



Faculty of Engineering & Applied Science

Experiment Name: Integrating Sensors to a Microcontroller Board

Experiment date: 09/21/2022

Group Number: 4

Section CRN:

Course Instructor: *Ramiro Liscano*

Lab TA: *Sifatul Mostafi*

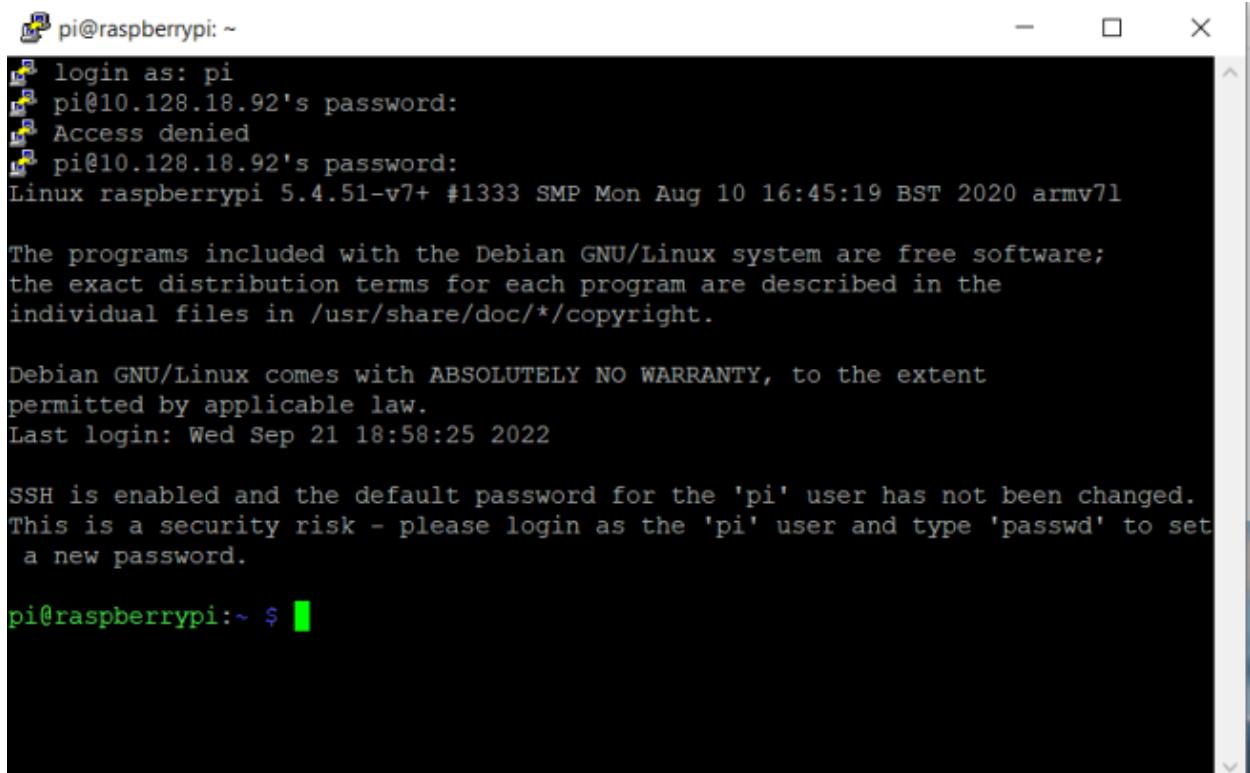
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Learning Objectives

The objective of this lab was to get introduced to working with the Raspberry Pi 3. We learned how to set up the Raspberry Pi OS image setup onto the Raspberry Pi 3, and we also learned how to set up the network on the Raspberry Pi 3 so it can be connected with a host machine using SSH from Linux and Putty (also SSH) from windows. We gained experience working with Linux and the Raspberry Pi 3, we learned how to compile code to a x86-64 executable file and transfer the file between a host machine and the Raspberry Pi 3.

