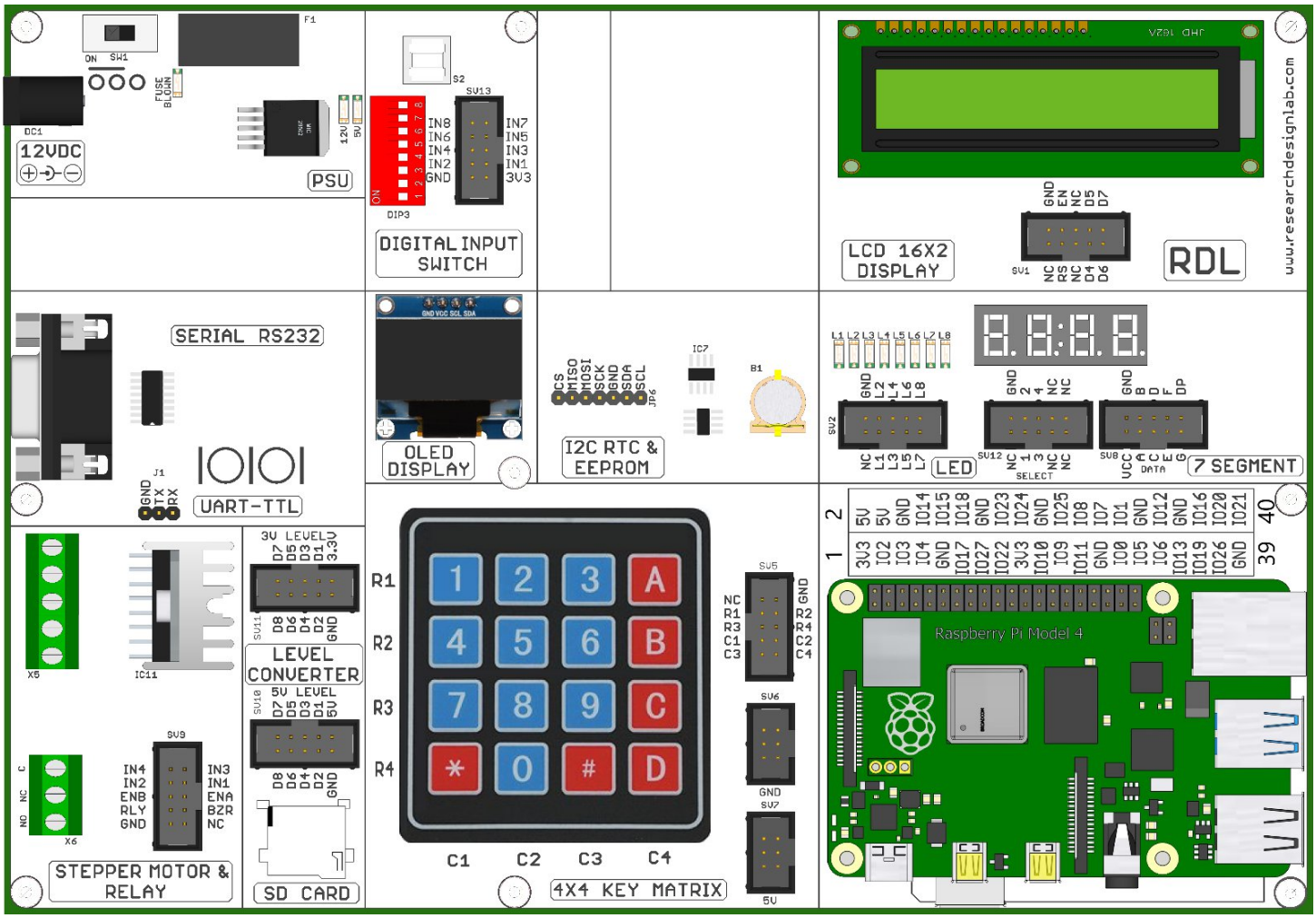
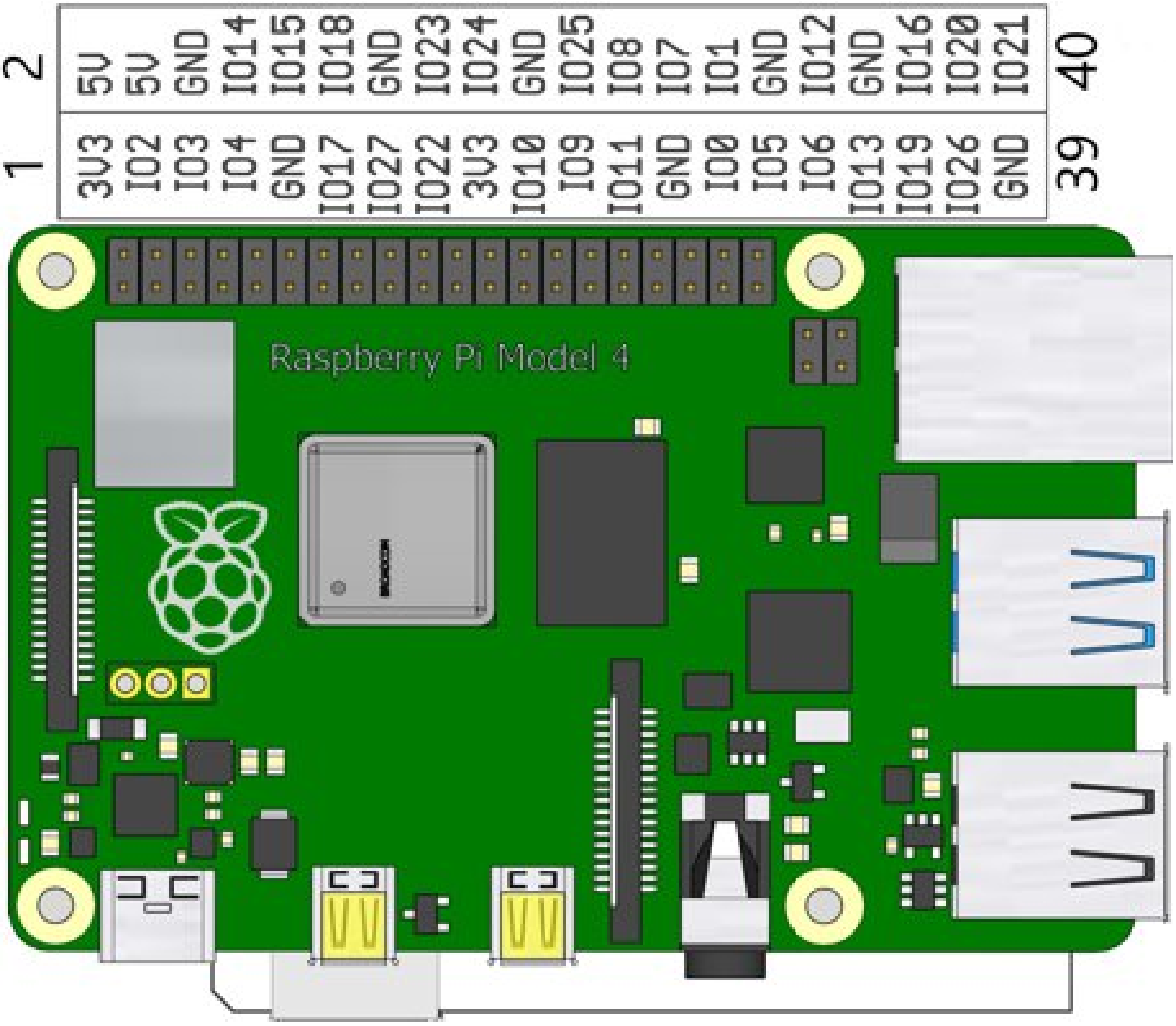


