DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
College of Engineering

UNT

Remote Embedded Systems Lab (RESL)

Discovery Park
3940 N. Elm, Room F201
Denton, TX 76207-7102

Introduction

Most of the computer engineering classes have a lab component attached to the class. These labs provide hands-on exposure on how to design a system for an application or to solve a problem. These labs are mostly done on general purpose embedded system based boards (Example: Tiva C Launch Pad and MKII Booster Pack). Since these classes have a hands-on component, many students from Electrical Engineering (EE), Computer Science (CS), and Computer Engineering (CE) fields are interested to learn more about embedded system design. As a result there is a 20% increase in class enrollments every time the class is offered at UNT. This increase in enrollment requires more resources (computers and boards) to teach these classes. In order to meet the demands of growing classes, buying more computers and boards is not a great way to scale.

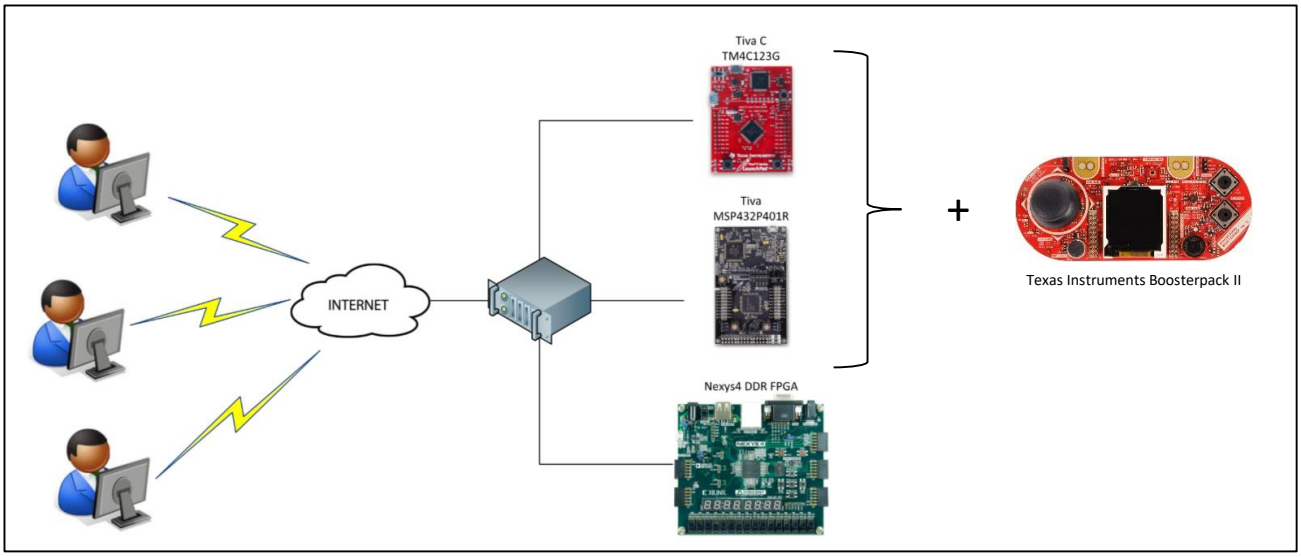

Figure 1: Overall Diagram of the Remote Embedded Systems Lab

The Remote Embedded Systems Lab (RESL) is a development environment for embedded systems. This lab is remotely accessible through a web browser, and allows users to upload compiled code to an embedded systems board, and to monitor the board's outputs by camera, microphone, and serial port. The user is capable of interacting with the target board, to activate sensors and buttons, through the web interface. The Remote Embedded Systems Lab also features an extensive database, permitting the management of boards, users, permissions, and statistics of usage. This lab also provides a web-based method of developing application using embedded systems, which opens paths to distance education as well as helping to reduce the required number of workstations and boards in traditional Labs.