Deliverables:

Connecting windows localhost with Raspberry Pi 3:



```
pi@raspberrypi: ~
pi@raspberrypi: ~$ login as: pi
pi@10.128.18.92's password:
Access denied
pi@10.128.18.92's password:
Linux raspberrypi 5.4.51-v7+ #1333 SMP Mon Aug 10 16:45:19 BST 2020 armv7l

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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: Wed Sep 21 18:58:25 2022

SSH is enabled and the default password for the 'pi' user has not been changed.
This is a security risk - please login as the 'pi' user and type 'passwd' to set
a new password.

pi@raspberrypi: ~ $
```

IP address used for putty connection:

```
pi@raspberrypi: ~ $ hostname -I
10.128.18.92
```

Checking Raspberry Version:

```
pi@raspberrypi:~ $ cat /etc/os-release
PRETTY_NAME="Raspbian GNU/Linux 10 (buster)"
NAME="Raspbian GNU/Linux"
VERSION_ID="10"
VERSION="10 (buster)"
VERSION_CODENAME=buster
ID=raspbian
ID_LIKE=debian
HOME_URL="http://www.raspbian.org/"
SUPPORT_URL="http://www.raspbian.org/RaspbianForums"
BUG_REPORT_URL="http://www.raspbian.org/RaspbianBugs"
```

Checking Raspberry Pi CPU Version:

```
pi@raspberrypi:~ $ cat /proc/cpuinfo
processor       : 0
model name     : ARMv7 Processor rev 4 (v7l)
BogoMIPS       : 38.40
Features        : half thumb fastmult vfp edsp neon vfpv3 tls vfpv4 idiva idivt
VFPd32 lpaes evtstnm crc32
CPU implementer : 0x41
CPU architecture: 7
CPU variant    : 0x0
CPU part       : 0xd03
CPU revision   : 4

processor       : 1
model name     : ARMv7 Processor rev 4 (v7l)
BogoMIPS       : 38.40
Features        : half thumb fastmult vfp edsp neon vfpv3 tls vfpv4 idiva idivt
VFPd32 lpaes evtstnm crc32
CPU implementer : 0x41
CPU architecture: 7
CPU variant    : 0x0
CPU part       : 0xd03
CPU revision   : 4

processor       : 2
model name     : ARMv7 Processor rev 4 (v7l)
BogoMIPS       : 38.40
Features        : half thumb fastmult vfp edsp neon vfpv3 tls vfpv4 idiva idivt
VFPd32 lpaes evtstnm crc32
CPU implementer : 0x41
CPU architecture: 7
CPU variant    : 0x0
CPU part       : 0xd03
CPU revision   : 4

processor       : 3
model name     : ARMv7 Processor rev 4 (v7l)
BogoMIPS       : 38.40
Features        : half thumb fastmult vfp edsp neon vfpv3 tls vfpv4 idiva idivt
VFPd32 lpaes evtstnm crc32
CPU implementer : 0x41
CPU architecture: 7
CPU variant    : 0x0
CPU part       : 0xd03
CPU revision   : 4

Hardware        : BCM2835
Revision       : a02082
Serial         : 00000001a13dc50
Model          : Raspberry Pi 3 Model B Rev 1.2
pi@raspberrypi:~ $
```

```
pi@raspberrypi:~ $ cat /proc/device-tree/model
Raspberry Pi 3 Model B Rev 1.2pi@raspberrypi:~ $
```

Download the toolchain on Ubuntu and adding path to the environment:

```
preet@DESKTOP-CWT5RG:~$ wget https://github.com/raspberrypi/tools/archive/master.zip
--2022-09-21 19:13:31-- https://github.com/raspberrypi/tools/archive/master.zip
Resolving github.com (github.com)... 140.82.113.3
Connecting to github.com (github.com)|140.82.113.3|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: unspecified [application/zip]
Saving to: 'master.zip'

master.zip                                              [ <=>                               ] 344.71M 3.43MB/s   in 2m 13s

2022-09-21 19:15:45 (2.99 MB/s) - 'master.zip' saved [361451383]

preet@DESKTOP-CWT5RG:~$ $echo $PATH
-bash: /usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/usr/games:/usr/local/games:/mnt/c/Program No such file or directory
```

