UCSD Embedded Linux Assignment 9

By

Hsuankai Chang

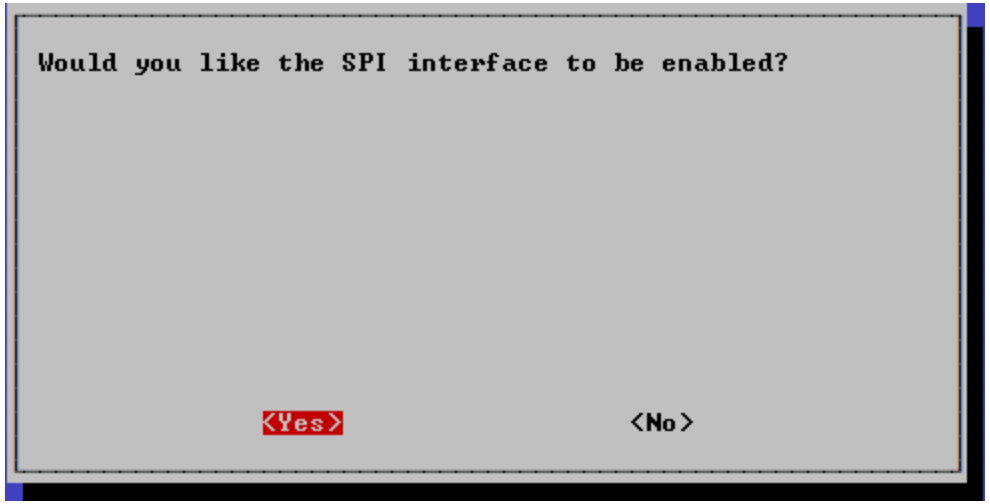
hsuankac@umich.edu

Step 1. Boot up on default, SPI is not turn on

```
pi@raspberrypi:~ $ ls /dev/spi*
ls: cannot access '/dev/spi*': No such file or directory
```

```
  GNU nano 7.2                                  /boot/config.txt
# For more options and information see
# http://rptl.io/configtxt
# Some settings may impact device functionality. See link above for details

# Uncomment some or all of these to enable the optional hardware interfaces
#dtparam=i2c_arm=on
#dtparam=i2s=on
#dtparam=spi=on

# Enable audio (loads snd_bcm2835)
dtparam=audio=on

# Additional overlays and parameters are documented
# /boot/firmware/overlays/README

# Automatically load overlays for detected cameras
camera_auto_detect=1

# Automatically load overlays for detected DSI displays
display_auto_detect=1

# Automatically load initramfs files, if found
auto_initramfs=1

# Enable DRM VC4 V3D driver
dtoverlay=vc4-kms-v3d
max_framebuffers=2

# Don't have the firmware create an initial video= setting in cmdline.txt.
# Use the kernel's default instead.
disable_fw_kms_setup=1

# Run in 64-bit mode
arm_64bit=1

# Disable compensation for displays with overscan
disable_overscan=1

# Run as fast as firmware / board allows
arm_boost=1

[cm4]
# Enable host mode on the 2711 built-in XHCI USB controller.
# This line should be removed if the legacy DWC2 controller is required
# (e.g. for USB device mode) or if USB support is not required.
otg_mode=1

[all]
```

Step 2. Enable the SPI interface in raspi-config



Step 3. Confirm SPI is on

```
pi@raspberrypi:~ $ ls /dev/spi*
/dev/spidev0.0  /dev/spidev0.1
pi@raspberrypi:~ $ ls -l /dev/spi*
crw-rw---- 1 root spi 153, 0 Nov 19 18:51 /dev/spidev0.0
crw-rw---- 1 root spi 153, 1 Nov 19 18:51 /dev/spidev0.1
pi@raspberrypi:~ $ grep 153 /proc/devices
153 spi
pi@raspberrypi:~ $ dmesg | grep spi
[ 2009.368805] OF: overlay: WARNING: memory leak will occur if overlay removed, property: /soc/spi@7e204000/status
pi@raspberrypi:~ $ lsmod | grep spi
spidev                  20480  0
spi_bcm2835             24576  0
pi@raspberrypi:~ $
```

