CMPE 443 PRINCIPLES OF EMBEDDED SYSTEMS DESIGN

PRE LAB #001 Part 2

"Setup QEMU"

Motivation

IMPORTANT NOTE: This semester, we will be using three software packages for the lab and course coding submissions. Before starting the custom lab sessions, we will assign you the first prelab session in two parts so that you will have sufficient time to install and get used to working with these environments. This document explains the second part of the first prelab that is due 24/11/2020 16:30.

In the second part of the first prelab, you will get introduced with the QEMU emulator environment[1]. Within the scope of this experiment, you will learn:

- setting up and working in a typical embedded hardware emulator environment
- implementing a circuit on a circuit simulation environment
- emulating a compiled embedded code.

1) Qemu Environment

In this course, we added LPC4088 to the QEMU environment. In order to use the QEMU environment, you need Ubuntu 18.04 or later operating system. You can download from:

https://releases.ubuntu.com/18.04/

https://releases.ubuntu.com/20.04/

For the initialization environment of the operating system, you should use a virtual environment. For this course, you need to run Windows and Ubuntu environments simultaneously. So, using virtual environments, you can instantly change the operating systems. The possible virtual free environments:

[1] "Keil Embedded Development Tools for ARM, Cortex-M ..." <http://www.keil.com/>

https://www.virtualbox.org/

https://my.vmware.com/en/web/vmware/downloads/details?downloadGroup=PLAYER-1600&productId=1039&rPId=51984

You can watch the installation videos:

https://www.youtube.com/watch?v=IBuuz9gTcR0

https://www.youtube.com/watch?v=QbmRXJJKsvs

2) Installing QEMU *1pt*

You can download the current version of the QEMU from:

https://drive.google.com/file/d/1d2xGoPkg23vlYTV3SEwJooKax-A4NPzT/view?usp=sharing

During the course, there can be some bug fixes, so we can send you the link of the new QEMU version. QEMU does not need any installation process, but in order to use it more efficiently, you can add build folders to the path. Firstly make a folder for Qemu as *CmpE443Qemu* and always copy-paste new versions to that folder in order to not adjust paths for new versions.

In order to add path, open the terminal:

gedit ~/.bashrc

After opening the bashrc add these lines at the bottom of the file according to your Qemu location:

export PATH="/home/ubuntu/Desktop/CmpE443Qemu/:$PATH"

export PATH="/home/ubuntu/Desktop/CmpE443Qemu/arm-softmmu:$PATH"

export QEMU_PATH="/home/ubuntu/Desktop/CmpE443Qemu/arm-softmmu/qemu-system-arm"

This path can change according to the extracted folder location.

You can also download this example project from:

https://drive.google.com/file/d/1veXSSGtMiKD0YJtQCcGs3aGvAdJ8Ju9z/view?usp=sharing

You can test your Qemu environment by writing this comment to terminal:

qemu-system-arm -machine LPC4088 -kernel LAB_001.axf -monitor stdio

(Ubuntu 20.04 you need to install: sudo apt-get install libsnappy-dev)

You can quit from the Qemu by writing "**quit**" and pressing the enter button on the terminal.

You can watch from: https://youtu.be/di71_-Mx-Ho

3) Installing LPC4088 Visualizer

In order to make circuits and simulate these circuits, you will use LPC4088 Visualizer. You can download from:

https://drive.google.com/file/d/192NhUKudEitCo2XP0odEEr23MFYNCLti/view?usp=sharing

During the course, there can be some bug fixes, so we can send you the link of the new LPC4088_Visualizer version. LPC4088_Visualier does not need any installation process, but in order to use it more efficiently, you can add build folders to the path. Firstly make a folder for LPC4088_Visualizer as *LPC4088_Visualizer* and always copy-paste new versions to that folder in order to not adjust paths for new versions.