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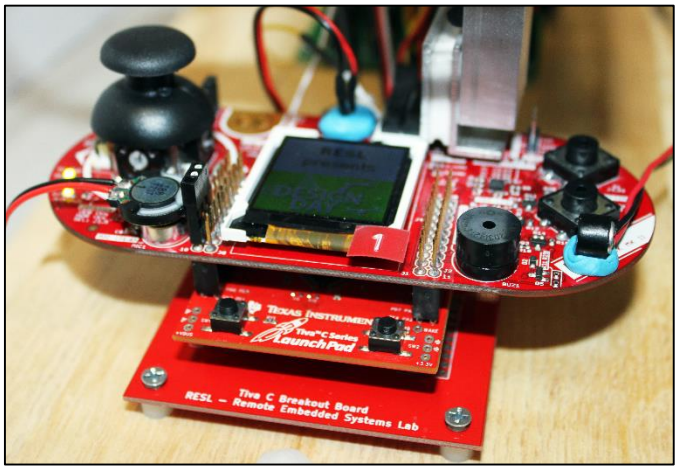

Figure 2: Tiva C with BoosterPack

Main Characteristics

- Multi-board
- Multi-user
- Responsive in **real-time**
- Ideal for long distance education
- Allows the sharing of expensive boards in traditional labs or large organizations

User Interaction

- Watch the LCD screen and LED of Booster Pack II through the video streaming in **real time**.
- Listen the Booster Pack II's Buzzer through the audio streaming.
- Press 2 buttons, and reset button.
- Set the external LED's brightness connected to the board's ambient light sensor.
- Set temperature to board's temperature sensor.
- Set voltage to board's ADC.
- Upload and flash the board with examples or the user's own binary code.
- Generate a sine tone and play it to the board's microphone.
- Select mp3 sound examples or send a user's mp3 sound file, for playback to the board's microphone.
- Record sound with the user's microphone and play it to the board's microphone.