Step 4. Modify the /boot/config.txt file for mcp2515

```
# For more options and information see
# http://rptl.io/configtxt
# Some settings may impact device functionality. See link above for details

# Uncomment some or all of these to enable the optional hardware interfaces
#dtparam=i2c_arm=on
#dtparam=i2s=on
dtparam=spi=on

# Enable audio (loads snd_bcm2835)
dtparam=audio=on

# Additional overlays and parameters are documented
# /boot/firmware/overlays/README

# Automatically load overlays for detected cameras
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# Enable DRM VC4 V3D driver
dtoverlay=vc4-kms-v3d
max_framebuffers=2

# Don't have the firmware create an initial video= setting in cmdline.txt.
# Use the kernel's default instead.
disable_fw_kms_setup=1

# Run in 64-bit mode
arm_64bit=1

# Disable compensation for displays with overscan
disable_overscan=1

# NCM CAN Interface via SPI
dtoverlay=mcp2515-can0, oscillator=8000000, interrupt=25

# Run as fast as firmware / board allows
arm_boost=1

[cm4]
# Enable host mode on the 2711 built-in XHCI USB controller.
# This line should be removed if the legacy DWC2 controller is required
# (e.g. for USB device mode) or if USB support is not required.
otg_mode=1

[all]
```

Step 5. Since I do not connect MCP2515, so the result failed when reboot

```
pi@raspberrypi:~ $ uptime
 18:58:48 up 1 min,  3 users,  load average: 0.43, 0.28, 0.11
pi@raspberrypi:~ $ ls /dev/spi*
/dev/spidev0.1
pi@raspberrypi:~ $ dmesg | grep spi
[    8.977948] mcp251x spi0.0: MCP251x didn't enter in conf mode after reset
[    8.978153] mcp251x spi0.0: Probe failed, err=110
[    8.978174] mcp251x: probe of spi0.0 failed with error -110
pi@raspberrypi:~ $ lsmod | grep spi
spidev                  20480  0
spi_bcm2835             24576  0
pi@raspberrypi:~ $
```

Step 6. dmesg and USB

```
pi@raspberrypi:~ $ dmesg | grep usb
[    0.154876] usbcore: registered new interface driver usbfs
[    0.154934] usbcore: registered new interface driver hub
[    0.155004] usbcore: registered new device driver usb
[    0.155425] usb_phy_generic phy: supply vcc not found, using dummy regulator
[    1.575196] usbcore: registered new interface driver r8152
[    1.575267] usbcore: registered new interface driver lan78xx
[    1.575339] usbcore: registered new interface driver smsc95xx
[    1.625525] usb usb1: New USB device found, idVendor=1d6b, idProduct=0002, bcdDevice= 6.01
[    1.625546] usb usb1: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[    1.625561] usb usb1: Product: xHCI Host Controller
[    1.625575] usb usb1: Manufacturer: Linux 6.1.0-rpi4-rpi-v8 xhci-hcd
[    1.625588] usb usb1: SerialNumber: 0000:01:00.0
[    1.627448] usb usb2: New USB device found, idVendor=1d6b, idProduct=0003, bcdDevice= 6.01
[    1.627470] usb usb2: New USB device strings: Mfr=3, Product=2, SerialNumber=1
[    1.627485] usb usb2: Product: xHCI Host Controller
[    1.627499] usb usb2: Manufacturer: Linux 6.1.0-rpi4-rpi-v8 xhci-hcd
[    1.627512] usb usb2: SerialNumber: 0000:01:00.0
[    1.631943] usbcore: registered new interface driver uas
[    1.632037] usbcore: registered new interface driver usb-storage
[    1.646850] usbcore: registered new interface driver usbhid
[    1.646864] usbhid: USB HID core driver
[    1.885939] usb 1-1: new high-speed USB device number 2 using xhci_hcd
[    2.036527] usb 1-1: New USB device found, idVendor=2109, idProduct=3431, bcdDevice= 4.21
[    2.036566] usb 1-1: New USB device strings: Mfr=0, Product=1, SerialNumber=0
[    2.036584] usb 1-1: Product: USB2.0 Hub
[    9.120132] usbcore: registered new interface driver brcmfmac
pi@raspberrypi:~ $
```