RPI4 TRAINING KIT

Board Features

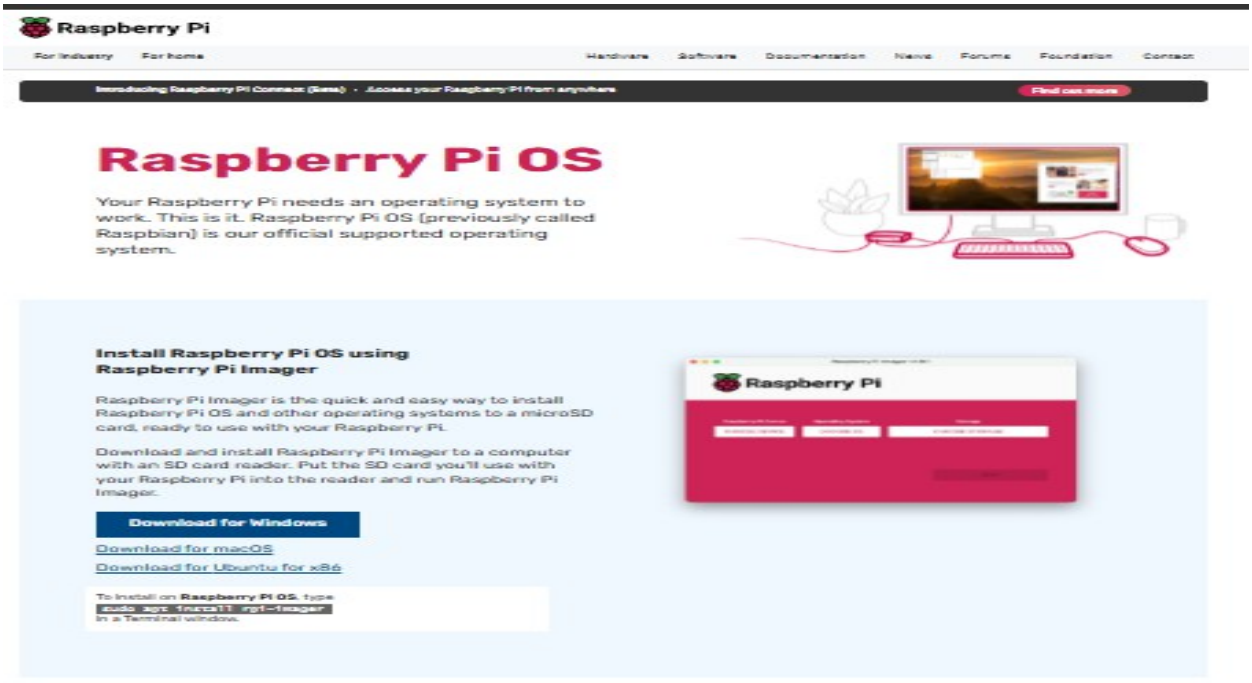



2
40
5V 5V GND IO14 IO15 IO18 GND IO23 IO24 GND IO25 IO8 IO7 IO1 GND IO12 GND IO16 IO20 IO21
1
39
3V3 IO2 IO3 IO4 GND IO17 IO27 IO22 3V3 IO10 IO9 IO11 GND IO0 IO5 IO6 IO13 IO19 IO26 GND
Raspberry Pi Model 4

Setup RPI device

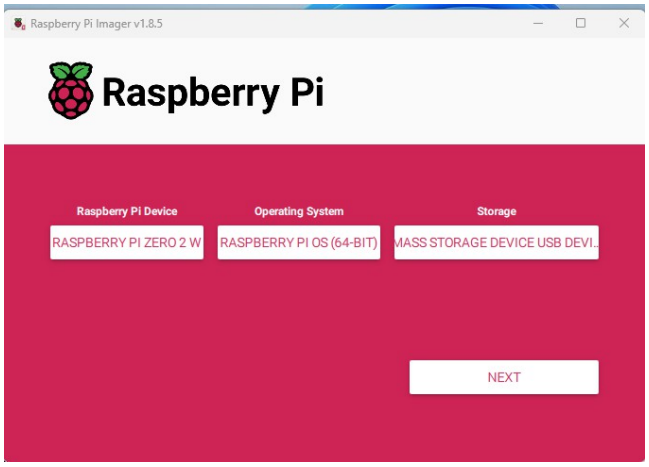
Download Raspberry Pi OS:

- Go to the official Raspberry Pi website: Raspberry Pi OS Software
- Download the "Raspberry Pi imager

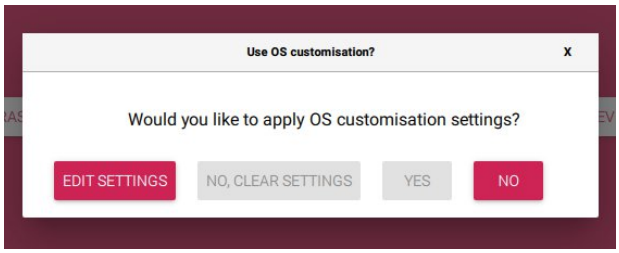


Write the Image to SD Card:

- Insert your microSD card into your computer.
- Open Raspberry Pi Imager, select the OS image , then choose the microSD card as the target.



- Click "NEXT" and click EDIT SETTINGS.



- Enter the details as per your need.
- Enter yes/Write to write OS to SD card.
- Remove SD card from System and insert to RPI SD card slot.

Install putty software or any other software to login to RPI.

HOW TO CREATE THE CODE:

1. Login to RPI account
2. Create Directory and install a virtual environment in the created directory.
    a. sudo apt update.
    b. sudo apt install python3 python3-pip python3-venv.
    c. cd /path/to/your/project.
    d. python3 -m venv myenv.
    e. source myenv/bin/activate.
3. Install libraries and packages you need.
    a. pip install <package-name>.
    b. sudo apt update.
    c. sudo apt upgrade -y.
    d. sudo apt install <library_name>.
4. Create a python file and write the code in the file.
    a. nano File_name.py.
5. Run the python file.
    a. python file_name.py or python3 file_name.py

Experiments

1.LED Blinking

AIM:

Interface LED with RPI 0.

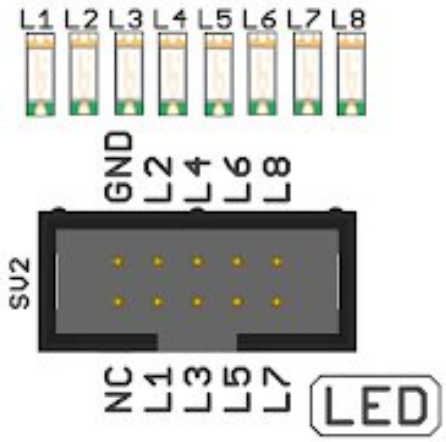
Description:

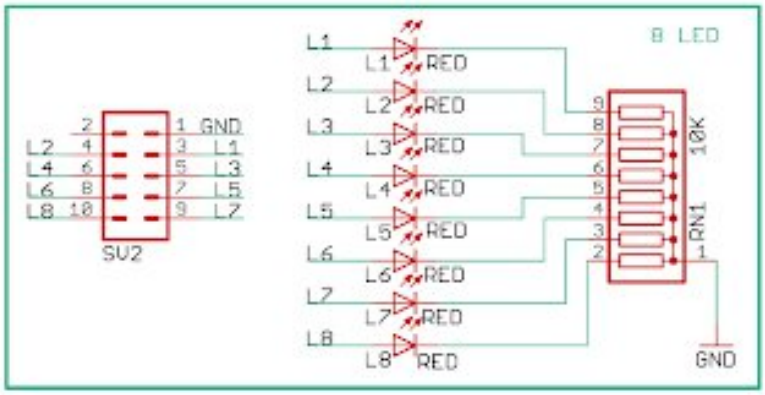
To blink 8 LED's with particular delay.

Hardware Required:

RPI 0 Trainer Kit, power supply, FRC cable, A to B cable.

Schematic Diagram:





Procedure:

1. Connect Power supply to the kit.
2. Connect the FRC cable from P2 port to SV2(LED).
3. Write the code and Run the code.

Program:

```
import RPi.GPIO as GPIO

import time
```

```
# Define pin numbers for LEDs

led_pins = [25, 24, 23, 18, 17, 27, 22,4]


def main():

   # Set GPIO mode (BOARD or BCM)

          GPIO.setmode(GPIO.BCM)

          # Set up LED pins as outputs

        for led_pin in led_pins:

          GPIO.setup(led_pin, GPIO.OUT)

          GPIO.output(led_pin, GPIO.LOW) # Ensure all LEDs are off initially

          try:

              while True:

              # Toggle each LED on and off with a 2-second

          delay for led_pin in led_pins:

          GPIO.output(led_pin, GPIO.HIGH) # Turn LED on

      time.sleep(2) # Wait for 2 seconds

for led_pin in led_pins:

          GPIO.output(led_pin, GPIO.LOW) # Turn LED off

          time.sleep(2) # Wait for 2 seconds
```

```
except KeyboardInterrupt:
        # Clean up GPIO on CTRL+C
        GPIO.cleanup()
        if __name__ == "__main__":
        main()
```

2.LCD Display

AIM:

Interface LCD display with RPI 0.

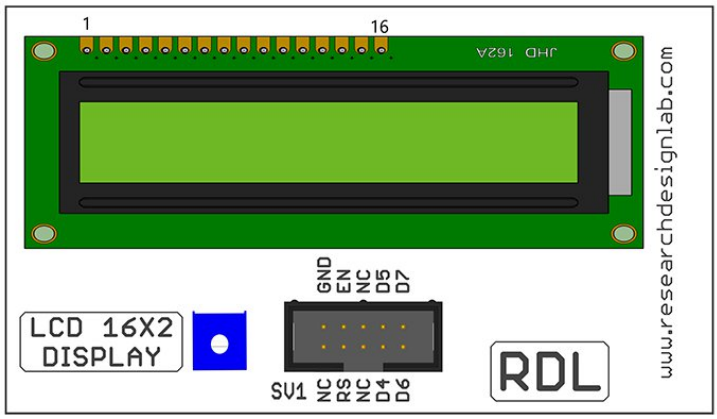
Description:

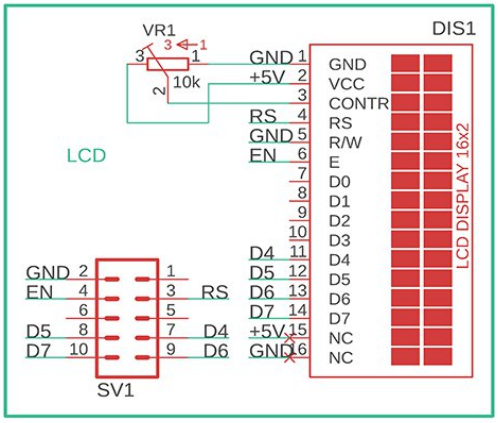
To print some text in LCD using RPI.