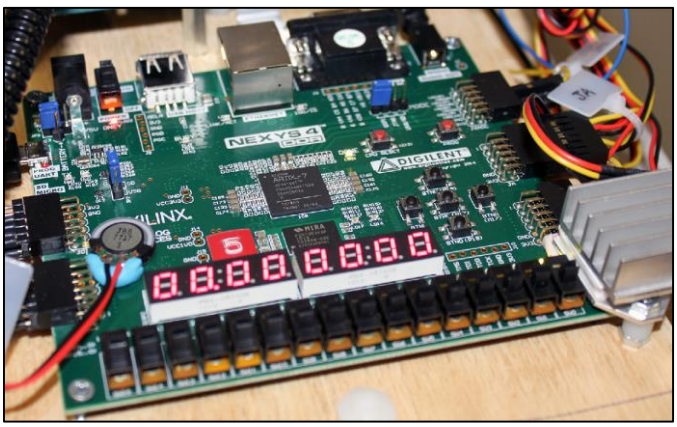

Figure 3: Nexys 4 DDR FPGA Board

Figure 4: MSP432 with BoosterPack II

Menu Board Options

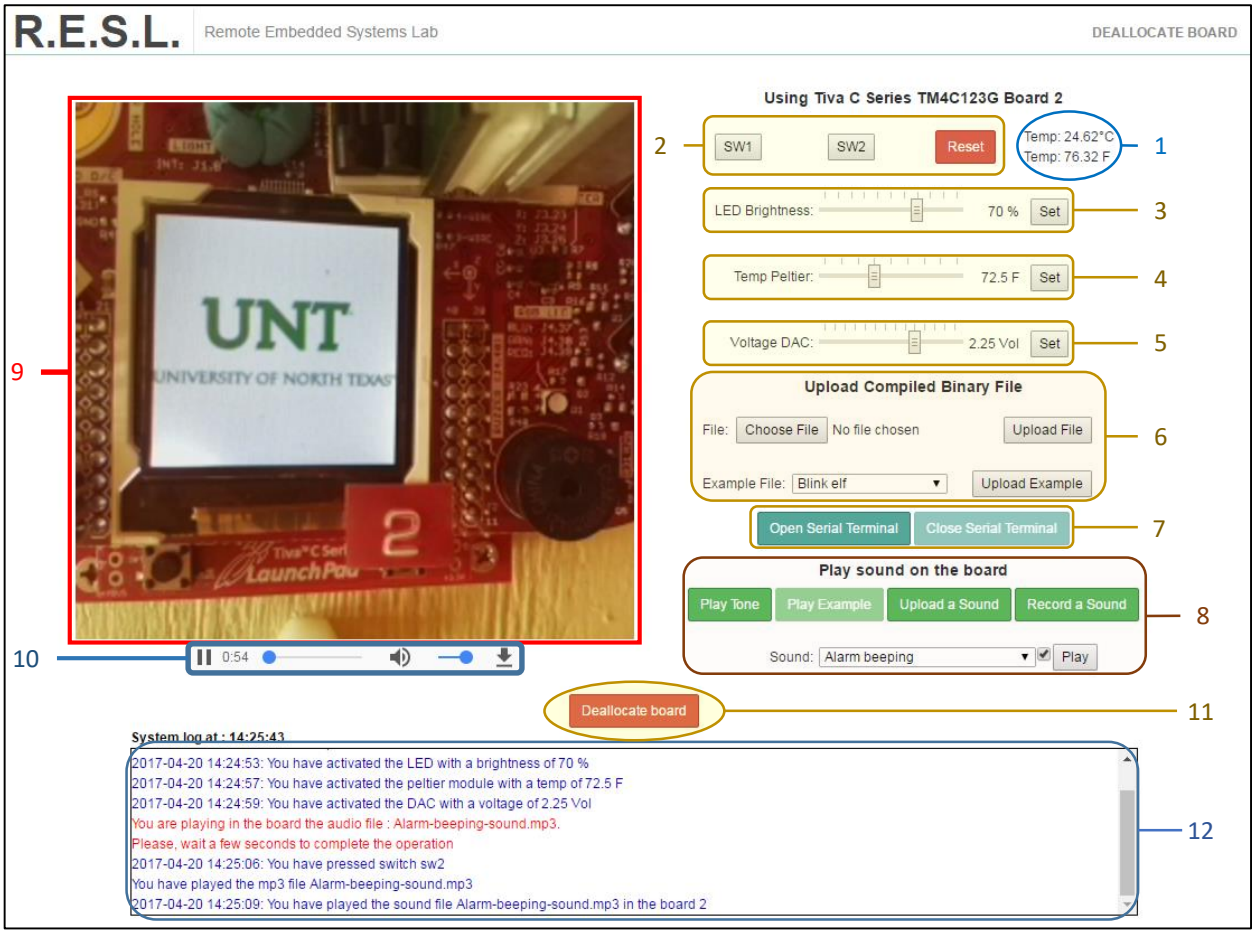

Figure 5: Menu Board Options

1. Show the temperature of the temperature sensor
2. Switches buttons and Reset button
3. Set the LED brightness (0 to 100%)
4. Set the temperature (65-85 F)
5. Set the voltage of the DAC (0 to 3 V)
6. Upload binary code (user and example code)
7. Open - close serial terminal windows
8. Play sound on the board options
9. Show video streaming
10. Control volume of audio Streaming
11. Deallocate board button
12. System log to show every action

