M2-TSI UE21 Labwork

Raspberry Pi Report

Authors:
Issmail Batou
Solange Eyeang-Mombo
Vanshika Kansal

Students of TSI:
2017-2018

Contents

1 INTRODUCTION

Raspberry Pi is a series of small single-board computers, in short SBC. It is about a complete computer build on a single circuit board with microprocessors, memory, input/output and other features required of a functional computer. These SBCs were manufactured for educational systems and built for embedded computer controllers. As a matter of fact, the development of Raspberry Pi makes easier to teach basic computer science in schools and also contribute to developing countries. Apart from education, Raspberry Pi is also presented in home and industrial automation areas and belongs to commercial products.

Moreover, its low sale price brings it an international notoriety.Hence, we can find these SBC in many computers at home or portable computers.

In this lab work, we use the Raspberry Pi 3 B+. Indeed, as there different types of Raspberry Pi on the market, we chose the most suitable one in our work frame. On the model B+ the Ethernet port is provided by a built-in USB Ethernet adapter. The Raspberry Pi 3, as well as Pi Zero W, is equipped with 2.4 GHz WiFi (150 MBPS) and Blue-tooth 4.1 (24 MBPS).At last,

We work on the following operating system named Raspbian Stretch Lite.

2 SETUP

1. First, we mounted our Grovepi on the Raspberry Pi which perfectly fits the metal pins of the Raspberry Pi.

2. Afterwards, we set the software on the MicroSD card (minimum 4GB) that allows to program the Raspberry Pi.

3.Then, we connect Screen to the Grovepi by plugging HDMI cable into the Raspberry Pi and to the Screen. We don't forget to provide the power to Raspberry Pi using the Micro USB power adapter.

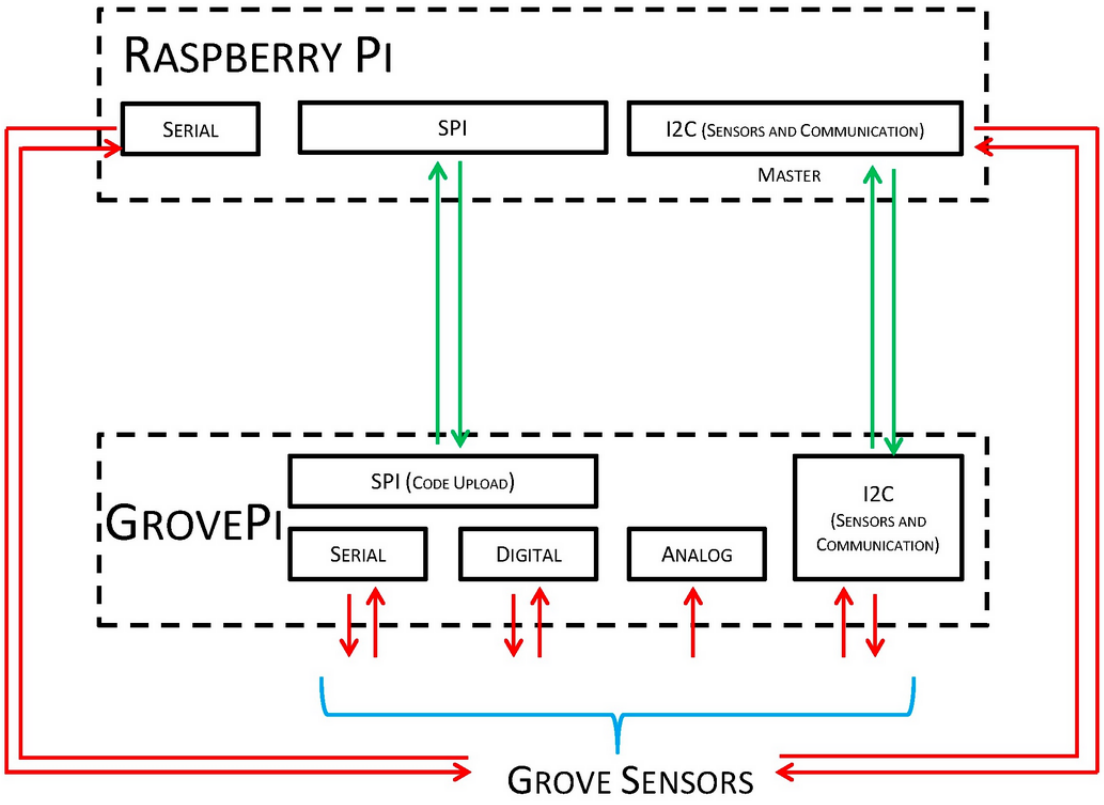
4. After that, a window appeared to install the Operating System. Thus, raspbian ran through its installation process.