Creating Hello.c file and installing arm toolchain for compiling Hello.c:

```
PowerShell      username@DESKTOP-1JMAVV      username@DESKTOP-1JMAVV      + 
username@DESKTOP-1JMAVV:~/delete_this fldr$ vim ~/.profile
username@DESKTOP-1JMAVV:~/delete_this fldr$ source ~/.profile
username@DESKTOP-1JMAVV:~/delete_this fldr$ touch Hello.c
username@DESKTOP-1JMAVV:~/delete_this fldr$ vim Hello.c
username@DESKTOP-1JMAVV:~/delete_this fldr$ cat Hello.c
#include <stdio.h>
int main() {
    // printf() displays the string inside quotation
    printf("Hello");
    return 0;
}
username@DESKTOP-1JMAVV:~/delete_this fldr$ sudo apt install gcc-arm-linux-gnueabihf -y
[sudo] password for username:
Reading package lists... Done
Building dependency tree
Reading state information... Done
gcc-arm-linux-gnueabihf is already the newest version (4:9.3.0-1ubuntu2).
0 upgraded, 0 newly installed, 0 to remove and 100 not upgraded.
username@DESKTOP-1JMAVV:~/delete_this fldr$
```

Updating profile path variable

```
PowerShell      username@DESKTOP-1JMAVV      + 
# the files are located in the bash-doc package.

# the default umask is set in /etc/profile; for setting the umask
# for ssh logins, install and configure the libpam-umask package.
#umask 022

# if running bash
if [ -n "$BASH_VERSION" ]; then
    # include .bashrc if it exists
    if [ -f "$HOME/.bashrc" ]; then
        . "$HOME/.bashrc"
    fi

    # set PATH so it includes user's private bin if it exists
    if [ -d "$HOME/bin" ] ; then
        PATH="$HOME/bin:$PATH"
    fi

    # set PATH so it includes user's private bin if it exists
    if [ -d "$HOME/.local/bin" ] ; then
        PATH="$HOME/.local/bin:$PATH"
    fi

PATH="$HOME/tool/arm-bcm2708/gcc-linaro-arm-linux-gnueabihf-raspbian-x64/bin:$PATH"
"~/.profile" 29L, 893C
```

