



Faculty of Engineering and Applied Science

SOFE 4590U Embedded Systems

Group 6 CRN 74020

Lab 3

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Introduction:

In this lab we continued with experimenting with the Jetson TX2 board to gain more understanding of how to program for embedded systems. We learned about the inter-integrated circuit serial communication method in which data is transferred along a single wire that the Jetson utilizes. We explored this by transferring data during the data transmission cycle to the LCD display that was connected to the Jetson TX2 board.

Task 1:

We started by entering the Jetson TX2 environment through the use of ssh, we then downloaded the necessary libraries on the device to complete the lab, such as the i2c library. We then ran a command that all confirmed the installation was successful.

```
root@DESKTOP-1JWAV9:~# ssh student1@10.128.18.58
The authenticity of host '10.128.18.58 (10.128.18.58)' can't be established.
ECDSA key fingerprint is SHA256:nnXQAOBSPSP1MM3V60ybfCzr/9A3ckWwvXa1XAHQ.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '10.128.18.58' (ECDSA) to the list of known hosts.
student1@10.128.18.58's password:
Welcome to Ubuntu 18.04.5 LTS (GNU/Linux 4.9.140-tegra aarch64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

This system has been minimized by removing packages and content that are
not required on a system that users do not log into.

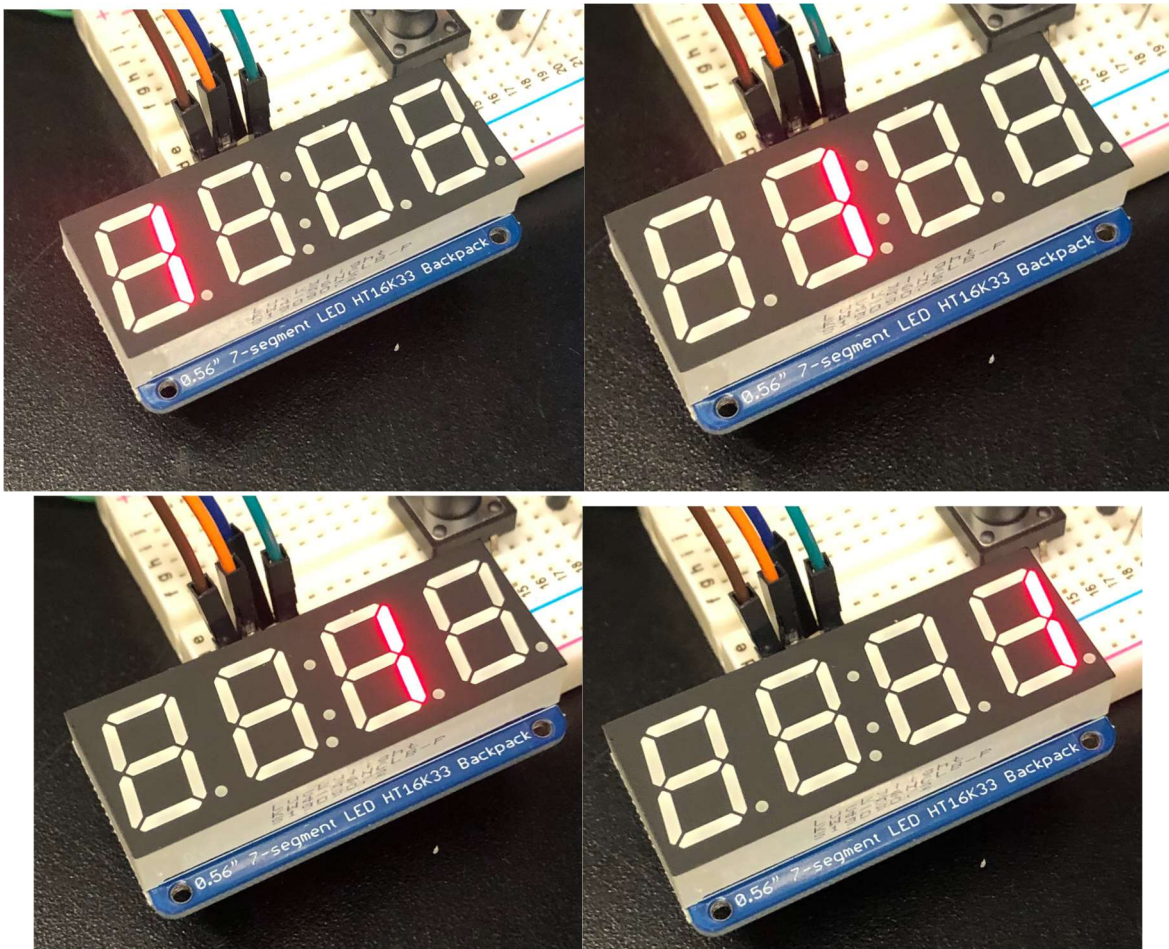
To restore this content, you can run the 'unminimize' command.

446 packages can be updated.
392 updates are security updates.

Last login: Tue Oct 25 19:38:41 2022 from 10.190.12.188
student1@jetson-desktop:~$ sudo apt-get install libi2c-dev i2c-tools
[sudo] password for student1:
Reading package lists... Done
Building dependency tree
Reading state information... Done
E: Unable to locate package libi2c-dev
student1@jetson-desktop:~$ sudo apt-get install libi2c-dev i2c-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
i2c-tools is already the newest version (4.0-2).
libi2c-dev is already the newest version (4.0-2).
The following packages were automatically installed and are no longer required:
apt-clone archdetect-deb bogl-bterm busybox-static cryptsetup-bin dpkg-repack efibootmgr
girl1.2-geocodeglib-1.0 girl1.2-timezonemap-1.0 girl1.2-xkl-1.0 grub-common kde-window-manager kinit
kio kpackagetools15 kwayland-data kwin-common kwin-data kwin-x11 libdebconf-installer4 libfswapi
libkdecorations2-5v5 libkdecorations2private5v5 libkf5activities5 libkf5attica5
libkf5completion-data libkf5completion5 libkf5declarative-data libkf5declarative5 libkf5doctools5
libkf5globalaccel-data libkf5globalaccel5 libkf5globalaccelprivate5 libkf5idle5
libkf5jowidgets-data libkf5jowidgets5 libkf5kcmutils-data libkf5kcmutils5 libkf5kdecore5
libkf5kionlms libkf5kionlms5 libkf5newstuff-data libkf5newstuff5 libkf5newstuffcore5
libkf5package-data libkf5package5 libkf5plasma5 libkf5quickaddons5 libkf5solid5 libkf5solid5-data
libkf5sonnet5-data libkf5sonnetcore5 libkf5sonnetui5 libkf5textwidgets-data libkf5textwidgets5
libkf5waylandclients libkf5waylandserver5 libkf5xalgui-bin libkf5xalgui-data libkf5xalgui5
libkscreenlocker5 libkwin4-effect-builtins1 libkwin5effects11 libkwinutils11 libkwinrenderutils11
liblvm8 libqstools-pl libqt5designer5 libqt5help5 libqt5multimedia5 libqt5multimedia5-plugins
libqt5multimediaquick-p5 libqt5multimediaquick5 libqt5opengl5 libqt5positioning5
libqt5sprintrsupport5 libqt5qml5 libqt5quick5 libqt5quickwidgets5 libqt5sensors5 libqt5sql5
libqt5test5 libqt5webchannel5 libqt5webkit5 libxcb-composite0 libxcb-cursor0 libxcb-damage0
os-prober python3-dbus.mainloop.pyqt5 python3-icu python3-pam python3-pyqt5 python3-pyqt5.qtsvg
python3-pyqt5.qtmultimedia qml-module-qtquick2 qml-module-qtquickcontrolsaddons qml-module-qtmultimedia
qml-module-qtquick2-qt5 taskel taskel-data
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 446 not upgraded.
student1@jetson-desktop:~$ sudo i2cdetect -y -t 1
0 1 2 3 4 5 6 7 8 9 a b c d e f
00: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
```