Step 7. lsusb and USB

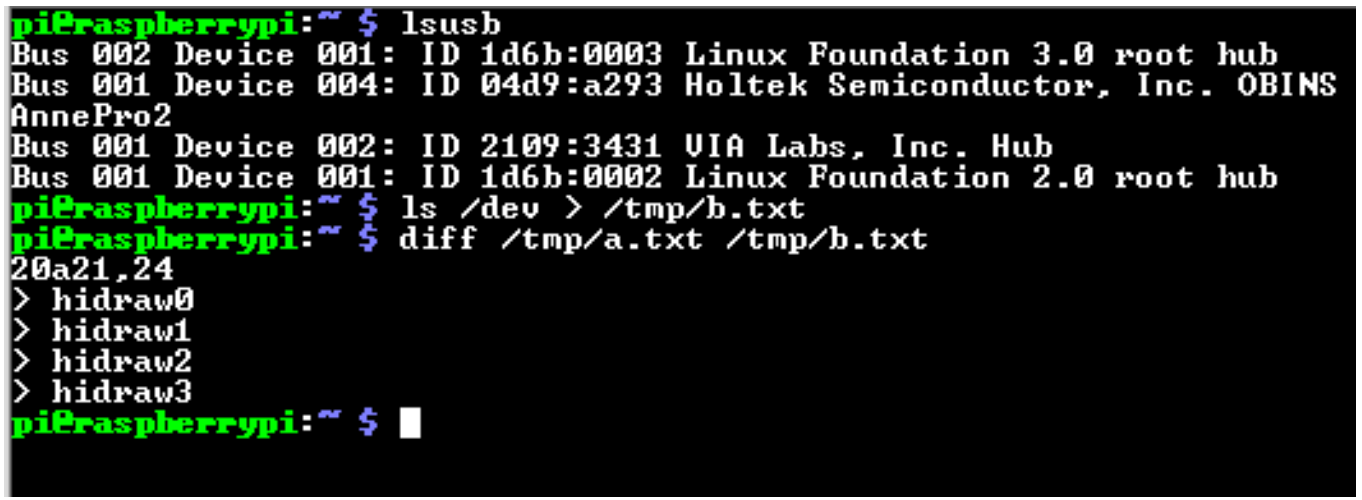
```
pi@raspberrypi:~ $ lsusb
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 001 Device 002: ID 2109:3431 VIA Labs, Inc. Hub
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
pi@raspberrypi:~ $ lsusb --tree
/:  Bus 02.Port 1: Dev 1, Class=root_hub, Driver=xhci_hcd/4p, 5000M
/:  Bus 01.Port 1: Dev 1, Class=root_hub, Driver=xhci_hcd/1p, 480M
    |__ Port 1: Dev 2, If 0, Class=Hub, Driver=hub/4p, 480M
pi@raspberrypi:~ $
```

Step 8. lsusb --verbose

```
pi@raspberrypi:~ $ sudo lsusb --verbose

Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Device Descriptor:
  bLength                18
  bDescriptorType         1
  bcdUSB               3.00
  bDeviceClass            9 Hub
  bDeviceSubClass         0
  bDeviceProtocol         3
  bMaxPacketSize0         9
  idVendor           0x1d6b Linux Foundation
  idProduct          0x0003 3.0 root hub
  bcdDevice            6.01
  iManufacturer           3 Linux 6.1.0-rpi4-rpi-v8 xhci-hcd
  iProduct                2 xHCI Host Controller
  iSerial                 1 0000:01:00.0
  bNumConfigurations      1
  Configuration Descriptor:
    bLength                 9
    bDescriptorType         2
    wTotalLength       0x001f
    bNumInterfaces          1
    bConfigurationValue     1
    iConfiguration          0
    bmAttributes         0xe0
      Self Powered
      Remote Wakeup
    MaxPower                0mA
    Interface Descriptor:
      bLength                 9
      bDescriptorType         4
      bInterfaceNumber        0
      bAlternateSetting       0
      bNumEndpoints           1
      bInterfaceClass         9 Hub
      bInterfaceSubClass      0
      bInterfaceProtocol      0 Full speed (or root) hub
      iInterface              0
      Endpoint Descriptor:
        bLength                 7
        bDescriptorType         5
        bEndpointAddress     0x81  EP 1 IN
```