Hardware Required:

RPI 0 Trainer Kit, power supply, FRC cable, A to B cable.

Schematic Diagram:





Procedure:

1. Connect Power supply to the kit.
2. Connect the FRC cable from P2 port to SV1(LCD).
3. Write the code and Run the code.

Program:

```
import RPi.GPIO as GPIO

from time import sleep

# Pin configuration
```

```
RS = 25

EN = 24

D4 = 23

D5 = 17

D6 = 27

D7 = 22

# LCDConstants

LCD_WIDTH=16

 LCD_CHR=True

LCD_CMD=False

# LCDline addresses

 LCD_LINE_1 = 0x80 # Address for line 1

LCD_LINE_2 = 0xC0 #Address for line 2

# Timing constants

E_PULSE = 0.0005

E_DELAY=0.0005

def main():

  # Setup GPIO

    GPIO.setwarnings(False)
```

```
  GPIO.setmode(GPIO.BCM)
  GPIO.setup(RS, GPIO.OUT)
  GPIO.setup(EN,GPIO.OUT)
  GPIO.setup(D4, GPIO.OUT)
  GPIO.setup(D5, GPIO.OUT)
  GPIO.setup(D6, GPIO.OUT)
  GPIO.setup(D7,GPIO.OUT)
# Initialize display
lcd_init()
try:
        while True:
           # Display messages on two lines
           lcd_string("  Welcome to  ", LCD_LINE_1)
           cd_string("RDL Technologies", LCD_LINE_2)
           sleep(2)  # Wait for 2 seconds
           # Clear display and show a goodbye message
           lcd_byte(0x01, LCD_CMD)  # Clear display
           lcd_string("Goodbye!", LCD_LINE_1)
```

```
sleep(2)  # Wait for 2 seconds
    except KeyboardInterrupt:
        # Cleanup GPIO on interrupt
        print("Exiting program...")
        GPIO.cleanup()
    def lcd_init():
    lcd_byte(0x33, LCD_CMD)  # 110011 Initialize
    lcd_byte(0x32, LCD_CMD)  # 110010 Initialize
    lcd_byte(0x06, LCD_CMD)  # Cursor move direction
    lcd_byte(0x0C, LCD_CMD)  # 000011 Display On, Cursor Off, Blink Off
    lcd_byte(0x28, LCD_CMD)  # Data length, number of lines, font size
    lcd_byte(0x01, LCD_CMD)  # Clear display
    sleep(E_DELAY)
def lcd_byte(bits, mode):
GPIO.output(RS, mode)
# High bits
GPIO.output(D4, False)
GPIO.output(D5, False)
 GPIO.output(D6, False)
GPIO.output(D7, False)
```

```
    if bits & 0x10 == 0x10:
        GPIO.output(D4, True)
    if bits & 0x20 == 0x20:
        GPIO.output(D5, True)
if bits & 0x40 == 0x40:
        GPIO.output(D6, True)
    if bits & 0x80 == 0x80:
        GPIO.output(D7, True)

    lcd_toggle_enable()

    # Low bits
    GPIO.output(D4, False)
    GPIO.output(D5, False)
    GPIO.output(D6, False)
    GPIO.output(D7, False)
    if bits & 0x01 == 0x01
        GPIO.output(D4, True)
    if bits & 0x02 == 0x02:
        GPIO.output(D5, True)
    if bits & 0x04 == 0x04:
        GPIO.output(D6, True)
```

```
    if bits & 0x08 == 0x08:
        GPIO.output(D7, True)
lcd_toggle_enable()
def lcd_toggle_enable():
    sleep(E_DELAY)
    GPIO.output(EN, True)
    sleep(E_PULSE)
    GPIO.output(EN, False)
    sleep(E_DELAY)


def lcd_string(message, line):
    message = message.ljust(LCD_WIDTH, " ")
    lcd_byte(line, LCD_CMD)


    for i in range(LCD_WIDTH):
        lcd_byte(ord(message[i]), LCD_CHR)


if __name___== '__main__':
    main()
```

3.Seven Segment Display

AIM:

Interface Seven segment display with RPI 0.

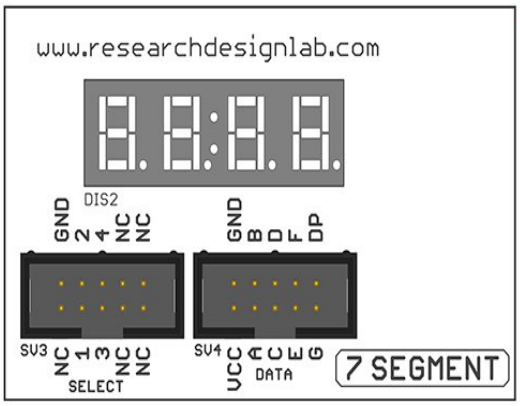
Description:

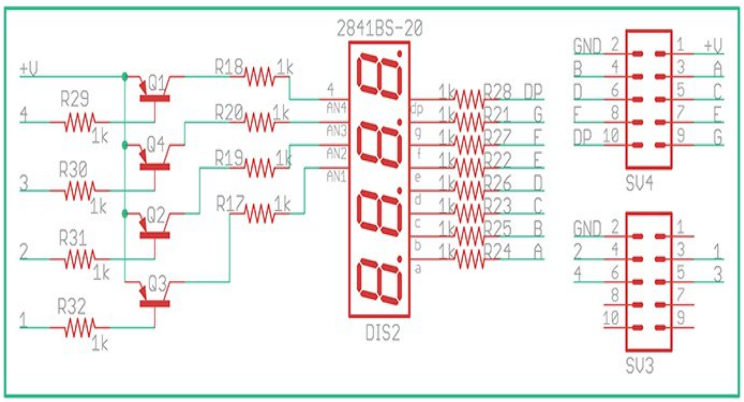
To print 0-9 digits in a seven segment display using RPI.

Hardware Required:

RPI 0 Trainer Kit, power supply, FRC cables, A to B cable.

Schematic Diagram:





Procedure:

1. Connect Power supply to the kit.
2. Connect the FRC cable from P2 port to SV4(DATA) and P3 port to SV3(SELECT).
3. Write the code and Run the code.

Program:

```
import RPi.GPIO as GPIO

import time

# Initialize GPIO mode
```

```
GPIO.setmode(GPIO.BCM

# Selection pins

sel1 = 16

sel2 = 20

sel3 = 21

sel4 = 5

# Data pins

a = 25

b = 24

c = 18

d = 4

e = 23

f = 17

g = 27

dp = 22

# Setup selection pins as output

GPIO.setup(sel1, GPIO.OUT)

GPIO.setup(sel2, GPIO.OUT)

GPIO.setup(sel3, GPIO.OUT)

GPIO.setup(sel4, GPIO.OUT)

# Select all 4 digits of 7-Segment display by making them LOW
```

```
GPIO.output(sel1, GPIO.LOW)

GPIO.output(sel2, GPIO.LOW)

GPIO.output(sel3, GPIO.LOW)

GPIO.output(sel4, GPIO.LOW

# Setup data pins as output

GPIO.setup(a, GPIO.OUT)

GPIO.setup(b, GPIO.OUT)

GPIO.setup(c, GPIO.OUT)

GPIO.setup(d, GPIO.OUT)

GPIO.setup(e, GPIO.OUT)

GPIO.setup(f, GPIO.OUT)

GPIO.setup(g, GPIO.OUT)

GPIO.setup(dp, GPIO.OUT

GPIO.setup(dp, GPIO.OUT)


time.sleep(0.1)  # Delay to ensure setup is complete

def display_digit(digit):
```

```
# Define the segment states for each

digit digits = {
        0: [GPIO.LOW, GPIO.LOW, GPIO.LOW, GPIO.LOW, GPIO.LOW, GPIO.LOW,
GPIO.HIGH, GPIO.LOW],

        1: [GPIO.HIGH, GPIO.LOW, GPIO.LOW, GPIO.HIGH, GPIO.HIGH, GPIO.HIGH,
GPIO.HIGH, GPIO.HIGH],

        2: [GPIO.LOW, GPIO.LOW, GPIO.HIGH, GPIO.LOW, GPIO.LOW, GPIO.HIGH,
GPIO.LOW, GPIO.LOW],

        3: [GPIO.LOW, GPIO.LOW, GPIO.LOW, GPIO.LOW, GPIO.HIGH, GPIO.HIGH,
GPIO.LOW, GPIO.LOW],

        4: [GPIO.HIGH, GPIO.LOW, GPIO.LOW, GPIO.HIGH, GPIO.HIGH, GPIO.LOW,
GPIO.LOW, GPIO.LOW],

        5: [GPIO.LOW, GPIO.HIGH, GPIO.LOW, GPIO.LOW, GPIO.HIGH, GPIO.LOW,
GPIO.LOW, GPIO.LOW],

        6: [GPIO.LOW, GPIO.HIGH, GPIO.LOW, GPIO.LOW, GPIO.LOW, GPIO.LOW,
GPIO.LOW, GPIO.LOW],

        7: [GPIO.LOW, GPIO.LOW, GPIO.LOW, GPIO.HIGH, GPIO.HIGH, GPIO.HIGH,
GPIO.HIGH, GPIO.HIGH],
```

```
        8: [GPIO.LOW, GPIO.LOW, GPIO.LOW, GPIO.LOW, GPIO.LOW, GPIO.LOW,
GPIO.LOW, GPIO.LOW],

        9: [GPIO.LOW, GPIO.LOW, GPIO.LOW, GPIO.LOW, GPIO.HIGH, GPIO.LOW,
GPIO.LOW, GPIO.LOW],

    }


    # Set the segments based on the digit

    segment_states = digits[digit]

    GPIO.output(a, segment_states[0])

    GPIO.output(b, segment_states[1])

    GPIO.output(c, segment_states[2])

    GPIO.output(d, segment_states[3])

    GPIO.output(e, segment_states[4])

    GPIO.output(f, segment_states[5])

    GPIO.output(g, segment_states[6])

    GPIO.output(dp, segment_states[7])


try:

    while True:

        for digit in range(10):
```

```
            display_digit(digit)

            time.sleep(2)  # Delay between digits


finally:

    GPIO.cleanup()  # Reset GPIO settings on exit
```