Menu Board Options

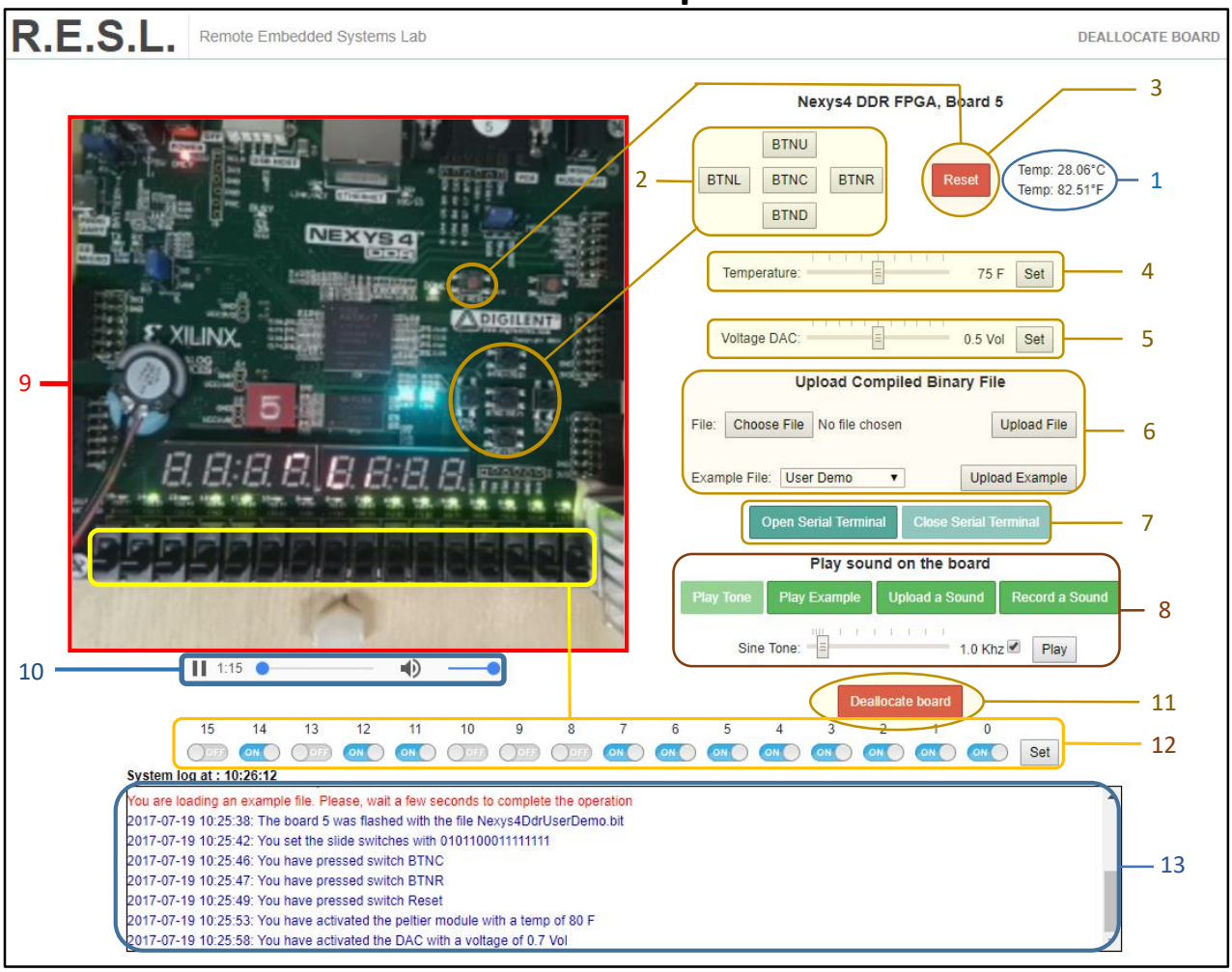

Figure 6: Menu Board Options

1. Show the temperature of the temperature sensor
2. 5 Switches buttons
3. Reset button
4. Set the temperature (65-85 F)
5. Set the voltage of the DAC (0 to 1 V)
6. Upload bitstream code (user and example code)
7. Open - close serial terminal windows
8. Play sound on the board options
9. Show video streaming
10. Control volume of audio Streaming
11. Deallocate board button
12. 16 slides switches
13. System log to show every action

Friendly Interface

- Boards Reservation selection
- Connection list (by board, time interval, EUID)
- Boards Monitor in **real time**
- User list
- Course List
- Server Settings