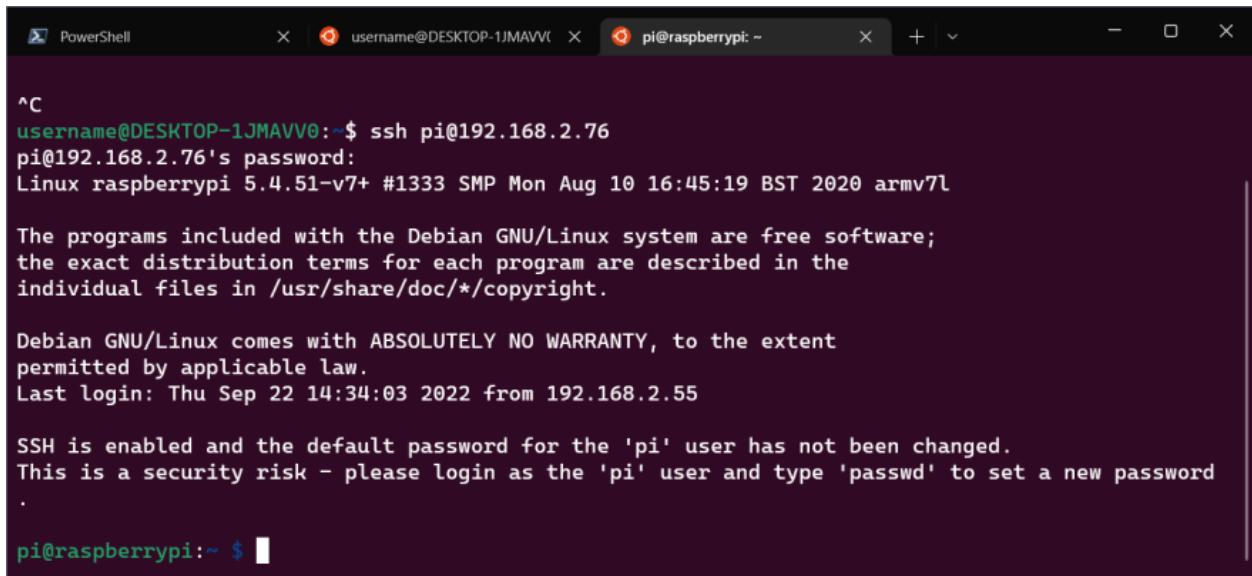
Compiling Hello.c:

```
PowerShell      username@DESKTOP-1JMAVV ~      username@DESKTOP-1JMAVV ~      -      X
printf("Hello");
return 0;
}
username@DESKTOP-1JMAVV:~/delete_this_fldr$ sudo apt install gcc-arm-linux-gnueabihf -y
[sudo] password for username:
Reading package lists... Done
Building dependency tree
Reading state information... Done
gcc-arm-linux-gnueabihf is already the newest version (4:9.3.0-1ubuntu2).
0 upgraded, 0 newly installed, 0 to remove and 100 not upgraded.
username@DESKTOP-1JMAVV:~/delete_this_fldr$ arm-linux-gnueabihf-gcc Hello.c
username@DESKTOP-1JMAVV:~/delete_this_fldr$ ls -al
total 353004
drwxr-xr-x  2 username username    4096 Sep 22 14:47 .
drwxr-xr-x 16 username username    4096 Sep 22 14:44 ..
-rw-r--r--  1 username username     128 Sep 22 14:44 Hello.c
-rwxr-xr-x  1 username username    8156 Sep 22 14:47 a.out
-rw-r--r--  1 username username 361451383 Sep 22 14:00 master.zip
username@DESKTOP-1JMAVV:~/delete_this_fldr$
```

Command executed to send a.out file to Pi: "scp a.out pi@192.168.2.76:home/pi/Documents":

```
PowerShell      username@DESKTOP-1JMAVV ~      username@DESKTOP-1JMAVV ~      -      X
Building dependency tree
Reading state information... Done
gcc-arm-linux-gnueabihf is already the newest version (4:9.3.0-1ubuntu2).
0 upgraded, 0 newly installed, 0 to remove and 100 not upgraded.
username@DESKTOP-1JMAVV:~/delete_this_fldr$ arm-linux-gnueabihf-gcc Hello.c
username@DESKTOP-1JMAVV:~/delete_this_fldr$ ls -al
total 353004
drwxr-xr-x  2 username username    4096 Sep 22 14:47 .
drwxr-xr-x 16 username username    4096 Sep 22 14:44 ..
-rw-r--r--  1 username username     128 Sep 22 14:44 Hello.c
-rwxr-xr-x  1 username username    8156 Sep 22 14:47 a.out
-rw-r--r--  1 username username 361451383 Sep 22 14:00 master.zip
username@DESKTOP-1JMAVV:~/delete_this_fldr$ scp a.out pi@192.168.2.76:home/pi/Documents
pi@192.168.2.76's password:
scp: home/pi/Documents: No such file or directory
username@DESKTOP-1JMAVV:~/delete_this_fldr$ scp a.out pi@192.168.2.76:/home/pi/Documents
pi@192.168.2.76's password:
a.out                                         100% 8156   568.6KB/s   00:00
username@DESKTOP-1JMAVV:~/delete_this_fldr$
```

Command to ssh to the Pi: "ssh pi@192.168.2.76":