4.HEX Keypad

AIM:

Interface Hex keypad with RPI 0.

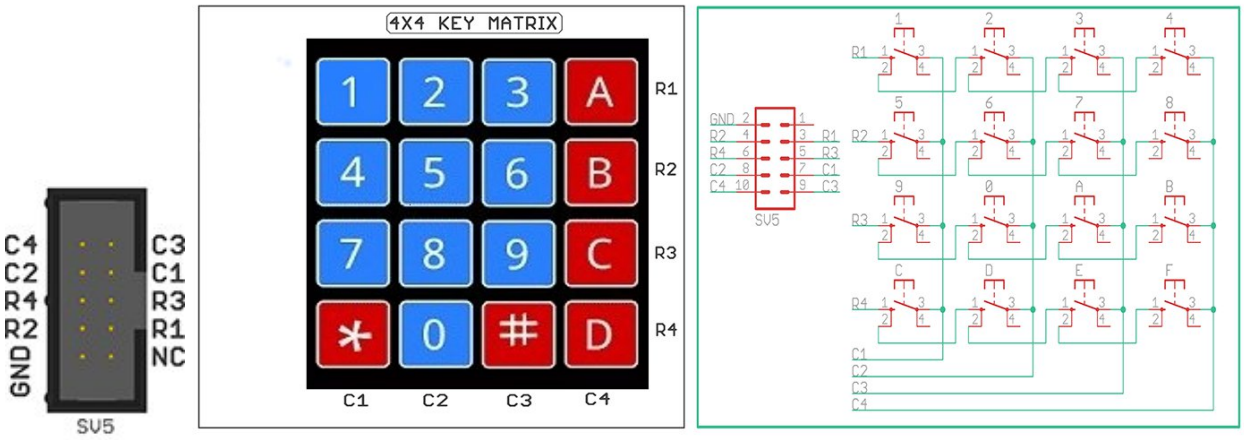
Description:

To print Hex value from hex keypad to terminal using RPI.

Hardware Required:

RPI 0 Trainer Kit, power supply, FRC cables, A to B cable.

Schematic Diagram:



Procedure:

1. Connect Power supply to the kit.
2. Connect the FRC cable from P3 port to SV5.
3. Write the code and Run the code.

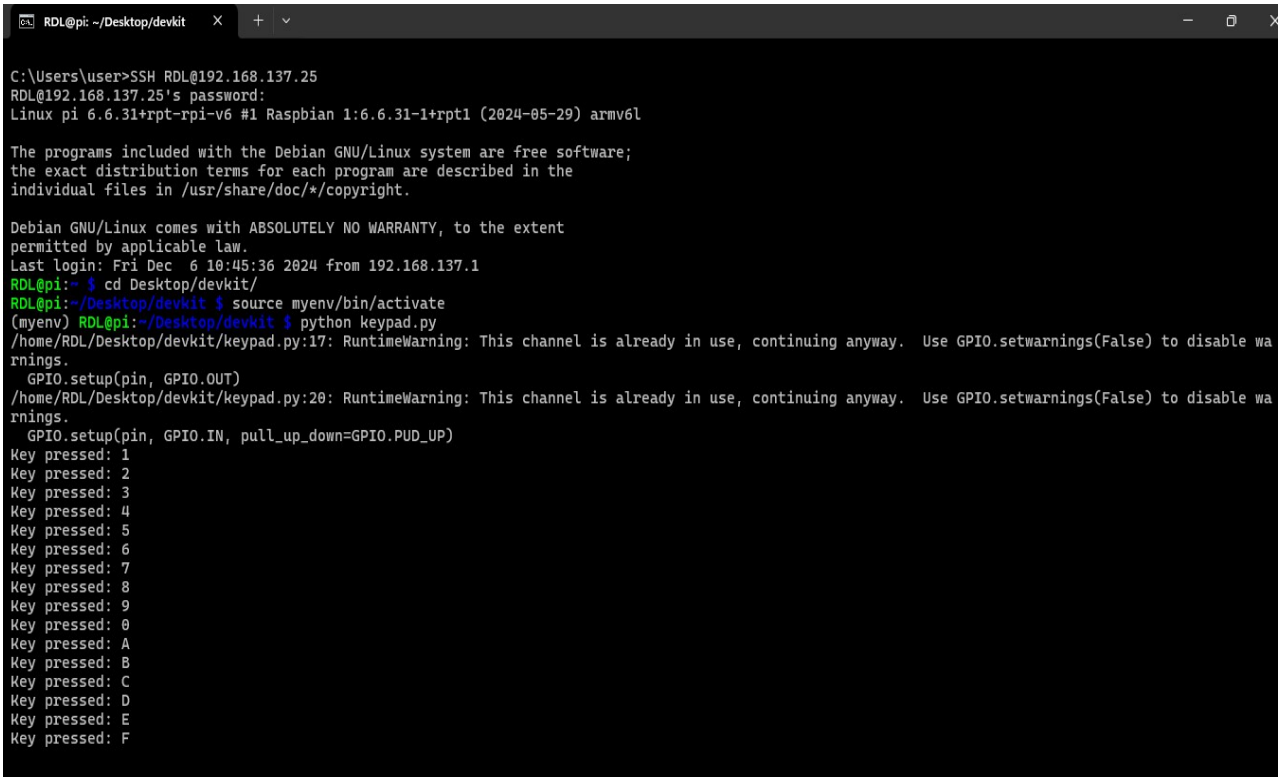
Program:

```
import RPi.GPIO as GPIO
import time


# Pin definitions
row_pins = [16, 20, 21, 5]
col_pins = [6, 13, 19, 26]
keys = [
['1', '2', '3', '4'],
['5', '6', '7', '8'],
['9', '0', 'A', 'B'],
['C', 'D', 'E', 'F']
]

    def init():
        GPIO.setmode(GPIO.BCM)
        for pin in row_pins:
            GPIO.setup(pin, GPIO.OUT)
            GPIO.output(pin, GPIO.HIGH)
        for pin in col_pins:
                GPIO.setup(pin, GPIO.IN, pull_up_down=GPIO.PUD_UP)
```

```
def get_key():
    for row in range(4):
        GPIO.output(row_pins[row], GPIO.LOW)
        for col in range(4):

            if not GPIO.input(col_pins[col]):
                key = keys[row][col]
                time.sleep(0.1)  # Debounce delay
                while not GPIO.input(col_pins[col]):
 pass  # Wait for key release
                GPIO.output(row_pins[row], GPIO.HIGH)
        return key
        GPIO.output(row_pins[row], GPIO.HIGH)
    return None
def main():
    init()
    try:
        while True:
            key = get_key()
            if key:
```

```
            print(f"Key pressed: {key}")
    except KeyboardInterrupt:
        GPIO.cleanup()
if _name___== "_main_":
 main()
```

Output:



5.Control LED using Switch

AIM:

Control LED using switch with RPI 0.