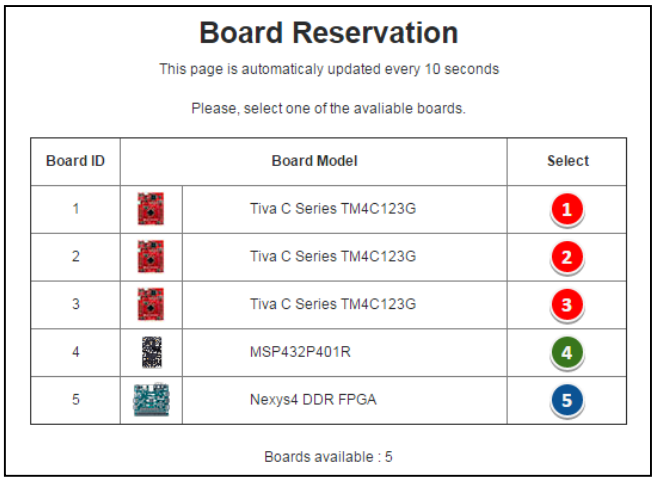

Figure 7: Board Reservation

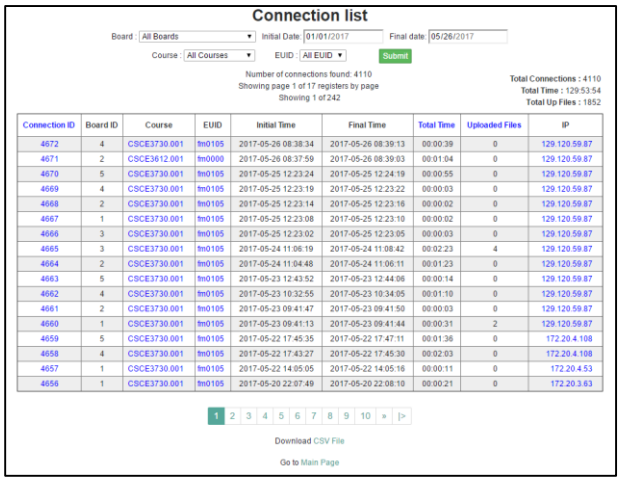

Figure 8: Connection list

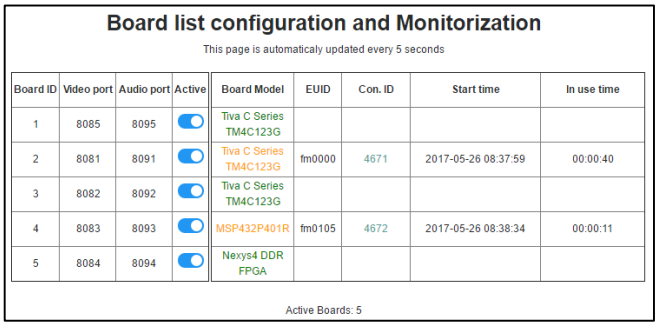

Figure 9: Board list and Monitor

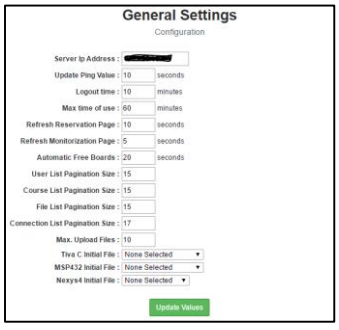

Figure 10: General Settings

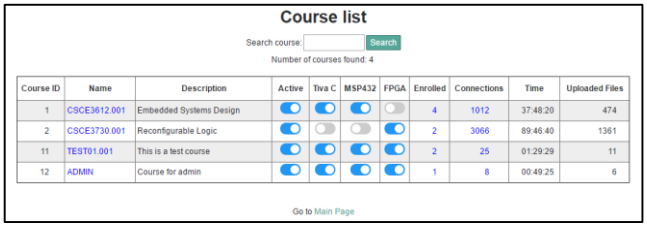

Figure 11: Course list

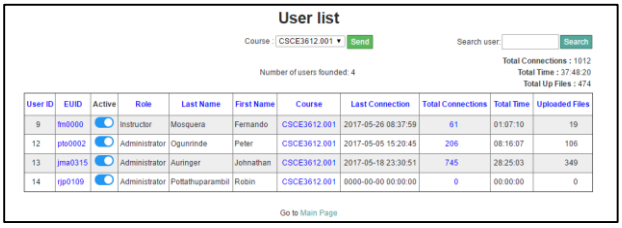

Figure 12: User list

Complete Connections Statistics Information

- Boards Statistics
- Overall course/student statistics
- Daily reservation counts by moth
- Hourly reservation counts for each day of the week.
- Bar chart daily counts
- Bar chart hourly counts