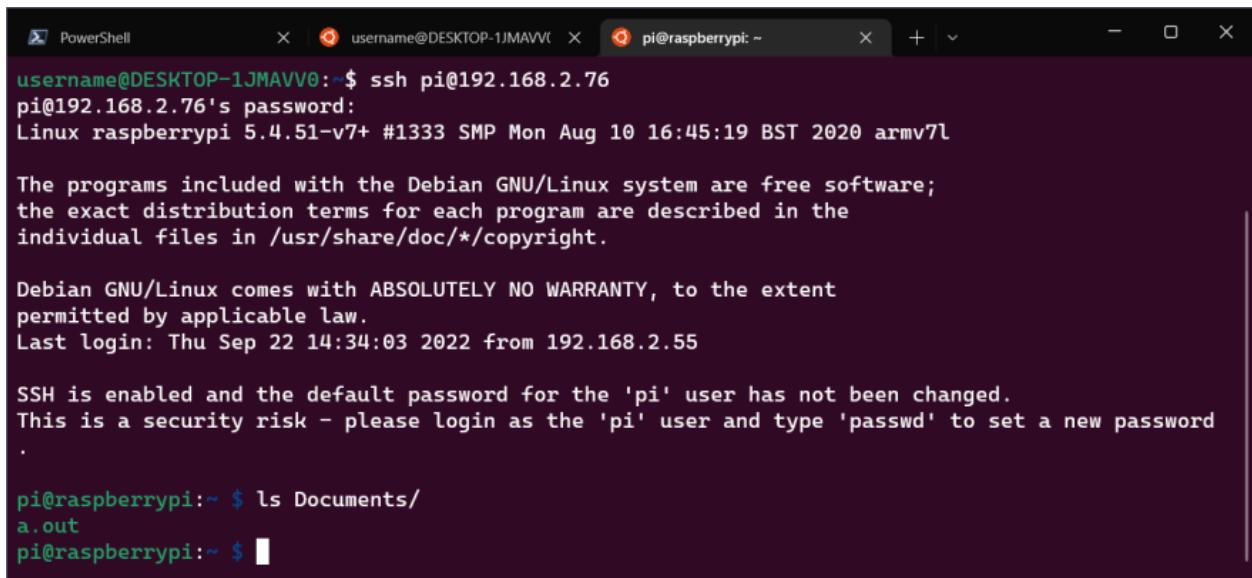
```
PowerShell          username@DESKTOP-1JMAVVO:~$ ssh pi@192.168.2.76
pi@192.168.2.76's password:
Linux raspberrypi 5.4.51-v7+ #1333 SMP Mon Aug 10 16:45:19 BST 2020 armv7l

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Last login: Thu Sep 22 14:34:03 2022 from 192.168.2.55

SSH is enabled and the default password for the 'pi' user has not been changed.
This is a security risk - please login as the 'pi' user and type 'passwd' to set a new password
.

pi@raspberrypi:~ $
```



```
PowerShell          username@DESKTOP-1JMAVVO:~$ ssh pi@192.168.2.76
pi@192.168.2.76's password:
Linux raspberrypi 5.4.51-v7+ #1333 SMP Mon Aug 10 16:45:19 BST 2020 armv7l

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Last login: Thu Sep 22 14:34:03 2022 from 192.168.2.55

SSH is enabled and the default password for the 'pi' user has not been changed.
This is a security risk - please login as the 'pi' user and type 'passwd' to set a new password
.

pi@raspberrypi:~ $ ls Documents/
a.out
pi@raspberrypi:~ $
```

Please describe the difficulties you run into and explain how you tackle the problems and resolve them

We had difficulties connecting with the Raspberry Pi through SSH using Putty. We kept running into a “connection refused” error. We hypothesized we had used the wrong IP address. We used Google to search for a solution in which we found out that one of the possible causes of the problem could be the Raspberry Pi 3 configuration. So we checked the configuration of the Raspberry Pi from preferences and saw that the settings for SSH, and other important network settings were turned off. We turned on those settings and rebooted the Raspberry Pi which then allowed us to connect to it using Putty from our windows environment. We also tried connecting to it from our Ubuntu VM environment which allowed us to directly connect to the Raspberry Pi using SSH.