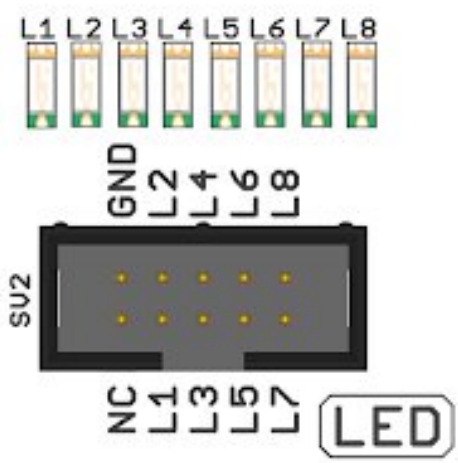
Description:

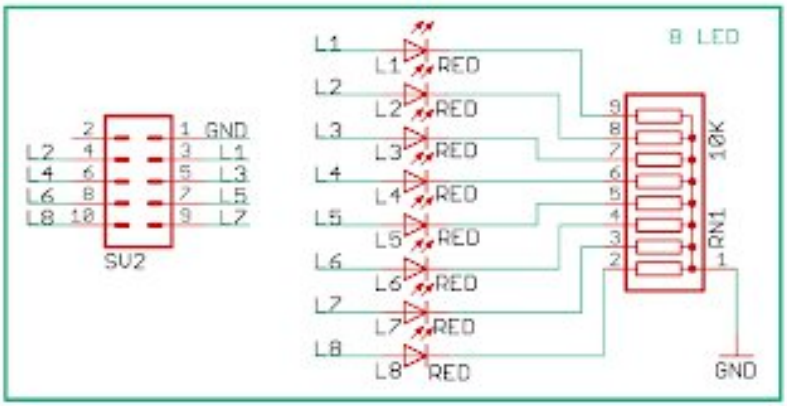
To control 8 LED's using 8 switches using RPI.

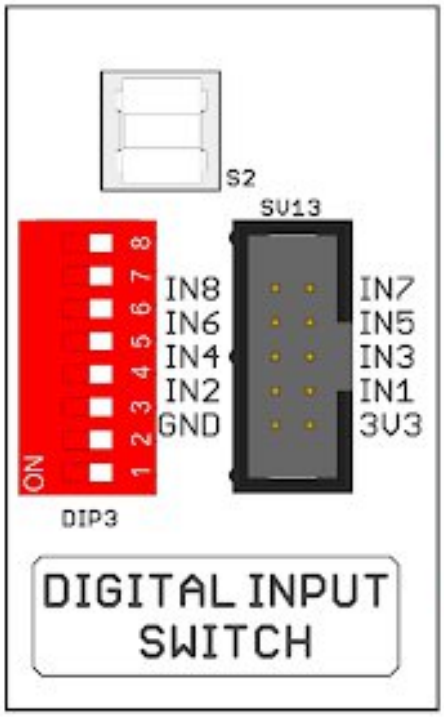
Hardware Required:

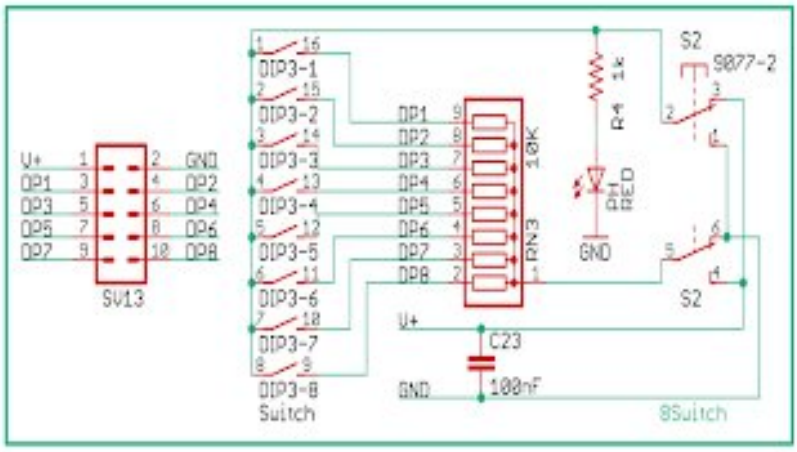
RPI 0 Trainer Kit, power supply, FRC cables, A to B cable.

Schematic Diagram:









Procedure:

1. Connect Power supply to the kit.
2. Connect the FRC cable from P2 port to SV2(LED) and P3 port to SV13(switches).
3. Write the code and Run the code.

Program:

```
import RPi.GPIO as GPIO

import time

# Define pin numbers for LEDs and switches

led_pins = [25, 24, 23, 18, 17, 27, 22]

switch_pins = [16, 20, 21, 5, 6, 13, 19]

def main():

    # Set GPIO mode (BOARD or BCM)

    GPIO.setmode(GPIO.BCM)


# Set up LED pins as outputs

    for led_pin in led_pins:

        GPIO.setup(led_pin, GPIO.OUT)

        GPIO.output(led_pin, GPIO.LOW)  # Ensure all LEDs are off initially



    # Set up switch pins as inputs with pull-down resistors

    for switch_pin in switch_pins:

        GPIO.setup(switch_pin, GPIO.IN, pull_up_down=GPIO.PUD_DOWN)
```

```
try:
        while True:
            # Check the state of each switch and update the corresponding LED
            for i in range(len(switch_pins)):
                switch_state = GPIO.input(switch_pins[i])
                GPIO.output(led_pins[i], switch_state)
                print(f"Switch {i+1} state: {switch_state}")
            time.sleep(0.1)  # Small delay to debounce the switches

            except KeyboardInterrupt:
        # Clean up GPIO on CTRL+C
        GPIO.cleanup()


if __name___== "__main__":
    main()
```

6.OLED

AIM:

Interface OLED with RPI 0.

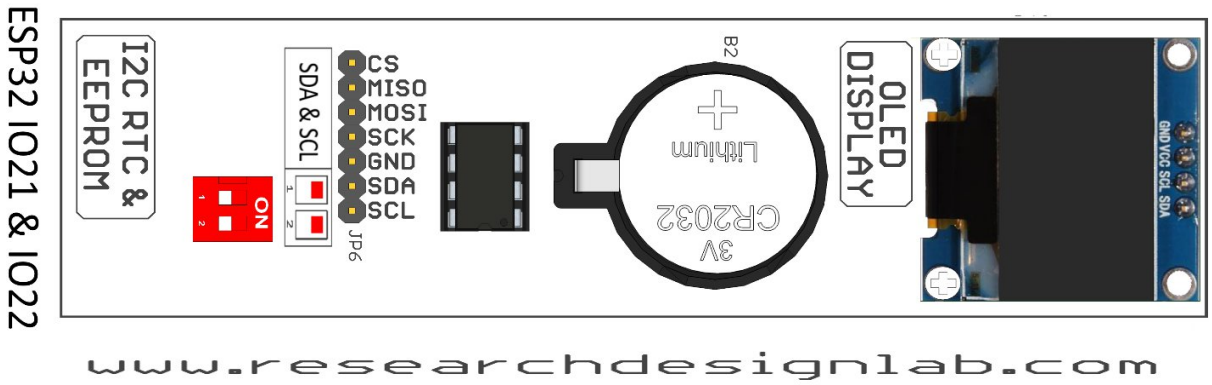
Description:

To print some text on an OLED display using RPI.

Hardware Required:

RPI 0 Trainer Kit, power supply, A to B cable.

Schematic Diagram:



Procedure:

1. Connect Power supply to the kit.
2. Write the code and Run the code.

Program:

```
import Adafruit_SSD1306

from PIL import Image, ImageDraw, ImageFont

# Initialize the OLED display (128x64 resolution)
```

```
disp = Adafruit_SSD1306.SSD1306_128_64(rst=None)

disp.begin()

disp.clear()

disp.display()

# Create an image to draw on

width = disp.width

height = disp.height

image =Image.new('1', (width, height))

draw = ImageDraw.Draw(image)

# Load a larger font size

font_path = "/usr/share/fonts/truetype/dejavu/DejaVuSans-Bold.ttf"

# Change path if needed font_size = 15

# Adjust size as desired font = ImageFont.truetype(font_path, font_size)

# Draw the text draw.text((20, 5), "Welcome to", font=font, fill=255)

draw.text((50, 25), "RDL", font=font, fill=255)

draw.text((15, 45), "Technologies", font=font, fill=255)

# Display the image on the OLED

disp.image(image)

disp.display()
```

7.RTC

AIM:

Interface RTC with RPI 0.

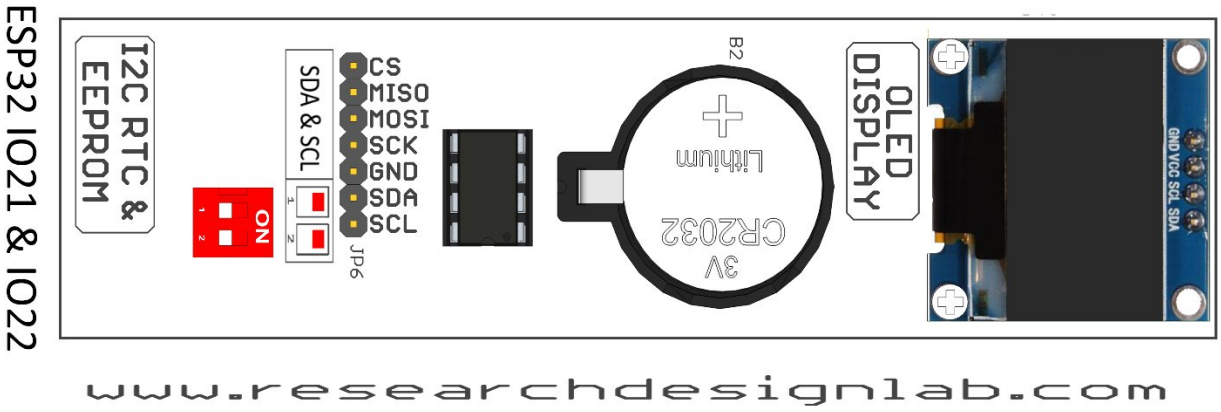
Description:

To print Real Time in the terminal using RPI.