5. Furthermore, the installation process is followed by the Raspberry Pi configuration menu loading. In this menu, we set the time and the date which enables Raspberry Pi board. That ends the booting process.

6. Now, we reboot the Raspberry Pi and we log into the desktop (GUI) environment.

7. However,to operate the Raspberry Pi from our laptop, we installed VNC viewer and we logged into the Raspberry Pi using the ip address of the Raspberry Pi that we got from our screen and password.

3 SOFTWARE ARCHTITECTURE



Grovepi and Raspberry Pi communicate together via I2C.

Raspberry Pi acts like master and sends commands to the Grovepi. The Grovepi is acting as slave, processes the command and then sends back data to the Raspberry Pi.

Grovepi can be easily integrated with grove sensors using different interfaces (like serial, I2C, digital and analog).

4 PROGRAMS

During this labwork, we executed some examples of projects on Raspberry Pi. First of all we worked on an LED blinking: it was about to establish that the LED blinked well after being to the Raspberry Pi. Thereafter, the next project deals with weather at home : we want to know humidity and temperature in our home (the room of the labwork). Afterwards, we implemented a door spying system, its goal is to take a picture of someone who would try to break into a home.

4.1 LED Blink

This is the first project that we execute on Raspberry Pi.

1. First, we connect the LED to the Port D4 using grove wire and provide power to the Raspberry Pi.

2.Then, in order to run the program, we first changed the directory to the GrovePi+/Software/Python folder. And then we run the program named as grove_led_blink.py

3.Finally, we can see the LED that starts blinking thanks to the following source code.

4.1.1 Source Code:

```
import time
from grovepi import*

led = 4      # Connect the Grove LED to digital port D4
pinMode(led,"OUTPUT")
time.sleep(5)
while true:
     try:
        digitalWrite(led,1)      # Send HIGH to switch on LED
        time.sleep(1)

        digitalWrite(led,0)       # Send LOW to switch off LED
```

```
        time.sleep(0)

    except KeyboardInterrupt:        # Turn LED off before stopping
        digitalWrite(led,0)
        break

    except IOError:              # Print "Error" if communication error encountere
        print "Error"
```

4.2 Home Weather Display

In this second project, executed on on Raspberry Pi, we used a grove DHT (Digital Humidity and Temperature sensor) which aim to record temperature and humidity in a room. In addition, we included a grove RGB LCD to display the temperature and humidity.

1. First we connected the DHT to the Port D7 and RGB LCD display to the I2C port using grove wire. We also provided power to the Raspberry Pi.

2. In order to run the program, we first changed the directory to the GrovePi+/Software/Python folder. And then, we run the program named as GrovePi_LCD_DHT.py

3. At last, the LCD displays live temperature and humidity data read by the DHT sensor.

4.2.1 Source Code:

```
from grovepi import *
from grove_rgb_lcd import *
from time import sleep
from math import isnan

dht_sensor_port = 7        # connect the DHt sensor to port 7

setRGB(0,255,0)
```

```
while True:
try:
       # get the temperature and Humidity from the DHT sensor
        [ temp,hum ] = dht(dht_sensor_port,dht_sensor_type)
        print("temp =", temp, "C\thumidity =", hum,"%")

        # check if we have nans
        # if so, then raise a type error exception
        if isnan(temp) is True or isnan(hum) is True:
            raise TypeError('nan error')

        t = str(temp)
        h = str(hum)

        setText_norefresh("Temp:" + t + "C\n" + "Humidity :" + h + "%")

        except (IOError, TypeError) as e:
          print(str(e))
          # and since we got a type error
          # then reset the LCD's text
          setText("")

       except KeyboardInterrupt as e:
          print(str(e))
          # since we're exiting the program
          # it's better to leave the LCD with a blank text
          setText("")
          break
      # wait some time before re-updating the LCD
       sleep(0.05)
```

4.3 Door Spying System

In this project, we used an Ultrasound Sensor and a Raspberry Pi Camera to take a picture. This project aims to take a picture of a potential intruder who would like to break into a home. This picture is later send to homeowner by e-mail thanks to the Raspberry Pi.
Moreover, we also included a few actuators like LED to know the status, a relay

to control circuit, a power switch to turn on and off the system and Buzzer which made sound when someone enters through the door.