In order to add path, open the terminal:

gedit ~/.bashrc

After opening the bashrc add these lines at the bottom of the file according to your LPC4088 Visualizer location:

export PATH="/home/ubuntu/Desktop/LPC4088_Visualizer:$PATH"

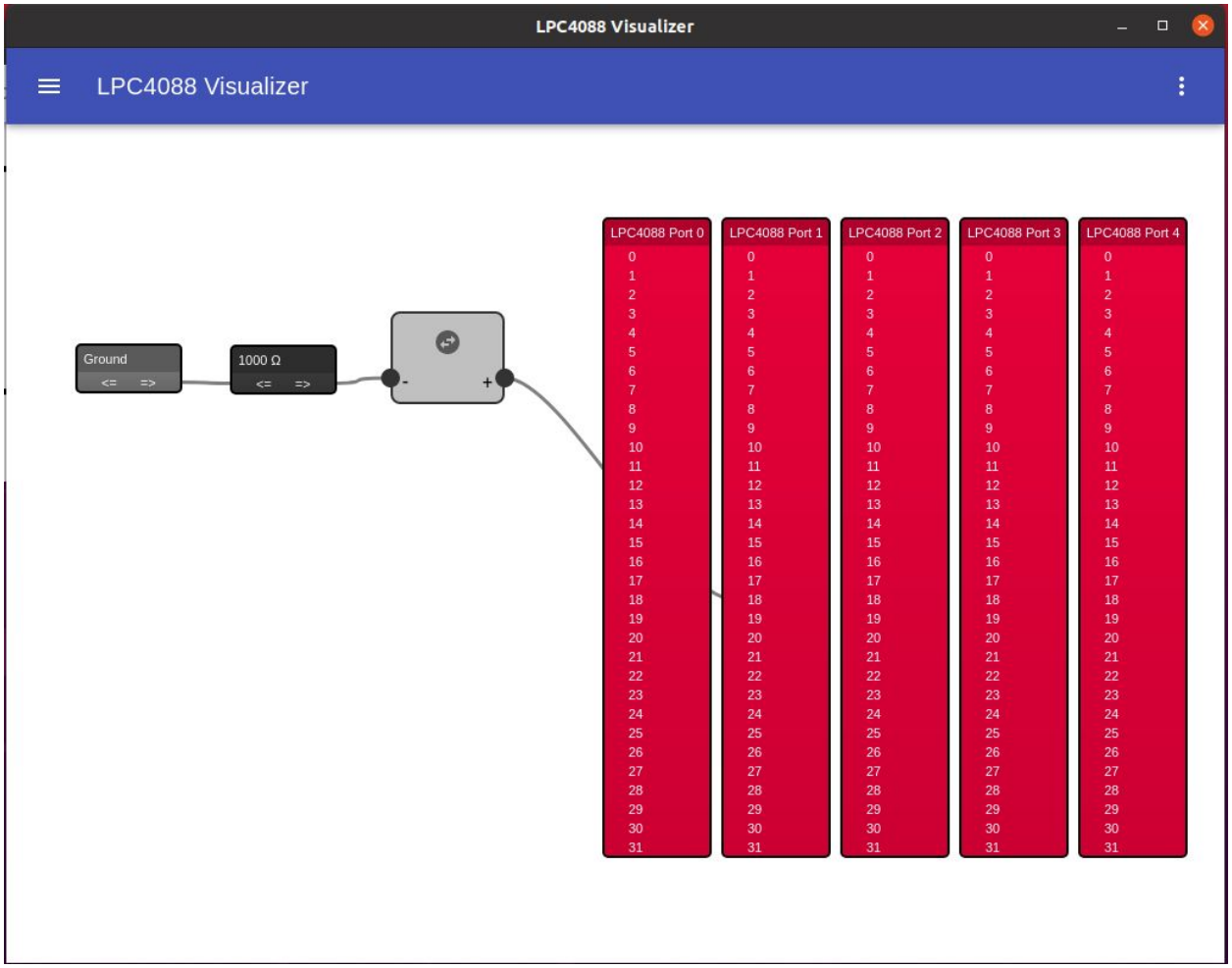
You can watch from: https://youtu.be/eUTRKeHclxM