Hardware Required:

RPI 0 Trainer Kit, power supply, A to B cable.

Schematic Diagram:



Procedure:

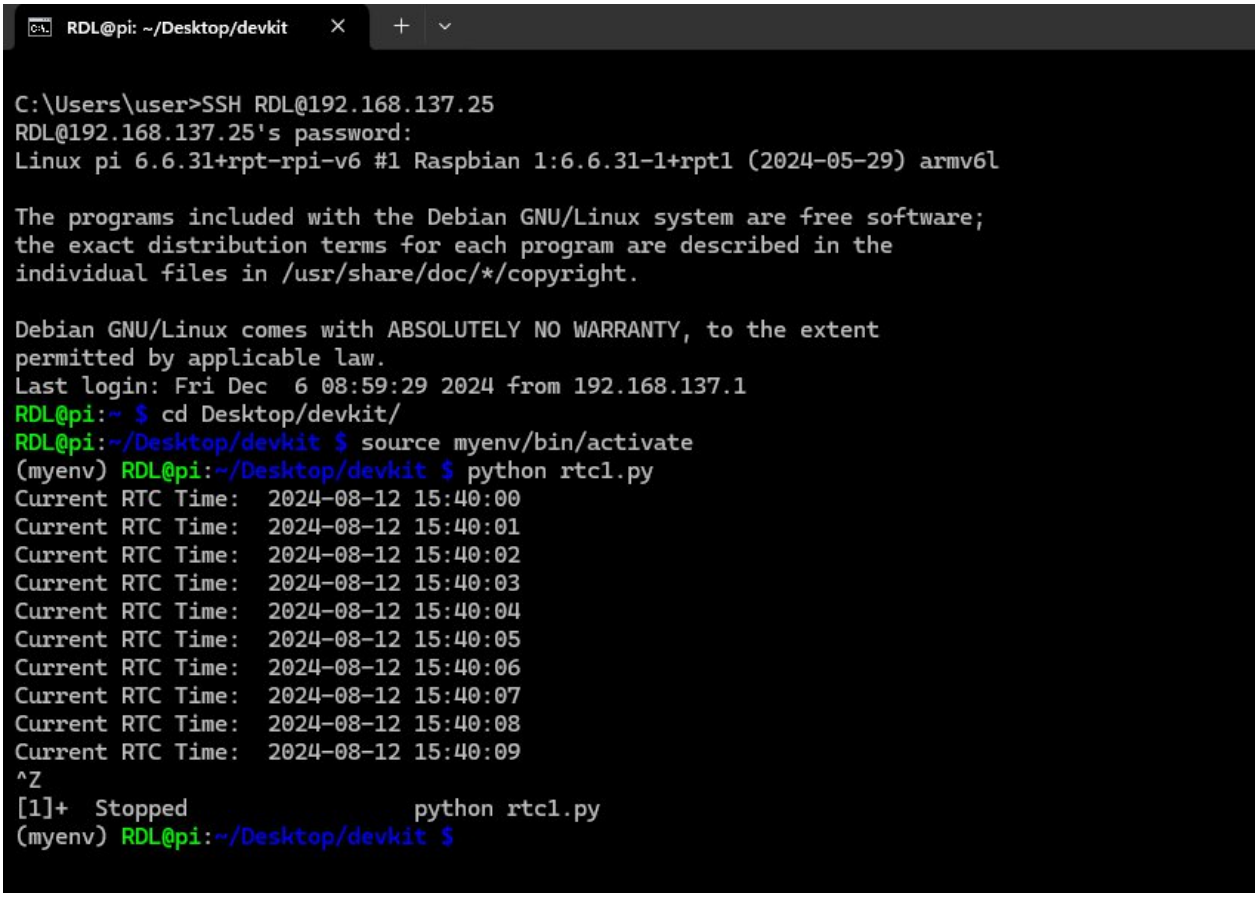
1. Connect Power supply to the kit.
2. Write the code and Run the code.

Program:

```
import smbus

import time

# Initialize I2C bus

bus = smbus.SMBus(1)

rtc_address = 0x68

def dec_to_bcd(dec):

    return (dec // 10) << 4 | (dec % 10)

def bcd_to_dec(bcd):


    return (bcd & 0x0F) + ((bcd >> 4) * 10)

def set_time(year, month, day, hour, minute, second):

    bus.write_byte_data(rtc_address, 0x00, dec_to_bcd(second))

    bus.write_byte_data(rtc_address, 0x01, dec_to_bcd(minute))

    bus.write_byte_data(rtc_address, 0x02, dec_to_bcd(hour))

    bus.write_byte_data(rtc_address, 0x04, dec_to_bcd(day))

    bus.write_byte_data(rtc_address, 0x05, dec_to_bcd(month))

    bus.write_byte_data(rtc_address, 0x06, dec_to_bcd(year - 2000))
```

```
def read_time():
    second = bcd_to_dec(bus.read_byte_data(rtc_address, 0x00))
    minute = bcd_to_dec(bus.read_byte_data(rtc_address, 0x01))
    hour = bcd_to_dec(bus.read_byte_data(rtc_address, 0x02))
    day = bcd_to_dec(bus.read_byte_data(rtc_address, 0x04))
    month = bcd_to_dec(bus.read_byte_data(rtc_address, 0x05))
    year = bcd_to_dec(bus.read_byte_data(rtc_address, 0x06)) + 2000
    return f"{year}-{month:02d}-{day:02d} {hour:02d}:{minute:02d}:{second:02d}"

# Set the time manually (e.g., August 12, 2024, 15:30:00)
set_time(2024, 8, 12, 15, 40, 0)

# Loop to continuously read and print the time from RTC
while True:
    print("Current RTC Time: ", read_time())
    time.sleep(1)
```

Output:


RDL@pi: ~/Desktop/devkit
C:\Users\user>SSH RDL@192.168.137.25
RDL@192.168.137.25's password:
Linux pi 6.6.31+rpt-rpi-v6 #1 Raspbian 1:6.6.31-1+rpt1 (2024-05-29) armv6l
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Fri Dec 6 08:59:29 2024 from 192.168.137.1
RDL@pi:~ $ cd Desktop/devkit/
RDL@pi:~/Desktop/devkit $ source myenv/bin/activate
(myenv) RDL@pi:~/Desktop/devkit $ python rtc1.py
Current RTC Time: 2024-08-12 15:40:00
Current RTC Time: 2024-08-12 15:40:01
Current RTC Time: 2024-08-12 15:40:02
Current RTC Time: 2024-08-12 15:40:03
Current RTC Time: 2024-08-12 15:40:04
Current RTC Time: 2024-08-12 15:40:05
Current RTC Time: 2024-08-12 15:40:06
Current RTC Time: 2024-08-12 15:40:07
Current RTC Time: 2024-08-12 15:40:08
Current RTC Time: 2024-08-12 15:40:09
^Z
[1]+ Stopped python rtc1.py
(myenv) RDL@pi:~/Desktop/devkit $

8.EEPROM

AIM:

Interface EEPROM with RPI 0.

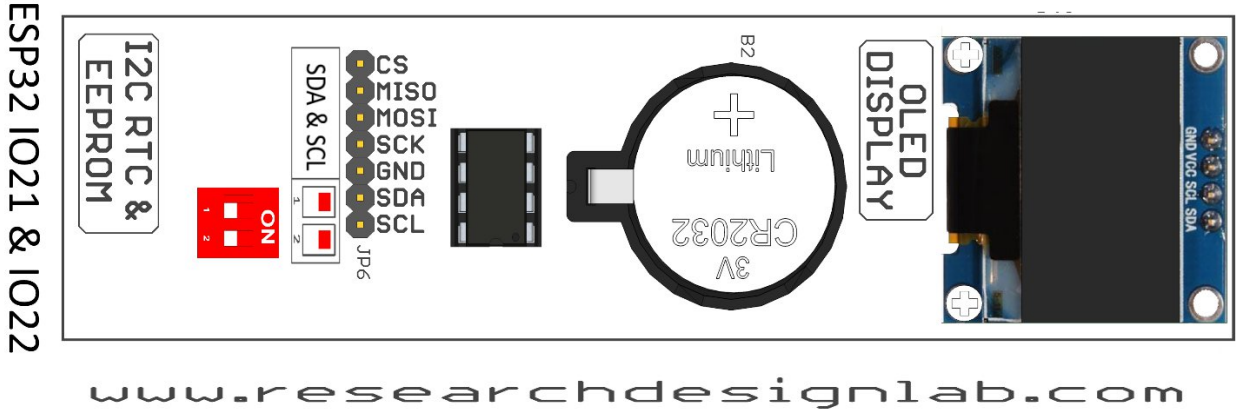
Description:

To operate EEPROM using RPI.