1. We first connect Raspberry Pi camera to the camera connector which is placed near the Ethernet jack on the Raspberry Pi board.

2. Then, we connected the Ultrasound sensor to the port D7, the Power switch to the Port D4, the LED to the Port D3 and the relay to the port D2.

3. After have established all these connections, We run the program.

4. The photos taken by the Raspberry camera were e-mailed to the given email address in source code by the security system. So the homeowner can see the face of this intruder.

4.3.1 Source Code:

```
import grovepi
# Import smtplib for the actual sending function
import smtplib, string, subprocess, time

# Here are the email package modules we'll need
from email.mime.image import MIMEImage
from email.mime.multipart import MIMEMultipart
from subprocess import call

print("System Working")
switch = 4
led_status = 3
relay = 2
buzzer = 5

SMTP_USERNAME = '*****@***.com'  # Mail id of the sender
SMTP_PASSWORD = '********'  # Pasword of the sender
SMTP_RECIPIENT = '*********@****.com' # Mail id of the reciever
SMTP_SERVER = 'smtp.gmail.com'  # Address of the SMTP server
SSL_PORT = 465
```

```
while True:     # in case of IO error, restart
    try:
        grovepi.pinMode(switch,"INPUT")
        while True:
            if grovepi.digitalRead(switch) == 1:    # If the system is ON
                if grovepi.ultrasonicRead() < 100:  # If a person walks through the
                    print("Welcome")
                    grovepi.analogWrite(buzzer,100) # Make a sound on the Buzzer
                    time.sleep(.5)
                    grovepi.analogWrite(buzzer,0)       # Turn off the Buzzer
                    grovepi.digitalWrite(led_status,1)  # Turn on the status LED to
                    grovepi.digitalWrite(relay,1)       # turn on the Relay to acti

                    # Take a picture from the Raspberry Pi camera
                    call (["raspistill -o i1.jpg -w 640 -h 480 -t 0"], shell=True)
                    print("Image Shot")
                    p = subprocess.Popen(["runlevel"], stdout=subprocess.PIPE)
                    out, err=p.communicate()    # Connect to the mail server
                    if out[2] == '0':
                        print('Halt detected')
                        exit(0)
                    if out [2] == '6':
                        print('Shutdown detected')
                        exit(0)
                    print("Connected to mail")

                    # Create the container (outer) email message
                    TO = SMTP_RECIPIENT
                    FROM = SMTP_USERNAME
                    msg = MIMEMultipart()
                    msg.preamble = 'Rpi Sends image'

                    # Attach the image
                    fp = open('i1.jpg', 'rb')
                    img = MIMEImage(fp.read())
                    fp.close()
                    msg.attach(img)

                    # Send the email via Gmail
                    print("Sending the mail")
```

```
                    server = smtplib.SMTP_SSL(SMTP_SERVER, SSL_PORT)
                    server.login(SMTP_USERNAME, SMTP_PASSWORD)
                    server.sendmail(FROM, [TO], msg.as_string())
                    server.quit()
                    print("Mail sent")

                    grovepi.digitalWrite(led_status,0)  # Turn off the LED
                    grovepi.digitalWrite(relay,0)       # Turn off the Relay
    except IOError:
print("Error")
```

5 CONCLUSION

Since it was launched in 2013, Raspberry Pi is very successful. Thanks to some of its characteristics such as its ARM processor, Ethernet port and micro-SD card reader, Raspberry Pi acquired an international notoriety. Raspberry Pi takes action in several fields such as embedded systems and education. Its had make easier programming of devices like camera in our case of study. This nano-computer provides a large number of students and non students (as we saw everyone could do house automation from its home) access to electronic technology. Easy to use and quite simple to implement, Raspberry Pi revolutionizes the field of electronic. As a matter of fact, Raspberry Pi allows specially for students to become familiar with basic electronic notions.