We then modified the one2ten.cpp file to display our group number(1) on the 7 segment display which iterates our group number through the segments of the display.


```
File Edit View Git Project Build Debug Test Analyze Tools Extensions Window Help Search (Ctrl+Q) Embedded-Labs
10.128.18.58 Jetson Debug Default lab3 Debug Live Share
CMakeLists.txt JHLEDBackpackh one2ten.cpp examples.cpp one2ten.cpp* Makefile JHLEDBackpack.cpp
Miscellaneous Files - No Configurations (Global Scope)
34
53 return character;
54
55
56 void displayLoop(HT16K33 displayMatrix, int pos) {...}
62
63 int main() {
64 //HT16K33* displayMatrix = new HT16K33();
65 HT16K33 displayMatrix;
66 // Default I2C Bus 1
67 int err = displayMatrix.openHT16K33();
68 if (err < 0) {
69 printf(_Format: "Error: %d", displayMatrix.error);
70
71 } else {
72 printf(_Format: "HT16K33 Device Address: 0x%02X\n", displayMatrix.ki2CAddress);
73 printf(_Format: "HT16K33 Device Bus: 0x%02X\n", displayMatrix.ki2CBus);
74 displayMatrix.begin();
75 displayMatrix.clear();
76
77 int i = 3;
78 while (getKey() != 27)
79 {
80 for (int i = 0; i < 5; i++) {
81 displayMatrix.clear();
82 displayMatrix.writeDigitNum(x:i, num:1);
83 displayMatrix.writeDisplay();
84 sleep(1);
85 }
86
87 }
```



Task 2:

After completing task 1, we moved onto task 2 in which we display the current time in hours and minutes on the LCD display. We did this by getting the current time using a standard

library to get the hours and minutes as the loop and updating the LCD display every second. The images below show the LCD display as it updates every second.

```
88      */
89
90      printf("Hit ESC key to exit\n");
91      // Minutes and seconds - Start a 9:50 to show an exciting time change at 10:00!
92      uint16_t counter = 590;
93      auto start = std::chrono::system_clock::now();
94
95      time_t currTime;
96      struct tm* localTime;
97      // Get the current time
98
99      bool drawDots = false;
100     while (displayMatrix.error >= 0 && getKey() != 27) {
101         time(&currTime);
102         localTime = localtime(&currTime);
103         // display as hours and minutes
104         int hours = localTime->tm_hour;
105         int minutes = localTime->tm_min;
106         // printf("Counter: %d\n", counter);
107         displayMatrix.writeDigitNum(0, (hours / 10), drawDots);
108         displayMatrix.writeDigitNum(1, hours % 10, drawDots);
109         displayMatrix.drawColon(true);
110         displayMatrix.writeDigitNum(3, (minutes / 10) % 10, drawDots);
111         displayMatrix.writeDigitNum(4, minutes % 10, drawDots);
112         displayMatrix.writeDisplay();
113         counter++;
114         sleep(1);
115     }
```



Conclusion:

This lab gave us practical experience in creating our own programs in an embedded development environment and programming devices that are attached to the embedded systems such as the LCD display.

Source Code Link: <https://github.com/tiwaojo/Embedded-Labs/tree/Lab3>

