Developing a New Lab Interface for EE224

Members:
Leif Bauer, Christopher Caldwell, Eric Joyce, Nicholas Starr, Martin Szuck, Tyler Tran

SDMAY18-31
Adviser/Client: Dr. Julie Dickerson
Adviser: Matthew Post

Our Problem

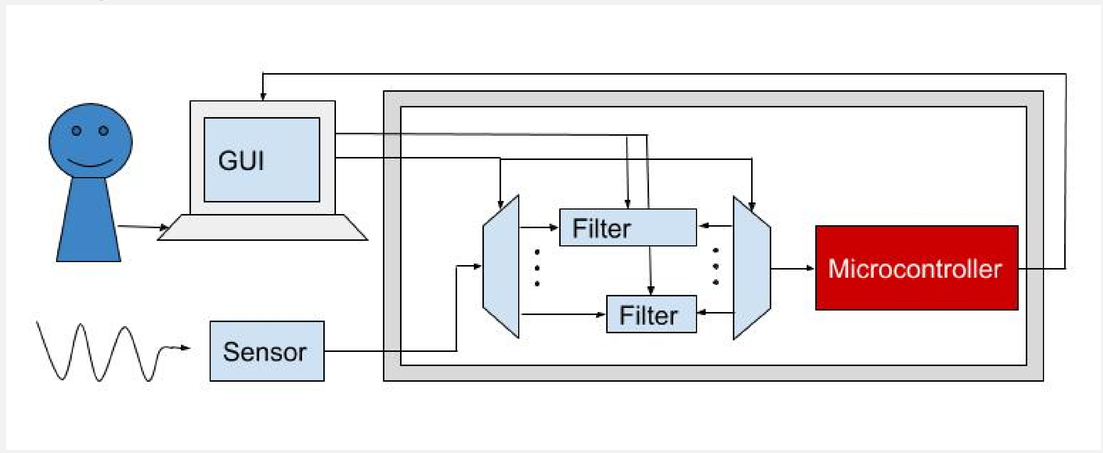
The goal of this project was to create a new platform which would update the laboratory experiments for EE 224 (Signals and Systems I). We wanted to make a user-friendly interface which the students can use for recording real world data from a variety of sensors.

Our Solution

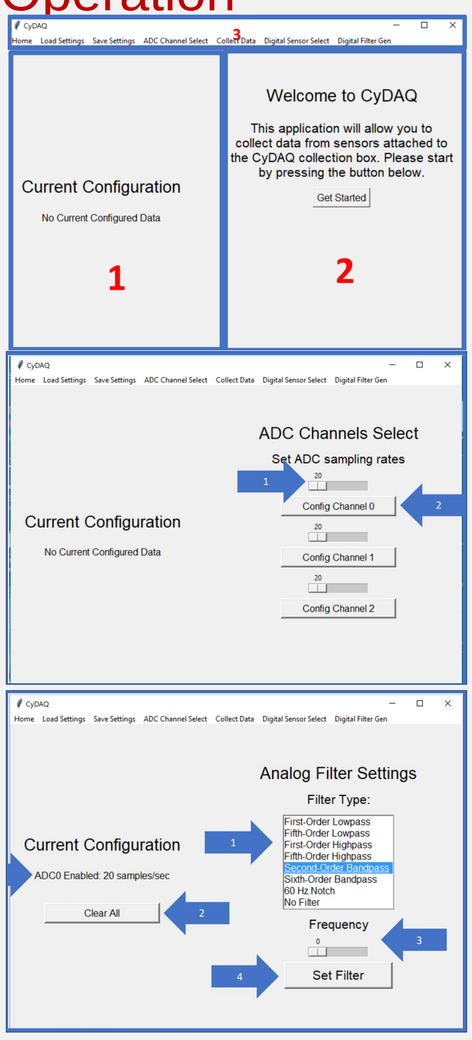
We've designed:

- GUI
- Firmware
- Filtering Circuit

Our System



GUI Operation



Technical Details

Front-End
- Python
- Tkinter
- Numpy
- Scipy
- Pyscript

Firmware
- C
- FreeRTOS
- Tiva TM4C123GH6PM
- TivaWare Library

Hardware
- 3 analog inputs
- SPI and I2C digital inputs
- Digitally Tunable Filters

Full Device Testing

TODO:
Pictures of Device in a lab setting
Discuss use of device in a teaching lab
Discuss Importance of hands on learning
Include Happy 224 Students

Standards Used

Coding Standards:
- Barr Group Embedded Systems Standards for C
- PEP 8 – Style Guide for Python Code
- Matlab 2.0 Style Guidelines

Full Device Testing

TODO: Include Results from full device testing

Lab Implementation

In addition to designing the CyDAQ, we've designed labs involving topics such as:
- Voice Activity Detection
- Audio Band Filtering
- Pulse Rate Sensors
- Home Automation

Commercial Alternative: myDAQ

- myDAQ (National Instruments)
- **$349.00/unit**
- Requires additional programming
- Further dilutes course content
- Recommended software: LabVIEW: **$2,999/unit**
- Requires breadboard circuit for analog filtering in lab use

Advantages of our device: CyDAQ

- **Under $160.00/unit**
- No additional software required
- Integrate with many popular software packages
- Custom-designed for EE224
- Developed here, ETG has access to all documentation
- Easily expandable with any off-the-shelf sensor

Learning Outcomes

By refocusing the lab experiments, we believe students will:
- Gain more confidence with the course material
- Be better equipped for future work in industry
- Be more comfortable applying the topics outside of the classroom

Design Requirements

Functional
- User Friendly GUI
- Affordable
- Use various sensors

Non-Functional
- Easy to maintain and add new sensors
- Valuable for teaching