You can watch the next steps videos from: https://youtu.be/YjfnbeO_acY

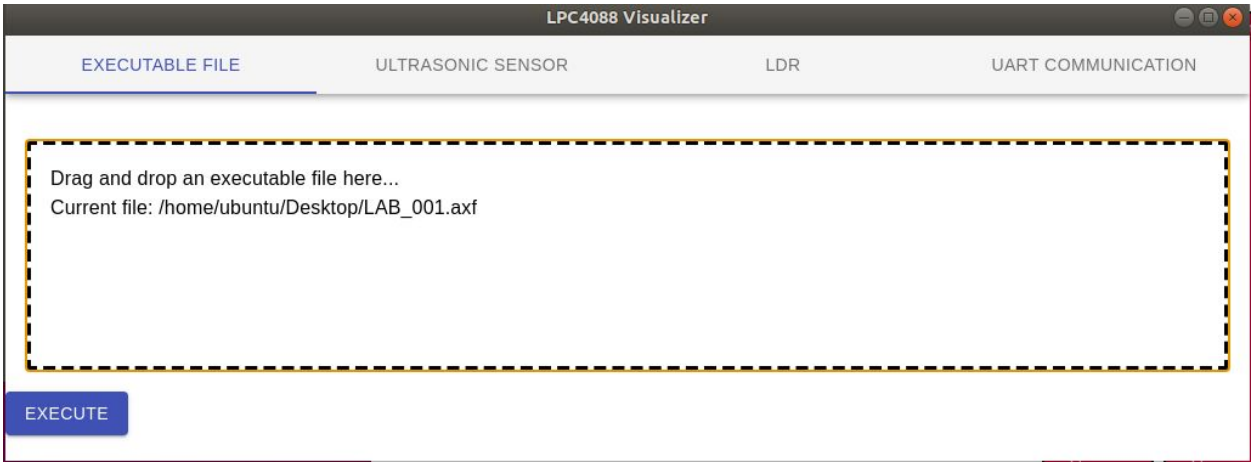
You can test your LPC4088 Visualizer by writing this comment to terminal:

LPC4088_Visualizer

The given example code makes the LED on and off in order to see that build a circuit (LED is connected to Port 1 Pin 18):



In order to run code from virtualizer select the AXF file and press execute:



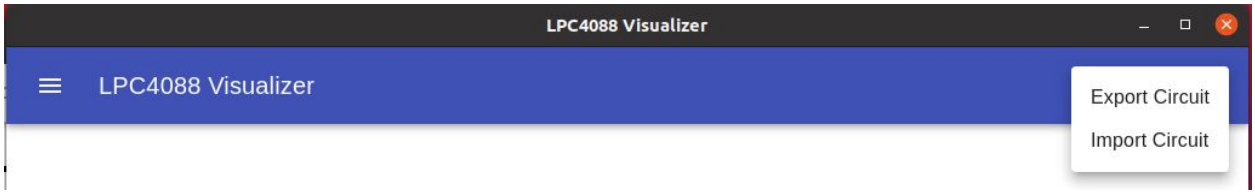
4) Combining Keil and QEMU

Use the Keil project you created in the previous part. When you build your code in Keil under the **Objects** folder **.axf** is made by Keil. Open the LPC4088 Virtualizer. Select the **.axf** file you build and press the execute.

You should see the same behaviour on the LED as the previous axf file.

5) Submission

You should submit two files to the PRE1 assignment on the moodle. The first one is the circuit file. You can export the circuit from the LPC4088 Virtualizer py pressing export button:



The other file is the **.axf** file.

The file name for the submissions should be (ex: PRE001_2020000000):

PRE<exp num>_<StudentID1>.axf (This will be generated **.axf** file)

PRE<exp num>_<StudentID1>.lpc_vcf (This will be exported circuit file)