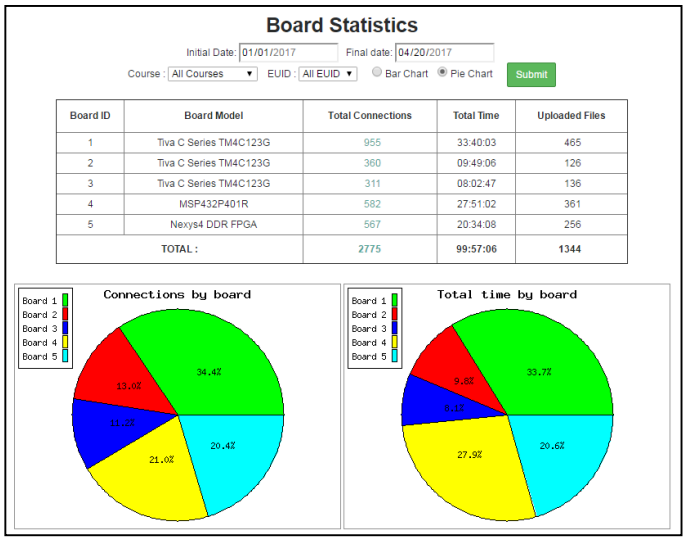

Figure 13: Board Statistics

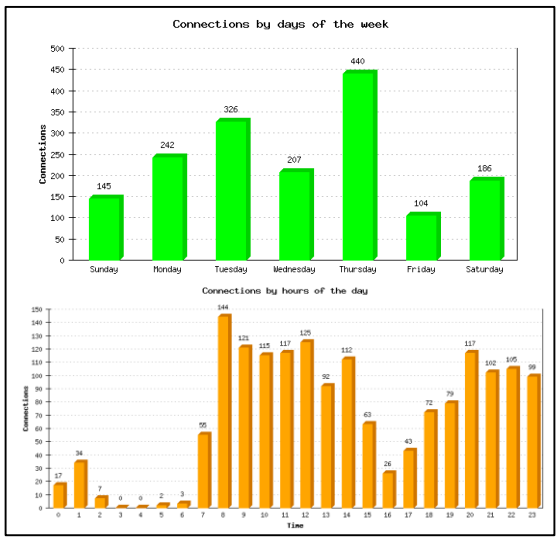

Figure 14: Bar Chart Statistics

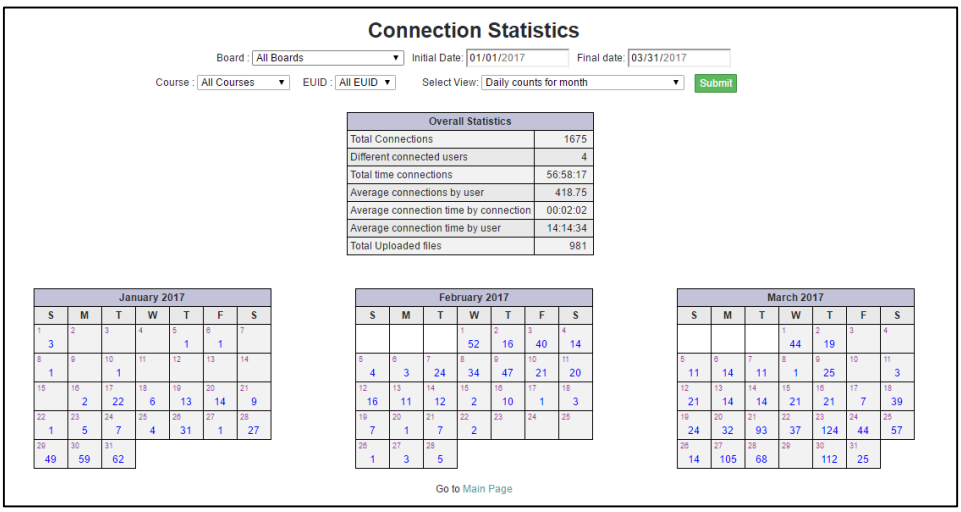

Figure 15: Connection Statistics

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Team: Embedded Systems Online

Fernando Mosquera
Software and Back-End

Johnathan Auringer
Hardware and Firmware

Peter Ogunrinde
Hardware and Front-End

Advisor: Dr. Robin J. Pottathuparambil

Senior Design Project

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