Hardware Required:

RPI 0 Trainer Kit, power supply, A to B cable.

Schematic Diagram:



Procedure:

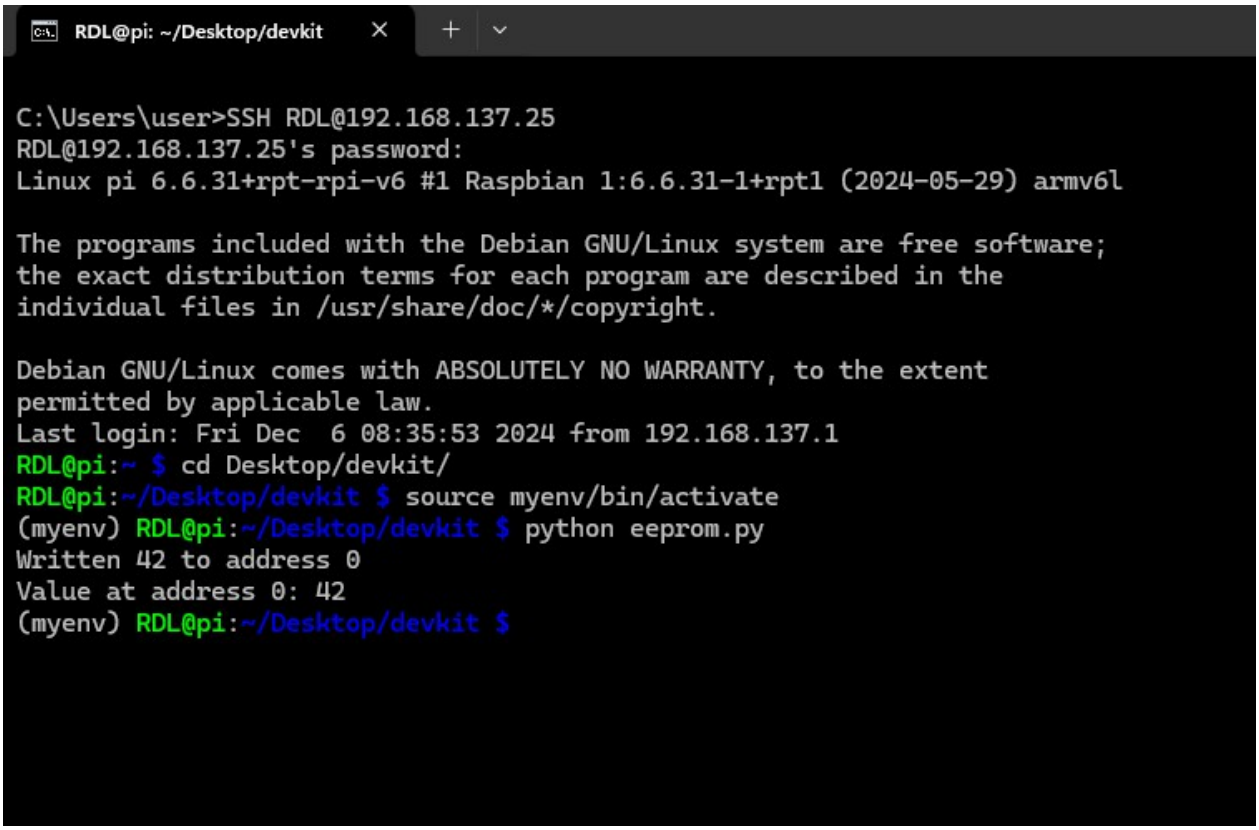
1. Connect Power supply to the kit.
2. Write the code and Run the code.

Program:

```
import smbus

import time

# Initialize the I2C bus

bus = smbus.SMBus(1)  # Use '1' for I2C on Raspberry Pi Zero

# Define the I2C address of the EEPROM (e.g., 0x50 for AT24C32)

EEPROM_ADDRESS = 0x50

# Function to write a byte to a specific EEPROM address

def write_eeprom(address, data)

    bus.write_byte_data(EEPROM_ADDRESS, address, data)

    time.sleep(0.01)  # Wait for the write operation to complete

# Function to read a byte from a specific EEPROM address

def read_eeprom(address):

    return bus.read_byte_data(EEPROM_ADDRESS, address)

# Example usage

def main():

    # Write the value 42 to EEPROM address 0

    write_eeprom(0x00, 42)

    print("Written 42 to address 0")

    # Read the value from EEPROM address 0
```

```
        value = read_eeprom(0x00)

    print(f"Value at address 0: {value}")


if __name__ == "__main__":

    main()
```

Output:



9.Relay & Buzzer

AIM:

Interface Relay and Buzzer with RPI 0.

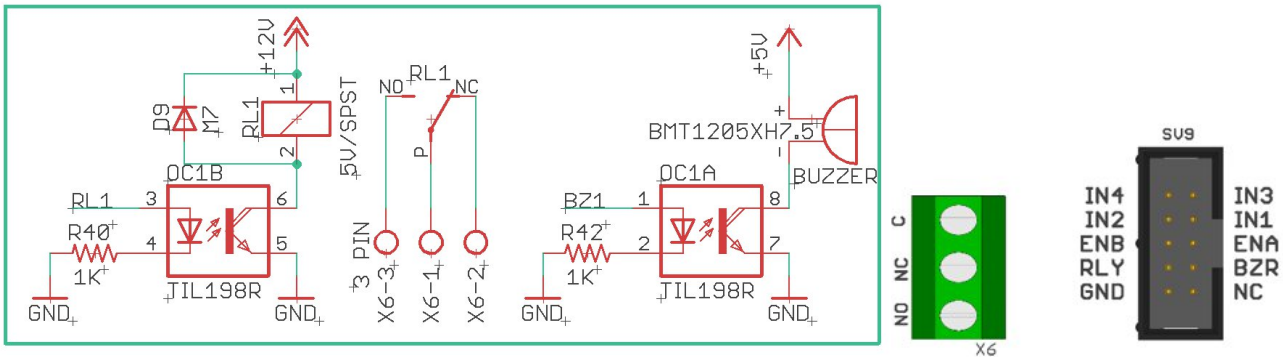
Description:

To toggle relay and buzzer using RPI.

Hardware Required:

RPI 0 Trainer Kit, power supply, FRC cable, A to B cable.

Schematic Diagram:



Procedure:

1. Connect Power supply to the kit.
2. Connect P2 port to SV9(Stepper motor,Relay & buzzer).
3. Write the code and Run the code.

Program:

```
import RPi.GPIO as GPIO

import time

# Define pin numbers for LEDs
```

```
    # Set up LED pins as outputs
    for led_pin in led_pins:
        GPIO.setup(led_pin, GPIO.OUT)
        GPIO.output(led_pin, GPIO.LOW)  # Ensure all LEDs are off initially
        try:
        while True:
            # Toggle each LED on and off with a 2-second delay
            for led_pin in led_pins:
            GPIO.output(led_pin, GPIO.HIGH)  # Turn LED on time.sleep(2)  # Wait for 2 seconds
            for led_pin in led_pins:
                GPIO.output(led_pin, GPIO.LOW)  # Turn LED off
            time.sleep(2)  # Wait for 2 seconds
    except KeyboardInterrupt:
        # Clean up GPIO on CTRL+C
        GPIO.cleanup()


if __name__== "__main__":
    main()
```

10.Motor

AIM:

Interface motor with RPI 0.

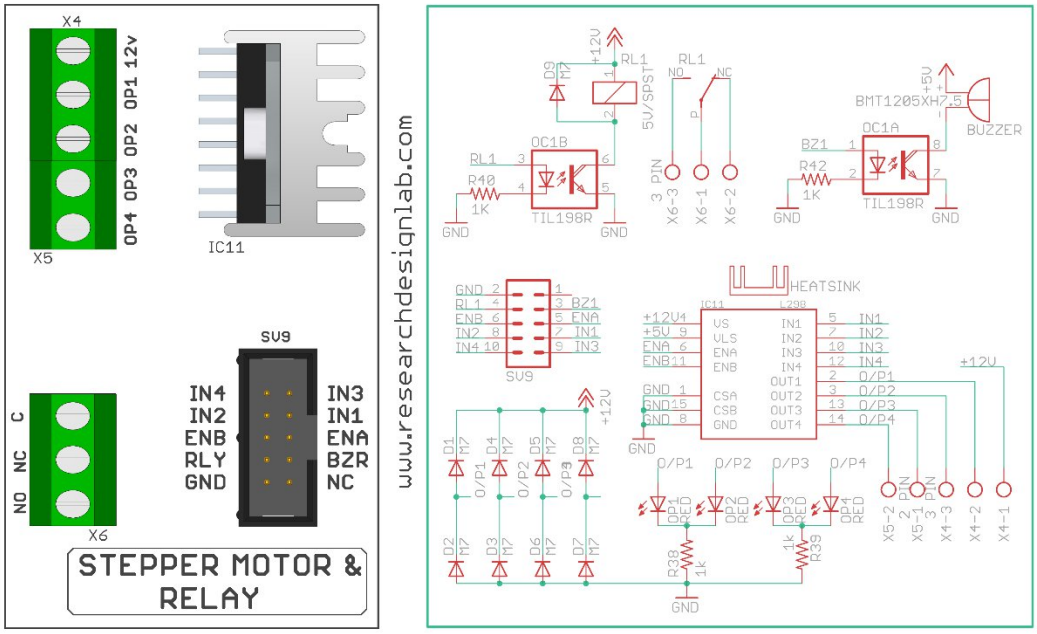
Description:

To control motor rotation using RPI.