Step 9. Plug in keyboard to raspberrypi, using AnnePro2 keyboard



Step 10. libusb installation

```
pi@raspberrypi:~ $ find /usr/include | grep libusb
pi@raspberrypi:~ $ sudo apt-get install libusb-1.0-0-dev
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libusb-1.0-doc
The following NEW packages will be installed:
  libusb-1.0-0-dev libusb-1.0-doc
0 upgraded, 2 newly installed, 0 to remove and 96 not upgraded.
Need to get 276 kB of archives.
After this operation, 1,965 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://deb.debian.org/debian bookworm/main arm64 libusb-1.0-0-dev arm64 2:1.0.26-1 [83.0 kB]
Get:2 http://deb.debian.org/debian bookworm/main arm64 libusb-1.0-doc all 2:1.0.26-1 [193 kB]
Fetched 276 kB in 0s (1,258 kB/s)
Selecting previously unselected package libusb-1.0-0-dev:arm64.
(Reading database ... 127982 files and directories currently installed.)
Preparing to unpack .../libusb-1.0-0-dev_2%3a1.0.26-1_arm64.deb ...
Unpacking libusb-1.0-0-dev:arm64 (2:1.0.26-1) ...
Selecting previously unselected package libusb-1.0-doc.
Preparing to unpack .../libusb-1.0-doc_2%3a1.0.26-1_all.deb ...
Unpacking libusb-1.0-doc (2:1.0.26-1) ...
Setting up libusb-1.0-doc (2:1.0.26-1) ...
Setting up libusb-1.0-0-dev:arm64 (2:1.0.26-1) ...
pi@raspberrypi:~ $ dpkg -L libusb-1.0-0-dev
/.
/usr
/usr/include
/usr/include/libusb-1.0
/usr/include/libusb-1.0/libusb.h
/usr/lib
/usr/lib/aarch64-linux-gnu
/usr/lib/aarch64-linux-gnu/libusb-1.0.a
/usr/lib/aarch64-linux-gnu/pkgconfig
/usr/lib/aarch64-linux-gnu/pkgconfig/libusb-1.0.pc
/usr/share
/usr/share/doc
/usr/share/doc/libusb-1.0-0-dev
/usr/share/doc/libusb-1.0-0-dev/README
/usr/share/doc/libusb-1.0-0-dev/changelog.Debian.gz
/usr/share/doc/libusb-1.0-0-dev/changelog.gz
/usr/share/doc/libusb-1.0-0-dev/copyright
```

Step 11. hello-usb.c file

```
pi@raspberrypi:~ $ cat hello-usb.c
#include <stdio.h>
#include <libusb-1.0/libusb.h>

int main() {
    libusb_context *ctx = NULL;
    libusb_device **devs;
    ssize_t cnt;

    // Initialize the libusb library
    if (libusb_init(&ctx) < 0) {
        fprintf(stderr, "Failed to initialize libusb\n");
        return 1;
    }

    // Get the list of USB devices
    cnt = libusb_get_device_list(ctx, &devs);
    if(cnt < 0) {
        fprintf(stderr, "Failed to get device list\n");
        libusb_exit(ctx);
        return 1;
    }

    printf("Found %ld USV devices\n", cnt);

    // Print information about each connected USB device
    for(ssize_t i = 0; i < cnt; i++) {
        libusb_device *dev = devs[i];
        struct libusb_device_descriptor desc;

        if(libusb_get_device_descriptor(dev, &desc) < 0) {
            fprintf(stderr, "Failed to get device descriptor\n");
        } else {
            printf("Device %ld: VID=0x%04x, PID=0x%04x\n", i, desc.idVendor, desc.idProduct);
        }
    }

    // Free the list of devices, unreference each device to allow them to be freed
    libusb_free_device_list(devs, 1);

    // Close the libusb context
    libusb_exit(ctx);

    printf("Program finished successfully!\n");
    return 0;
}
pi@raspberrypi:~ $
```

Step 12. Building and running hello-usb, before and after plugging in AnnePro2 keyboard

```
pi@raspberrypi:~ $ gcc -o hello-usb hello-usb.c -lusb-1.0
pi@raspberrypi:~ $ ./hello-usb
Found 3 USV devices
Device 0: VID=0x1d6b, PID=0x0003
Device 1: VID=0x2109, PID=0x3431
Device 2: VID=0x1d6b, PID=0x0002
Program finished successfully!
pi@raspberrypi:~ $ ./hello-usb
Found 4 USV devices
Device 0: VID=0x1d6b, PID=0x0003
Device 1: VID=0x04d9, PID=0xa293
Device 2: VID=0x2109, PID=0x3431
Device 3: VID=0x1d6b, PID=0x0002
Program finished successfully!
pi@raspberrypi:~ $
```