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| **1** | **Displaying different LED patterns with Raspberry Pi.** |
|  | import RPi.GPIO as GPIO  import time  x=1  numTimes=int(input("Enter tottal number of times to blink"))  speed=float(input("Enter length of each blink(seconds) : "))  GPIO.setwarnings(False)  GPIO.setmode(GPIO.BOARD)  GPIO.setup(5,GPIO.OUT)  GPIO.setup(10,GPIO.OUT)  GPIO.setup(19,GPIO.OUT)  GPIO.setup(26,GPIO.OUT)  GPIO.setup(29,GPIO.OUT)  def Blink(numTimes,speed):  for i in range(0,numTimes):  GPIO.output(5,True)  print ("Iteration ", (i+1))      GPIO.output(10,True)  print ("Iteration ", (i+1))      GPIO.output(19,True)  print ("Iteration ", (i+1))      GPIO.output(26,True)  print ("Iteration ", (i+1))      GPIO.output(29,True)  print ("Iteration ", (i+1))      GPIO.output(29,False)  print ("Iteration ", (i+1))  time.sleep(speed)    GPIO.output(26,False)  print ("Iteration ", (i+1))  time.sleep(speed)    GPIO.output(19,False)  print ("Iteration ", (i+1))  time.sleep(speed)    GPIO.output(10,False)  print ("Iteration ", (i+1))  time.sleep(speed)    GPIO.output(5,False)  print ("Iteration ", (i+1))  time.sleep(speed)    Blink(numTimes,speed)  print("Done") |
| **2** | **Displaying Time over 4-Digit 7-Segment Display using Raspberry Pi.** |
|  | Control 4 digits-7 segments LED display with TM1637 controller  **Connection scheme Raspberry Pi**  Connect the LED to your Raspberry Pi according to the following diagram:   |  |  |  |  | | --- | --- | --- | --- | | 1. **TM1637 Board Pin** | **Function** | **RPI Pin** | **Raspberry Function** | | 1. GND | Ground | 14 | GND | | 1. VCC | + 5V Power | 4 | 5V | | 1. DI0 | Data In | 18 | GPIO 24 | | 1. CLK | Clock | 16 | GPIO 23 |     **TM1637 script**  In order to control the LED, we use a special script with pre-defined functions. Various functions are available in the script, for example you can display numbers and adjust the intensity of the LEDs. Download the script with the command:  wget https://raspberrytips.nl/files/tm1637.py  **Code:**  import sys  import time  import datetime  import RPi.GPIO as GPIO  import tm1637  #CLK -> GPIO23 (Pin 16)  #Di0 -> GPIO24 (Pin 18)  Display = tm1637.TM1637(23,24,tm1637.BRIGHT\_TYPICAL)  Display.Clear()  Display.SetBrightnes(1)  while(True):  now = datetime.datetime.now()  hour = now.hour  minute = now.minute  second = now.second  currenttime = [ int(hour / 10), hour % 10, int(minute / 10), minute % 10 ]  Display.Show(currenttime)  Display.ShowDoublepoint(second % 2)  time.sleep(1) |
| **3** | **Raspberry Pi Based Oscilloscope** |
|  | ****Project Requirements**** The requirement for this project can be classified into two:   1. Hardware Requirements 2. Software Requirements   **Hardware requirements**  To build this project, the following components/part are required;   1. Raspberry pi 2 (or any other model) 2. 8 or 16GB SD Card 3. LAN/Ethernet Cable 4. Power Supply or USB cable 5. ADS1115 ADC 6. LDR (Optional as its meant for test) 7. 10k or 1k resistor 8. Jumper wires 9. Breadboard 10. Monitor or any other way of seeing the pi’s Desktop(VNC inclusive)   **Software Requirements**  The software requirements for this project are basically the python modules (**matplotlib and drawnow**) that will be used for data visualization and the Adafruit module for interfacing with the ADS1115 ADC chip. I will show how to install these modules on the Raspberry Pi as we proceed.  While this tutorial will work irrespective of the raspberry pi OS used, I will be using the Raspberry Pi stretch OS and I will assume you are familiar with [setting up the Raspberry Pi](http://circuitdigest.com/microcontroller-projects/getting-started-with-raspberry-pi) with the Raspbian stretch OS, and you know how to SSH into the raspberry pi using a terminal software like putty. If you have issues with any of this, there are tons of [Raspberry Pi Tutorials](https://circuitdigest.com/simple-raspberry-pi-projects-for-beginners) on this website that can help.  With all the hardware components in place, let's create the schematics and connect the components together.   ****Circuit Diagram:**** To convert the analog input signals to digital signals which can be visualized with the Raspberry Pi, we will be using the **ADS1115 ADC chip**. This chip becomes important because the Raspberry Pi, unlike Arduino and most micro-controllers, does not have an on-board analog to digital converter(ADC). While we could have used any raspberry pi compatible ADC chip, I prefer this chip due to its high resolution(16bits) and its well documented datasheet and use instructions by Adafruit. You can also check our [Raspberry Pi ADC tutorial](https://circuitdigest.com/microcontroller-projects/raspberry-pi-adc-tutorial) to learn more about it.    **ADS1115 and Raspberry Pi Connections:**  VDD – 3.3v  GND – GND  SDA – SDA  SCL – SCL  With the connections all done, power up your pi and proceed to install the dependencies mentioned below. ****Install Dependencies for Raspberry Pi Oscilloscope:**** Before we start writing the python script to pull data from the ADC and plot it on a live graph, we need to **enable the I2C communication interface** of the raspberry pi and install the software requirements that were mentioned earlier. This will be done in below steps so its easy to follow:  **Step 1: Enable Raspberry Pi I2C interface**  To enable the I2C, from the terminal, run;  **sudo raspi-config**  When the configuration panels open, select interface options, select I2C and click enable.    **Step 2: Update the Raspberry pi**  The first thing I do before starting any project is updating the Pi. Through this, I am sure every thing on the OS is up to date and I won’t experience compatibility issue with any latest software I choose to install on the Pi. To do this, run below two commands:  **sudo apt-get update**  **sudo apt-get upgrade**    **Step 3: Install the Adafruit ADS1115 library for ADC**  With the update done, we are now ready to install the dependencies starting with the Adafruit python module for the ADS115 chip. Ensure you are in the Raspberry Pi home directory by running;  **cd ~**  then install the build-essentials by running;  **sudo apt-get install build-essential python-dev python-smbus git**  Next, clone the Adafruit git folder for the library by running;  **git clone [https://github.com/adafruit/Adafruit\_Python\_ADS1x15.git](https://github.com/adafruit/Adafruit_Python_ADS1x15.git" \t "_blank)**  Change into the cloned file’s directory and run the setup file;  **cd Adafruit\_Python\_ADS1x1z**  **sudo python setup.py install**  After installation, your screen should look like the image below.    **Step 4: Test the library and 12C communication.**  Before we proceed with the rest of the project, it is important to test the library and ensure the ADC can communicate with the raspberry pi over I2C. To do this we will use an example script that comes with the library.  While still in the Adafruit\_Python\_ADS1x15 folder, change directory to the examples directory by running;  **cd examples**  Next, run the sampletest.py example which displays the value of the four channels on the ADC in a tabular form.  Run the example using:  **python simpletest.py**  If the [I](mailto:I@C)2C module is enabled and connections good, you should see the data as shown in the image below.    If an error occurs, check to ensure the ADC is well connected to the PI and I2C communication is enabled on the Pi.    **Step 5: Install Matplotlib**  To visualize the data we need to install the matplotlib module which is used to plot all kind of graphs in python. This can be done by running;  **sudo apt-get install python-matplotlib**  You should see an outcome like the image below.      **Step6: Install the Drawnow python module**  Lastly, we need to install the drawnow python module. This module helps us provide live updates to the data plot.  We will be installing drawnow via the python package installer; pip, so we need to ensure it is installed.  This can be done by running;  **sudo apt-get install python-pip**  We can then use pip to install the drawnow package by running:  **sudo pip install drawnow**  You should get an outcome like the image below after running it.    With all the dependencies installed, we are now ready to write the code. ****Python Code for Raspberry Pi Oscilloscope:**** The python code for this **Pi Oscilloscope** is fairly simple especially if you are familiar with the python matplotlib module. Before showing us the whole code, I will try to break it into part and explain what each part of the code is doing so you can have enough knowledge to extend the code to do more stuffs.  At this stage it is important to switch to a monitor or use the VNC viewer, anything through which you can see your Raspberry Pi’s desktop, as the graph being plotted won’t show on the terminal.    With the monitor as the interface **open a new python file**. You can call it any name you want, but I will call it scope.py.  **sudo nano scope.py**  With the file created, the first thing we do is import the modules we will be using;  **import time**  **import matplotlib.pyplot as plt**  **from drawnow import \***  **import Adafruit\_ADS1x15**    Next, we **create an instance of the ADS1x15 library** specifying the ADS1115 ADC  **adc = Adafruit\_ADS1x15.ADS1115()**    Next, we set the gain of the ADC. There are different ranges of gain and should be chosen based on the voltage you are expecting at the input of the ADC. For this tutorial, we are estimating a 0 – 4.09v so we will be using a gain of 1. For more info on gain you can check the ADS1015/ADS1115 datasheet.  **GAIN = 1**    Next, we need to create the array variables that will be used to store the data to be plotted and another one to serve as count.  **Val = [ ]**  **cnt = 0**    Next, we make know our intentions of making the plot interactive known so as to **enable us plot the data live**.  **plt.ion()**    Next, we start continuous ADC conversion **specifying the ADC channel**, in this case, channel 0 and we also specify the gain.  It should be noted that all the four ADC channels on the ADS1115 can be read at the same time, but 1 channel is enough for this demonstration.  **adc.start\_adc(0, gain=GAIN)**    Next we create a function def makeFig, to **create and set the attributes of the graph** which will hold our live plot. We first of all set the limits of the y-axis using ylim, after which we input the title of the plot, and the label name before we specify the data that will be plotted and its plot style and color using plt.plot(). We can also state the channel (as channel 0 was stated) so we can identify each signal when the four channels of the ADC are being used.  plt.legend is used to specify where we want the information about that signal(e.g Channel 0) displayed on the figure.  **plt.ylim(-5000,5000)**  **plt.title('Osciloscope')**  **plt.grid(True)**  **plt.ylabel('ADC outputs')**  **plt.plot(val, 'ro-', label='lux')**  **plt.legend(loc='lower right')**    Next we write the while loop which will be used constantly read data from the ADC and update the plot accordingly.  The first thing we do is **read the ADC conversion value**  **value = adc.get\_last\_result()**  Next we print the value on the terminal just to give us another way of confirming the plotted data. We wait a few seconds after printing then we append the data to the list (val) created to store the data for that channel.  **print('Channel 0: {0}'.format(value))**  **time.sleep(0.5)**  **val.append(int(value))**    We then call drawnow to update the plot.  **drawnow(makeFig)**    To ensure the latest data is what is available on the plot, we delete the data at index 0 after every 50 data counts.  **cnt = cnt+1**  **if(cnt>50):**  **val.pop(0)**  That’s all!  The **complete Python code** is given at the end of this tutorial.   ****Raspberry Pi Oscilloscope in Action:**** Copy the complete python code and paste in the python file we created earlier, remember we will need a monitor to view the plot so all of this should be done by either VNC or with a connected monitor or screen.  Save the code and run using;  **sudo python scope.py**  If you used a different name other than scope.py, don’t forget to change this to match.  After a few minutes, you should see the ADC data being printed on the terminal. Occasionally you may get a warning from matplotlib (as shown in the image below) which should be suppressed but it doesn’t affect the data being displayed or the plot in anyway. To suppress the warning however, the following lines of code can be added after the import lines in our code.  **Import warnings**  **import matplotlib.cbook**  **warnings.filterwarnings(“ignore”, category=matplotlib.cbook.mplDeprecation)**      **Code:**  import time import matplotlib.pyplot as plt #import numpy from drawnow import \* # Import the ADS1x15 module. import Adafruit\_ADS1x15 # Create an ADS1115 ADC (16-bit) instance. adc = Adafruit\_ADS1x15.ADS1115()  GAIN = 1 val = [ ] cnt = 0 plt.ion() # Start continuous ADC conversions on channel 0 using the previous gain value. adc.start\_adc(0, gain=GAIN) print('Reading ADS1x15 channel 0') #create the figure function def makeFig():     plt.ylim(-5000,5000)     plt.title('Osciloscope')     plt.grid(True)     plt.ylabel('ADC outputs')     plt.plot(val, 'ro-', label='Channel 0')     plt.legend(loc='lower right') while (True):     # Read the last ADC conversion value and print it out.     value = adc.get\_last\_result()     print('Channel 0: {0}'.format(value))     # Sleep for half a second.     time.sleep(0.5)     val.append(int(value))     drawnow(makeFig)     plt.pause(.000001)     cnt = cnt+1     if(cnt>50):         val.pop(0) |
| **4** | **Controlling Raspberry Pi with Telegram.** |
|  | Step 1: Open Telegram app in your system or mobile  * 1. **Open Telegram app in your system or mobile\**   **1.2 Start "BotFather"**    **1.3 Open "BotFather"**    **1.4 Start "BotFather"**    /start  **1.5 Create a new Bot**    **1.6 Obtain access token**    **3.3 Install "Python Package Index"**  sudo apt-get install python-pip    **Note:** Make sure Pi has internet access    **3.4 Install "telepot"**  sudo pip install telepot   Step 4: Run the Python Code **4.1 Clone the git**  git clone https://github.com/salmanfarisvp/TelegramBot.git  **4.2 Paste your Bot Token here**  bot = telepot.Bot('Bot Token')  **Note:** 1.6 for more details  **4.3 Run the Code**  python telegrambot.py  All set, now time to connect the Pi and LED. Step 5: Connect LED to Pi  Step 6: Send Command **6.1 Start our Bot**      **6.2 Send "on" & "off"**      Look at your Pi, you can see the LED on and off when you send "on" and "off" to our bot.  **Code:**  import sys  import time  import random  import datetime  import telepot  import RPi.GPIO as GPIO  #LED  def on(pin):  GPIO.output(pin,GPIO.HIGH)  return  def off(pin):  GPIO.output(pin,GPIO.LOW)  return  # to use Raspberry Pi board pin numbers  GPIO.setmode(GPIO.BOARD)  # set up GPIO output channel  GPIO.setup(11, GPIO.OUT)  def handle(msg):  chat\_id = msg['chat']['id']  command = msg['text']  print 'Got command: %s' % command  if command == 'on':  bot.sendMessage(chat\_id, on(11))  elif command =='off':  bot.sendMessage(chat\_id, off(11))  bot = telepot.Bot('Bot Token')  bot.message\_loop(handle)  print 'I am listening...'  while 1:  time.sleep(10) |
| **5** | **Setting up Wireless Access Point using Raspberry Pi** |
|  | **Required Components:**  The following components will be needed to set up a raspberry pi as a wireless access point:   1. Raspberry Pi 2 2. 8GB SD card 3. WiFi USB dongle 4. Ethernet cable 5. Power supply for the Pi. 6. Monitor (optional) 7. Keyboard (optional) 8. Mouse (optional)  ****Steps for Setting up Raspberry Pi as Wireless Access Point:**** **Step 1: Update the Pi**  As usual, we update the raspberry pi to ensure we have the latest version of everything. This is done using;  sudo apt-get update  followed by;  sudo apt-get upgrade  With the update done, reboot your pi to effect changes.    **Step 2: Install “*dnsmasq*” and “*hostapd*”**  Next, we install the software that makes it possible to setup the pi as a wireless access point and also the software that helps assign network address to devices that connect to the AP. We do this by running;  sudo apt-get install dnsmasq​  followed by;  sudo apt-get install hostapd​  or you could combine it by running;  sudo apt-get install dnsmasq hostapd    **Step 3: Stop the software from Running**  Since we don’t have the software configured yet there is no point running it, so we disable them from running in the underground. To do this we run the following commands to stop the *systemd*operation.  sudo systemctl stop dnsmasq  sudo systemctl stop hostapd    **Step 4: Configure a Static IP address for the wireless Port**  Confirm the *wlan* port on which the wireless device being used is connected. For my Pi, the wireless is on wlan0. **Setting up the Raspberry Pi to act as a server** requires us to assign a static IP address to the wireless port. This can be done by editing the *dhcpcd*config file. To edit the configuration file, run;  sudo nano /etc/dhcpcd.conf  Scroll to the bottom of the config file and add the following lines.  interface wlan0  static ip\_address=192.168.1.200/24 #machine ip address  After adding the lines, the config file should look like the image below.    Note: This IP address can be changed to suit your preferred configuration.  Save the file and exit using; ctrl+x followed by Y    Restart the *dhcpcd* service to effect the changes made to the configuration using;  sudo service dhcpcd restart    **Step 5: Configure the *dhcpcd* server**  With a static IP address now configured for the Raspberry Pi wlan, the next thing is for us to configure the *dhcpcd* server and provide it with the **range of IP addresses to be assigned to devices that connect to the wireless access point**. To do this, we need to edit the configuration file of the *dnsmasq*software but the config file of the software contains way too much info and a lot could go wrong If not properly edited, so instead of editing, we will be creating a new config file with just the amount of information that is needed to make the wireless access point fully functional.  Before creating the new config file, we keep the old on safe by moving and renaming it.  sudo mv /etc/dnsmasq.conf /etc/dnsmasq.conf.old  Then launch the editor to create a new configuration file;  sudo nano /etc/dnsmasq.conf  with the editor launched, copy the lines below and paste in or type directly into it.  interface = wlan0 #indicate the communication interface which is usually wlan0 for wireless  dhcp-range = 192.168.1.201, 192.168.1.220, 255.255.255.0,24h #start addr(other than machine ip assigned above), end addr, subnet mask, mask  the content of the file should look like the image below.    Save the file and exit. The content of this config file is just to specify the range of IP address that can be assigned to devices connected to the wireless access point.  With this done, we will be able to give an identity to devices on our network.  The next set of steps will help us configure the access point host software, setup the ssid, select the encrytpion etc.    **Step 6: Configure *hostapd*for SSID and Password**  We need to edit the *hostapd*config file(run ***sudo nano /etc/hostapd/hostapd.conf***) to add the various parameters for the wireless network being **setup including the ssid and password**. Its should be noted that the password (passphrase) should be between 8 and 64 characters. Anything lesser won’t work.  interface=wlan0  driver=nl80211  ssid=piNetwork  hw\_mode=g  channel=7  wmm\_enabled=0  macaddr\_acl=0  auth\_algs=1  ignore\_broadcast\_ssid=0  wpa=2  wpa\_passphrase=mumbai123 # use a very secure password and not this  wpa\_key\_mgmt=WPA-PSK  wpa\_pairwise=TKIP  rsn\_pairwise=CCMP    The content of the file should look like the image below.    Feel free to change the ssid and password to suit your needs and desire.  Save the config file and exit.    After the config file has been saved, we need to point the hostapd software to where the config file has been saved. To do this, run;  sudo nano /etc/default/hostapd find the line with daemon\_conf commented out as shown in the image below.   Uncomment the DAEMON\_CONF line and add the line below in between the quotes in front of the “equal to” sign.  /etc/hostapd/hostapd.conf    **Step 7: Fire it up**  Since we disabled the two software initially, to allow us configure them properly, we need to restart the system after configuration to effect the changes.  Use;  sudo systemctl start hostapd  sudo systemctl start dnsmasq    **Step 8: Routing and masquerade for outbound traffic**  We need to add routing and masquerade for outbound traffic.  To do this, we need to edit the config file of the *systemctl* by running:  sudo nano /etc/sysctl.conf  Uncomment this line ***net.ipv4.ip\_forward=1***(highlighted in the image below)    Save the config file and exit using ctrl+x followed by y.  Next we move to masquerading the outbound traffic. This can be done by making some changes to the iptable rule. To do this, run the following commands:  sudo iptables -t nat -A POSTROUTING -o eth0 -j MASQUERADE  then save the Iptables rule using:  sudo sh -c "iptables-save > /etc/iptables.ipv4.nat"    **Step 9: Create Wireless Access Point on startup:**  For most wireless access point application, it is often desired that the access point comes up as soon as the system boots. To implement this on the raspberry pi, one of the easiest ways is to add instructions to run the software in the *rc.local* file so we put commands to install the iptable rules on boot in the rc.local file.  To edit the rc.local file, run:  sudo nano /etc/rc.local  and add the following lines at the bottom of the system, just before the exit 0 statement  iptables-restore < /etc/iptables.ipv4.nat    **Step 9: Reboot! and Use**  At this stage, we need to reboot the system to effect all the changes and test the wireless access point starting up on boot with the iptables rule updated.  Reboot the system using:  sudo reboot  As soon as the system comes back on, you should be able to access the wireless access point using any Wi-Fi enabled device and the password used during the setup. ****Accessing the Internet from the Raspberry Pi’s Wi-Fi Hotspot**** To implement this, we need to put a “bridge” in between the wireless device and the Ethernet device on the Raspberry Pi (the wireless access point) to pass all traffic between the two interfaces. To set this up, we will use the *bridge-utils* software. Install *hostapd* and *bridge-utils*. While we have installed*hostapd* before, run the installation again to clear all doubts.  sudo apt-get install hostapd bridge-utils  Next, we stop hostapd so as to configure the software.  sudo systemctl stop hostapd    When a bridge is created, a higher level construct is created over the two ports being bridged and the bridge thus becomes the network device. To prevent conflicts, we need to stop the allocation of IP addresses by the DHCP client running on the Raspberry Pi to the eth0 and wlan0 ports. This will be done by editing the config file of the dhcpcd client to include ***denyinterfaces wlan0*** and ***denyinterfaces eth0*** as shown in the image below.  The file can be edited by running the command;  sudo nano /etc/dhcpcd.conf    ***Note:****From this point on, ensure you don’t disconnect the Ethernet cable from your PC if you are running in headless mode as you may not be able to connect via SSH again since we have disabled the Ethernet port. If working with a monitor, you have nothing to fear.*   Next, we create a new bridge called br0  sudo brctl addbr br0  Next, we connect the ethernet port (eth0) to the bridge (br0) using;  sudo brctl addif br0 eth0  (Note: if eth0 doesn’t exists use ifconfig command to list all Ethernet adapters and use the name from list)  Next, we edit the interfaces file using ***sudo nano /etc/network/interfaces*** so various devices can work with the bridge. Edit the interfaces file to include the information below;  #Bridge setup  auto br0  iface br0 inet manual  bridge\_ports eth0 wlan0​    Lastly we edit the hostapd.conf file to include the bridge configuration. This can be done by running the command: ***sudo nano /etc/hostapd/hostapd.conf*** and editing the file to contain the information below. Note the bridge was added below the wlan0 interface and the driver line was commented out.  interface=wlan0  bridge=br0  ssid=piNetwork  hw\_mode=g  channel=7  wmm\_enabled=0  macaddr\_acl=0  auth\_algs=1  ignore\_broadcast\_ssid=0  wpa=2  wpa\_passphrase=mcctest1  wpa\_key\_mgmt=WPA-PSK  wpa\_pairwise=TKIP  rsn\_pairwise=CCMP  With this done, save the config file and exit.  To effect the changes made to the Raspberry Pi, **reboot** the system. Once it comes back up, you should now be **able to access the internet by connecting to the Wireless access point created by the Raspberry Pi**. This of course will only work if internet access is available to the pi via the Ethernet port. |
| **6** | **Raspberry Pi GPS Module Interfacing.** |
|  | sudo nano /boot/config.txt  ###############  dtparam=spi=on  dtoverlay=pi3-disable-bt  core\_freq=250  enable\_uart=1  force\_turbo=1  #############  sudo systemctl stop serial-getty@ttyS0.service  sudo systemctl disable serial-getty@ttyS0.service  sudo systemctl enable serial-getty@ttyAMA0.service  sudo apt-get install minicom  sudo pip install pynmea2  sudo cat /dev/ttyAMA0  **code:**  import time  import serial  import string  import pynmea2  import RPi.GPIO as gpio  gpio.setmode(gpio.BCM)  port = "/dev/ttyAMA0" # the serial port to which the pi is connected.    #create a serial object  ser = serial.Serial(port, baudrate = 9600, timeout = 0.5)  while 1:  try:  data = ser.readline()  # print data  except:  print("loading")  #wait for the serial port to churn out data    if data[0:6] == '$GPGGA':  msg = pynmea2.parse(data)  print msg  time.sleep(2) |
| **7** | IoT based Web Controlled Home Automation using Raspberry Pi |
|  | Code: import RPi.GPIO as GPIO  from time import sleep  relay\_pin = 26  GPIO.setmode(GPIO.BCM)  GPIO.setup(relay\_pin, GPIO.OUT)  GPIO.output(relay\_pin, 1)  try:  while True:  GPIO.output(relay\_pin, 0)  sleep(5)  GPIO.output(relay\_pin, 1)  sleep(5)  except KeyboardInterrupt:  pass  GPIO.cleanup() |
| **8** | Interfacing Raspberry Pi with Pi Camera. |
|  | **To capture image:**  import picamera  from time import sleep  #create object for PiCamera class  camera = picamera.PiCamera()  #set resolution  camera.resolution = (1024, 768)  camera.brightness = 60  camera.start\_preview()  #add text on image  camera.annotate\_text = 'Hi Pi User'  sleep(5)  #store image  camera.capture('image1.jpeg')  camera.stop\_preview()  **To capture video:**  import picamera  from time import sleep  camera = picamera.PiCamera()  camera.resolution = (640, 480)  print()  #start recording using pi camera  camera.start\_recording("/home/pi/demo.h264")  #wait for video to record  camera.wait\_recording(20)  #stop recording  camera.stop\_recording()  camera.close()  print("video recording stopped")  **To Play the video:**  Omxplayer demo.h264 |
| **9** | Interfacing Raspberry Pi with RFID. |
|  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | I2C Communication Instructions for Raspberry PiOpen I2C of the Raspberry Pi : sudo raspi-config  Select **5 Interfacing Options** -> **I2C** ->**yes**.   1. **Install some dependent packages**   sudo apt-get update  sudo apt-get install libusb-dev libpcsclite-dev i2c-tools   1. **Download and unzip the source code package of libnfc**   cd ~  wget [http://dl.bintray.com/nfc-tools/sources/libnfc-1.7.1.tar.bz2](http://dl.bintray.com/nfc-tools/sources/libnfc-1.7.1.tar.bz2" \t "_blank)  tar -xf libnfc-1.7.1.tar.bz2   1. **Compile and install**   cd libnfc-1.7.1  ./configure --prefix=/usr --sysconfdir=/etc  make  sudo make install   1. **Write the configuration file for NFC communication**   cd /etc  sudo mkdir nfc  sudo nano /etc/nfc/libnfc.conf  Check the following details of the file *etc/nfc/libnfc.conf*:  # Allow device auto-detection (default: true)  # Note: if this auto-detection is disabled, user has to set manually a device  # configuration using file or environment variable  allow\_autoscan = true  # Allow intrusive auto-detection (default: false)  # Warning: intrusive auto-detection can seriously disturb other devices  # This option is not recommended, user should prefer to add manually his device.  allow\_intrusive\_scan = false  # Set log level (default: error)  # Valid log levels are (in order of verbosity): 0 (none), 1 (error), 2 (info), 3 (debug)  # Note: if you compiled with --enable-debug option, the default log level is "debug"  log\_level = 1  # Manually set default device (no default)  # To set a default device, you must set both name and connstring for your device  # Note: if autoscan is enabled, default device will be the first device available in device list.  #device.name = "\_PN532\_SPI"  #device.connstring = "pn532\_spi:/dev/spidev0.0:500000"  device.name = "\_PN532\_I2c"  device.connstring = "pn532\_i2c:/dev/i2c-1"   1. **Wiring**   Toggle the switch to the **I2C mode**   |  |  | | --- | --- | | SEL0 | SEL1 | | H | L |   Connect the devices:   |  |  | | --- | --- | | PN532 | Raspberry | | 5V | 5V 4 | | GND | GND 6 | | SDA | SDA0 3 | | SCL | SCL0 5 |   **7. Run *i2cdetect –yes 1* to check whether the I2C device is recognized.**  If yes, it means both the module and the wiring work well. Then type in *nfc-list* to check the NFC module:   Run *nfc-poll* to scan the RFID tag and you can read information on the card:   **SPI Communication Instructions for Raspberry Pi**  **1. Open SPI of the Raspberry Pi:**  sudo raspi-config  Select **9 Advanced Options** -> **SPI** -> **yes**. **2. Install some dependent packages**  sudo apt-get update  sudo apt-get install libusb-dev libpcsclite-dev i2c-tools  **3. Download and unzip the source code package of libnfc**  cd ~  wget [http://dl.bintray.com/nfc-tools/sources/libnfc-1.7.1.tar.bz2](http://dl.bintray.com/nfc-tools/sources/libnfc-1.7.1.tar.bz2" \t "_blank)  tar -xf libnfc-1.7.1.tar.bz2  **4. Compile and install**  cd libnfc-1.7.1  ./configure --prefix=/usr --sysconfdir=/etc  make  sudo make install  **5. Write the configuration file for NFC communication**  cd /etc  sudo mkdir nfc  sudo nano /etc/nfc/libnfc.conf  Check the following details of the file *etc/nfc/libnfc.conf*:  # Allow device auto-detection (default: true)  # Note: if this auto-detection is disabled, user has to set manually a device  # configuration using file or environment variable  allow\_autoscan = true  # Allow intrusive auto-detection (default: false)  # Warning: intrusive auto-detection can seriously disturb other devices  # This option is not recommended, user should prefer to add manually his device.  allow\_intrusive\_scan = false  # Set log level (default: error)  # Valid log levels are (in order of verbosity): 0 (none), 1 (error), 2 (info), 3 (debug)  # Note: if you compiled with --enable-debug option, the default log level is "debug"  log\_level = 1  # Manually set default device (no default)  # To set a default device, you must set both name and connstring for your device  # Note: if autoscan is enabled, default device will be the first device available in device list.  device.name = "\_PN532\_SPI"  device.connstring = "pn532\_spi:/dev/spidev0.0:500000"  #device.name = "\_PN532\_I2c"  #device.connstring = "pn532\_i2c:/dev/i2c-1"  **6. Wiring** Toggle the switch to the **SPI mode**   |  |  | | --- | --- | | SEL0 | SEL1 | | L | H |   Connect the devices:   |  |  | | --- | --- | | PN532 | Raspberry | | 5V | 5V | | GND | GND | | SCK | SCKL | | MISO | MISO | | MOSI | MOSI | | NSS | CE0 |   **7. Run *ls /dev/spidev0.\** to check whether the SPI is opened or not.** If yes, it means both the module and the wiring work well. Then type in *nfc-list* to check the NFC module:  */dev/spidev0.0 /dev/spidev0.1* If two devices are detected, it means the SPI is already opened. Then type in *nfc-list* to check the NFC module:   For Raspberry Pi 3, you may be appear the following error  You should modifiy the *libnfc.conf*  sudo nano /etc/nfc/libnfc.conf  then modify 500000 to 50000:  device.connstring = "pn532\_spi:/dev/spidev0.0:50000"  Run *nfc-poll* to scan the RFID tag and you can read information on the card:    **Code:**  import subprocess  import time  def nfc\_raw():  lines=subprocess.check\_output("/usr/bin/nfc-poll", stderr=open('/dev/null','w'))  return lines  def read\_nfc():  lines=nfc\_raw()  return lines  try:  while True:  myLines=read\_nfc()  buffer=[]  for line in myLines.splitlines():  line\_content=line.split()  if(not line\_content[0] =='UID'):  pass  else:  buffer.append(line\_content)  str=buffer[0]  id\_str=str[2]+str[3]+str[4]+str[5]  print (id\_str)  except KeyboardInterrupt:  pass |  | |
| **10** | **Installing Windows 10 IoT Core on Raspberry Pi.** |
|  | To get up and running you need a few bits and pieces:   1. [Raspberry Pi 3](http://target.georiot.com/Proxy.ashx?TSID=15093&dtb=1&GR_URL=https%3A%2F%2Fwww.amazon.com%2FRaspberry-Pi-RASPBERRYPI3-MODB-1GB-Model-Motherboard%2Fdp%2FB01CD5VC92%2F%3Ftag%3Dwpcentralb-20%26ascsubtag%3DUUwpUdUnU46378YYwYg). 2. [5V 2A microUSB power supply](http://target.georiot.com/Proxy.ashx?TSID=15093&dtb=1&GR_URL=https%3A%2F%2Fwww.amazon.com%2FCanaKit-Raspberry-Supply-Adapter-Listed%2Fdp%2FB00MARDJZ4%2F%3Ftag%3Dwpcentralb-20%26ascsubtag%3DUUwpUdUnU46378YYwYg). 3. [8GB or larger Class 10 microSD card with full-size SD adapter](http://target.georiot.com/Proxy.ashx?TSID=15093&dtb=1&GR_URL=https%3A%2F%2Fwww.amazon.com%2Fdp%2FB073K14CVB%2F%3Ftag%3Dwpcentralb-20%26ascsubtag%3DUUwpUdUnU46378YYwYg). 4. [HDMI cable](http://target.georiot.com/Proxy.ashx?TSID=15093&dtb=1&GR_URL=https%3A%2F%2Fwww.amazon.com%2FAmazonBasics-High-Speed-HDMI-Cable-Standard%2Fdp%2FB014I8SIJY%2F%3Ftag%3Dwpcentralb-20%26ascsubtag%3DUUwpUdUnU46378YYwYg). 5. Access to a PC. 6. [USB WiFi adapter (older models of Raspberry Pi)](http://target.georiot.com/Proxy.ashx?TSID=15093&dtb=1&GR_URL=https%3A%2F%2Fwww.amazon.com%2FEdimax-EW-7811Un-150Mbps-Raspberry-Supports%2Fdp%2FB003MTTJOY%2F%3Ftag%3Dwpcentralb-20%26ascsubtag%3DUUwpUdUnU46378YYwYg) or Ethernet cable.   At this point, the HDMI cable is only to plug the Raspberry Pi into a display so you can make sure your install worked. Some Raspberry Pi starter kits include everything you need, but the list above covers the power, display, and something to install Windows 10 IoT Core on.   1. Go to the [Windows 10 developer center](https://developer.microsoft.com/en-us/windows/iot/Downloads.htm). 2. Click **Get Windows 10 IoT Core Dashboard** to download the necessary application.      1. Install the application and open it. 2. Select **set up a new device** from the sidebar. 3. Select the options as shown in the image below. Make sure you select the correct drive for your microSD card and give your device a name and admin password.      1. Select the WiFi network connection you want your Raspberry Pi to connect to, if required. Only networks your PC connects to will be shown. 2. Click **download and install**.   The application will now download the necessary files from Microsoft and flash them to your microSD card. It'll take a little while, but the dashboard will show you the progress.    Once the image has been installed on the microSD card, it's time to eject it from your PC and go over to the Raspberry Pi. First connect up the micro USB cable and power supply, HDMI cable and USB WiFi adapter or Ethernet cable. Connect the HDMI cable to your chosen display, insert the microSD card into the Raspberry Pi and power it up. |