Hardware Required:

RPI 0 Trainer Kit, power supply, FRC cable, A to B cable, Motor.

Schematic Diagram:



Procedure:

1. Connect Power supply to the kit.
2. Connect P3 port to SV9(Stepper motor,Relay & buzzer).
3. Write the code and Run the code.

Program:

```
import RPi.GPIO as GPIO

import time

# Set up the GPIO mode

GPIO.setmode(GPIO.BCM)

# Define the motor control pins

ENA = 21  # Motor A Enable

ENB = 5  # Motor B Enable

IN1 = 6  # Motor A Input 1

IN2 = 13  # Motor A Input 2

IN3 = 19  # Motor B Input 3

IN4 = 26 # Motor B Input 4

print("Hi")

# Set up the GPIO pins as outputs

GPIO.setup(ENA, GPIO.OUT)

GPIO.setup(ENB, GPIO.OUT)

GPIO.setup(IN1, GPIO.OUT)

GPIO.setup(IN2, GPIO.OUT)

GPIO.setup(IN3, GPIO.OUT)
```

```
GPIO.setup(IN4, GPIO.OUT)

# Set up PWM on the Enable pins

pwmA = GPIO.PWM(ENA, 10)  # 100 Hz frequency

pwmB = GPIO.PWM(ENB, 10)  # 100 Hz frequency

pwmA.start(0)  # Start PWM with 0% duty cycle

pwmB.start(0)  # Start PWM with 0% duty cycle

# Function to move motor A forward

def motorA_forward():

    GPIO.output(IN1, GPIO.HIGH)

    GPIO.output(IN2, GPIO.LOW)

    pwmA.ChangeDutyCycle(10)  # Full speed

    print("motor A forward")

# Function to move motor A backward

def motorA_backward():

    GPIO.output(IN1, GPIO.LOW)

    GPIO.output(IN2, GPIO.HIGH)

    pwmA.ChangeDutyCycle(10)  # Full speed

    print("motor A backward")
```

```
# Function to move motor B forward
def motorB_forward():
    GPIO.output(IN3, GPIO.HIGH)
    GPIO.output(IN4, GPIO.LOW)
    pwmB.ChangeDutyCycle(2)  # Full speed
    print("motor B forward")
# Function to move motor B backward
def motorB_backward():
    GPIO.output(IN3, GPIO.LOW)
    GPIO.output(IN4, GPIO.HIGH)
    pwmB.ChangeDutyCycle(2)  # Full speed
    print("motor B backward")
# Function to stop all motors
def stop_motors():
    pwmA.ChangeDutyCycle(0)
    pwmB.ChangeDutyCycle(0)
    GPIO.output(IN1, GPIO.LOW)

    GPIO.output(IN2, GPIO.LOW)
    GPIO.output(IN3, GPIO.LOW)
```

```
    GPIO.output(IN4, GPIO.LOW)
    print("Stop")
try:
    # Example usage
    motorA_forward()
    motorB_forward()
    time.sleep(2)  # Run motors for 2 seconds
    stop_motors()
    time.sleep(1)  # Wait for 1 second
    motorA_backward()
    motorB_backward()
    time.sleep(2)  # Run motors for 2 seconds
    stop_motors()
finally:
    # Cleanup the GPIO pins
    pwmA.stop()
    pwmB.stop()
    GPIO.cleanup()
    print("Bye")
```

11.UART communication

AIM:

UART communication with RPI 0.

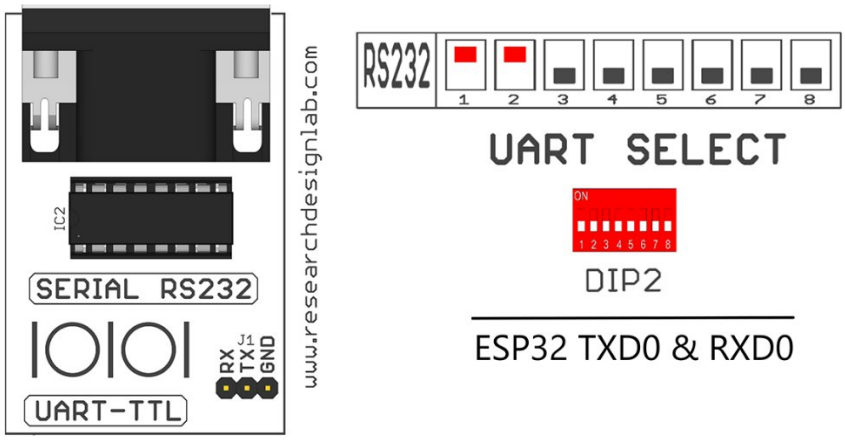
Description:

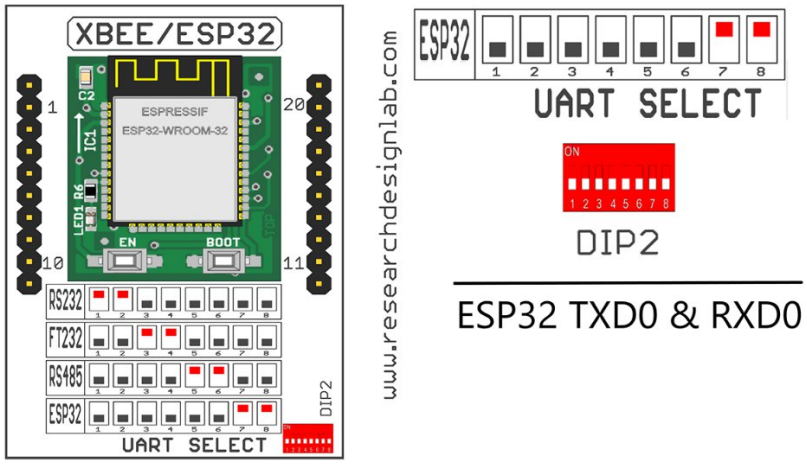
To enable data transfer with other devices using RPI.

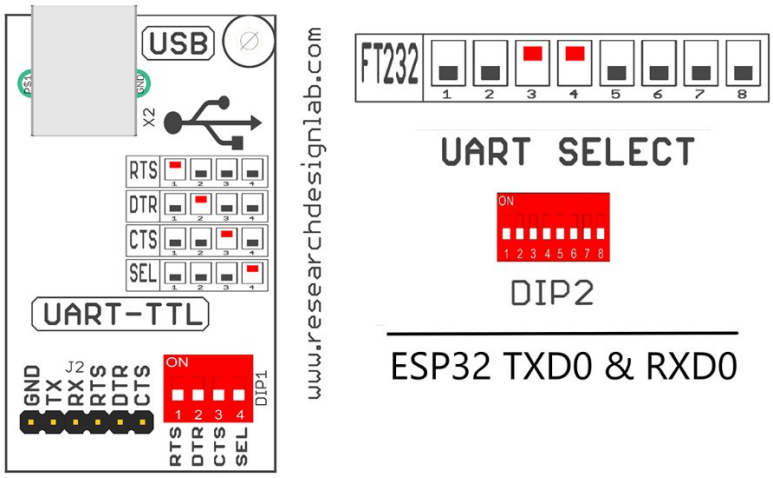
Hardware Required:

RPI 0 Trainer Kit, power supply, A to B cable.

Schematic Diagram:







Procedure:

1. Connect Power supply to the kit.
2. Connect A-B cable to UART port.
3. open UART communication software.
3. Write the code and Run the code.

Program:

```
from serial import Serial

import time

import threading

# Initialize the serial connection

arduino_serial = Serial('/dev/ttyS0', 9600, timeout=0.1)

arduino_serial.flush()

def send_data():
```

```
while True:
    try:
        user_input = input("Enter data to send (type 'exit' to quit): ")
        if user_input.lower() == 'exit':
            print("Exiting...")
            arduino_serial.close()
            break
        arduino_serial.write(user_input.encode('utf-8') + b'\n')
        except KeyboardInterrupt:
        print("Interrupted by user. Closing the connection.")
        arduino_serial.close()
        break
def receive_data():
  while True:
    try:
        if arduino_serial.in_waiting > 0:  # Check if there's any data in the buffer
            line = arduino_serial.readline().decode('utf-8').rstrip()
            if line:
                print(f"Received: {line}")
    except KeyboardInterrupt:
```

```
break

# Start threads for sending and receiving data

send_thread = threading.Thread(target=send_data)

receive_thread = threading.Thread(target=receive_data)

send_thread.start()

receive_thread.start()

send_thread.join()

receive_thread.join()
```

Output: