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Intern Exit | Presentation

Chengming Li

Agenda

1. About Me & Future Journey
2. Accomplished Projects
3. Key takeaways
4. Acknowledgment
5. Q&A

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About me

Chengming(Steven) Li

- BS Electrical & Computer Engineering Degree at University of Colorado, Boulder
- Will be MS Electrical & Computer Engineering Student at University of California, San Diego
- Here, at Eridan, RF Test Engineering Intern

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Accomplished Projects

1. pyEridanLab

The Problem? Why?

- Cost of MATLAB License
- Transition from C# to Python
- How to use DLLs in Python

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Accomplished Projects

1. pyEridanLab

The Solution -> How !?:

- Cost of MATLAB License
  - Use C# and Python.
  - Open source,
  - Free to use.
- Transition From C# to Python
  - Use Dynamic Link Library (DLL)
  - .Net
  - pythonnet
- How to use DLLs in python
  - Type hint files, .pyi
  - Import clr

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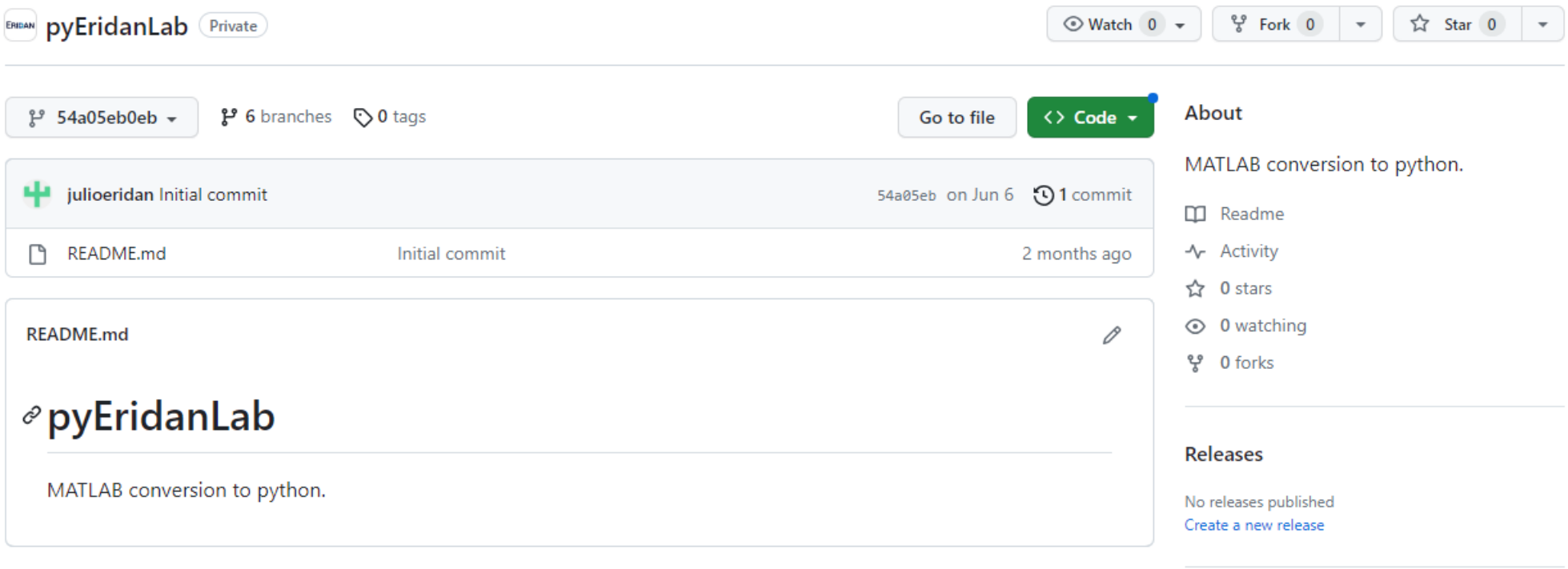
Accomplished Projects

1. pyEridanLab

- What it looks like at the beginning



Accomplished Projects

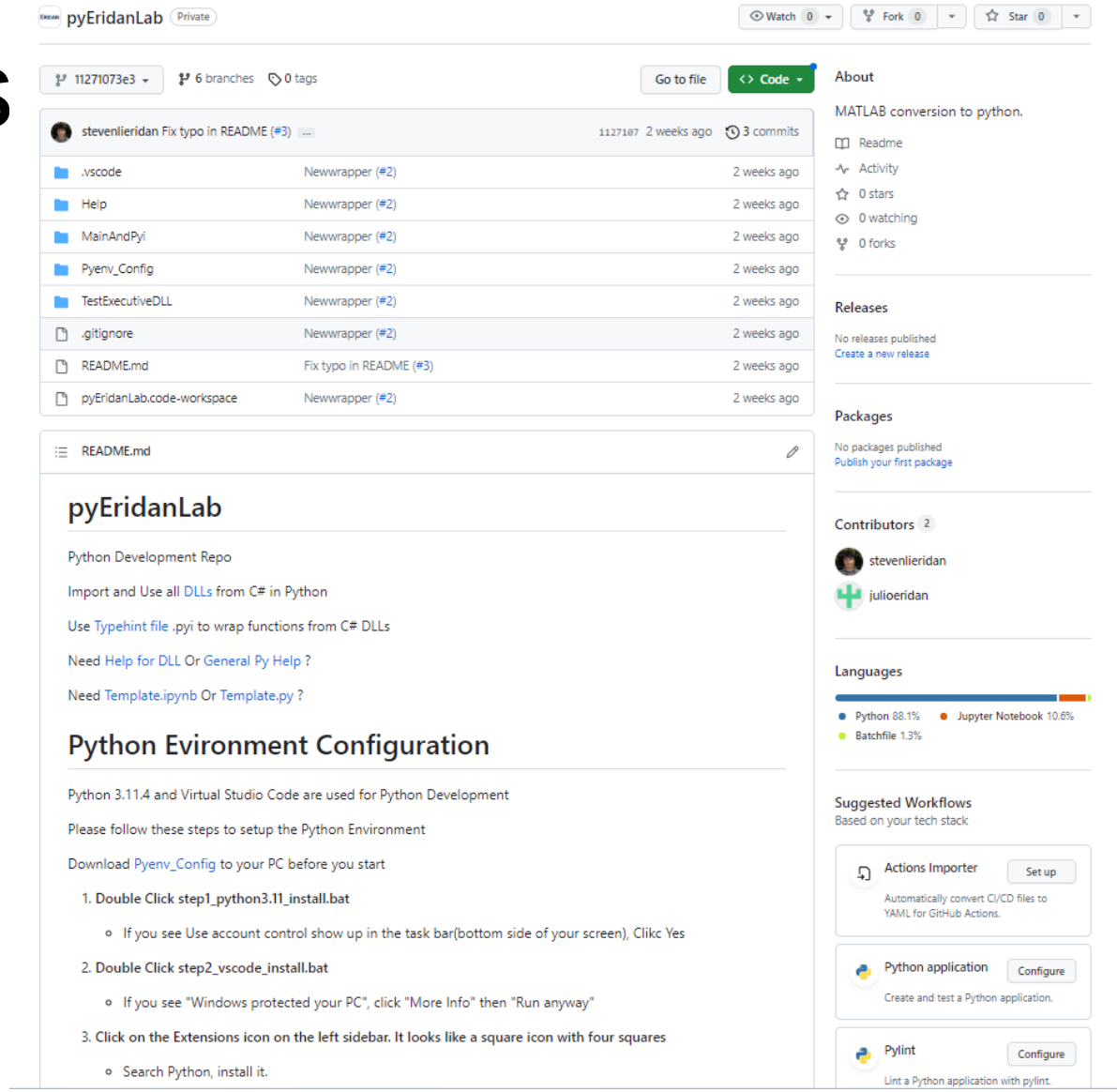
1. pyEridanLab

- After a month effort…
- Ignore 65621 additions, which are dlls
- 8265 lines of code, wrap everything from C#

Showing **101 changed files** with **73,886 additions** and **1 deletion.**

73886 - 65621 =

8,265



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Accomplished Projects

1. pyEridanLab

- Double click to install everything as you need

Name	Last commit message	Last commit date
..		
activate_env.bat	Newwrapper (#2)	2 weeks ago
rclone_install.ps1	update the name	3 days ago
requirements.txt	Newwrapper (#2)	2 weeks ago
step1_python3.11_install.bat	Newwrapper (#2)	2 weeks ago
step2_vscode_install.bat	Newwrapper (#2)	2 weeks ago

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Accomplished Projects

1. pyEridanLab

- Need help for DLLs usage? --> **DLL Help Script!**

DLL_Help_Example.ipynb

pyEridanLab > MainAndPyi > DLL_Help_Example.ipynb > PowerSupply

+ Code + Markdown | Run All Restart Clear All Outputs | Variables Outline ··· .venv (Python 3.11.4)

Before you start, Do this

```python
# Add references of all DLLs
from ImportDLL.TestExecutiveDLL import *
```

[2] Python

PowerSupply

```
Class:
    PowerSupplyOutputMode(Enum)
    PowerSupply
    IPowerSupply
```

```python
# Use PowerSupply DLL
from Eridan.Instruments.PowerSupply import *

# Example: Get object
mysupply = PowerSupply.CreatePowerSupply("TCPIP0::10.0.0.108::inst0::INSTR")

# Example: Access Element
mysupply.OutputMode = PowerSupplyOutputMode.VoltageMode
mysupply.Channels[0].MeasureVoltage()
```

[ ] Python

DAQ

```
Class:
    DAQMeasurementType(Enum)
    DAQ
    IDAQ
```

PowerSupply.pyi

pyEridanLab > MainAndPyi > Eridan > Instruments > PowerSupply.pyi > IPowerSupply > IDString

```python
from typing import List
from enum import Enum


class PowerSupplyOutputMode(Enum):
    """
    PowerSupplyOutputMode Enum\n
    VoltageMode: int\n
    CurrentMode: int
    """
    VoltageMode: int
    CurrentMode: int

class PowerSupply:
    """
    PowerSupply Class

    Methods:
        CreatePowerSupply(address: str): Create the PowerSupply Object and
    """

    def CreatePowerSupply(address: str) -> IPowerSupply:
        """Create the PowerSupply Object and Return the object"""
        ...

class IPowerSupply:
    """
    Attributes:\n
        self.Channels: A list of My_IPowerSupplyChannel\n
        self.Alias: Get/Set the Alias of PowerSupply.\n
        self.IDString: Get the IDString of PowerSupply.\n
        self.OutputMode: Get/Set the OutputMode of PowerSupply.\n
        self.OutputState: Get/Set the OutputState of PowerSupply.

    Methods:\n
        Open(self, address): Open the PowerSupply with address.\n
        Close(self): Close the PowerSupply.\n
        Reset(self): Reset the PowerSupply.
    """
```

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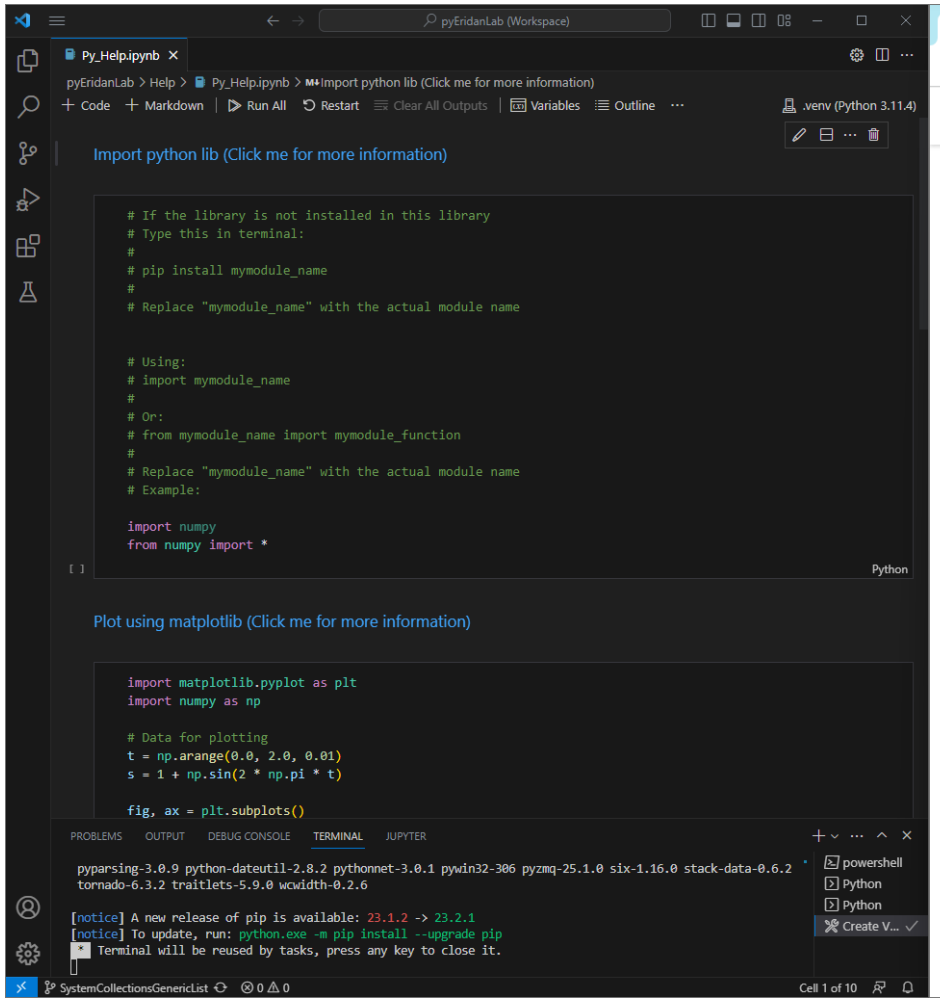
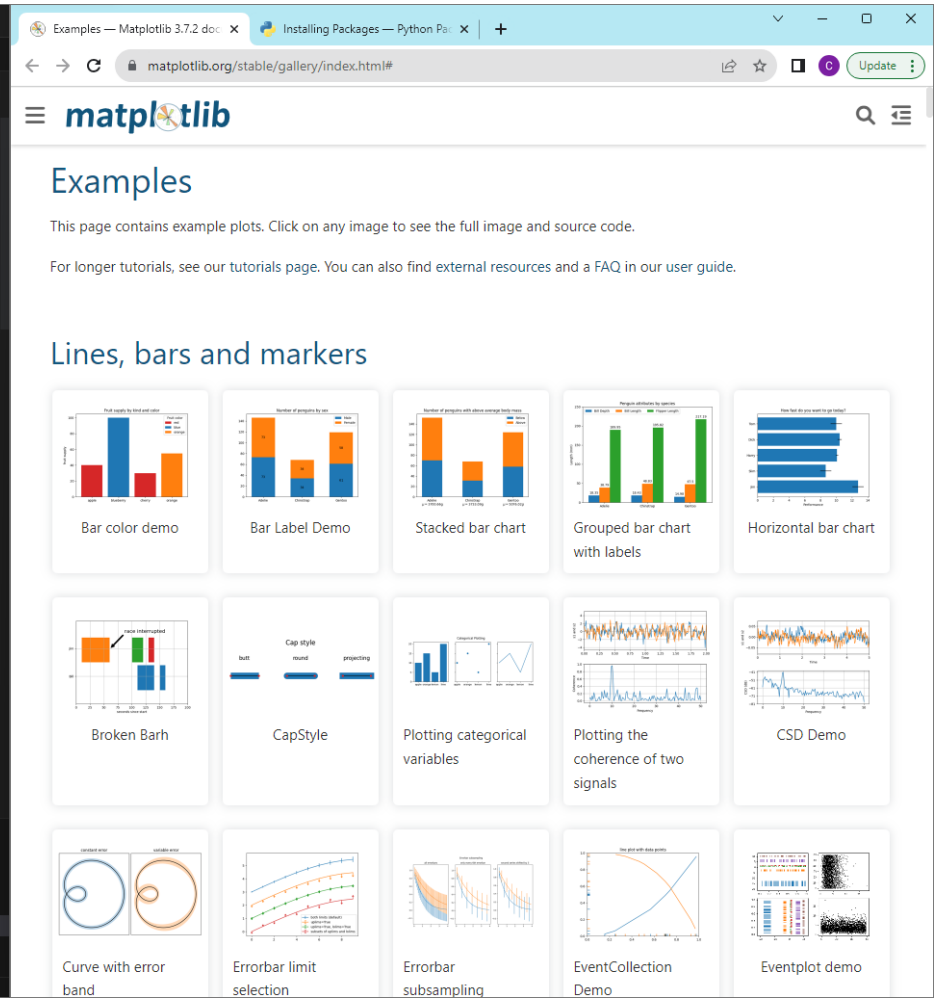
Accomplished Projects

1. pyEridanLab

- Need help for Python usage? --> **Python Help Script!**





Accomplished Projects

1. pyEridanLab

- Hands off? --> Confluence Page

Project status Aug 7, 2023

Accomplishments

1. All DLLs are imported in .pyi form
2. DLL & Python Help Scripts
3. Python, VScode and rclone installation scripts finished
4. README about repo usage
5. Test team have cloned the pyEridanLab repo to their Lab PCs

Status: USE WITH CONSTRAINTS

Next steps

- [ ] Put more documentation in the Help scripts (Variable Type Conversion)
- [ ] Collect feedback about user's experience
- [ ] Interface with hardware
- [ ] Duplicate test sequence using Python
- [ ] Risks in the right side ---------->

Periodic Aug 7, 2023

- [ ] Periodic Maintenance
- [ ] requirements.txt
- [ ] .pyi
- [ ] DLL version

Risks, constraints & project issues

1. **Maintenance:**
   a. update .pyi when corresponding C# file is updated
   b. requirements.txt
   c. DLL Version
2. **Naming issue of DLLs:**
   a. two dot in the DLL file's name
   b. where to store DLL-related scripts (they can only be in /MainAndPyi right now, no sub-folder is allowed)
3. **Variable Type Conversion:**
   a. C# variable type to Python variable type
4. **Import Warning:**
   a. regarding #3, this reports a warning, but runs freely. (Python can't understand these from C#)

```
# from System import ValueTuple, UInt32, Int32
# from System.Collections.Generic import List
```

5. **Repo Growth:**
   a. regarding #2.b, repo will get messy after lots of DLLs scripts are created

Repo Usage

How to use pyEridanLab

1. Follow the Python Environment Configuration in repo's README.md
2. For .ipynb file
   a. Before you run, on top right side, Choose Select Kernel → python environment → .venv (recommended)
   b. + code is used to create code section
   c. + markdown is used to create header/comment
3. For .py file
   a. on top right side, Click triangle button to run the script

What to Add?

1. For None-DLL scripts, it is recommended to put the scripts inside the **/MainAndPyi**, and can also be stored in a sub-folder
2. For DLL scripts, it must be stored inside the /MainAndPyi, (**NO SUB-FOLDER!**)
3. For help script, if you find any common problems with solutions, please do add them to the **Help/Py_Help.ipynb**

Note

1. You can skip step4 in README if you already have VScode installed on your computer
2. Please comment line12 - 14 in **.vscode/tasks.json** if you don't want the VScode to reinstall the library and virtual environment every time. Note: please don't commit this change to the remote repo
3. Please **CLOSE ALL** current open files in vscode if you are reopening the workspace with newer **requirements.txt**

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Accomplished Projects

2. Temperature Chamber

The Problem? Why?

- Oscillation during the heating/cooling
- How to know if there is an error in 30s
  - Whether the hardware switch is on
  - Whether it is going to the right direction
- How to handle the overshooting

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Accomplished Projects

2. Temperature Chamber

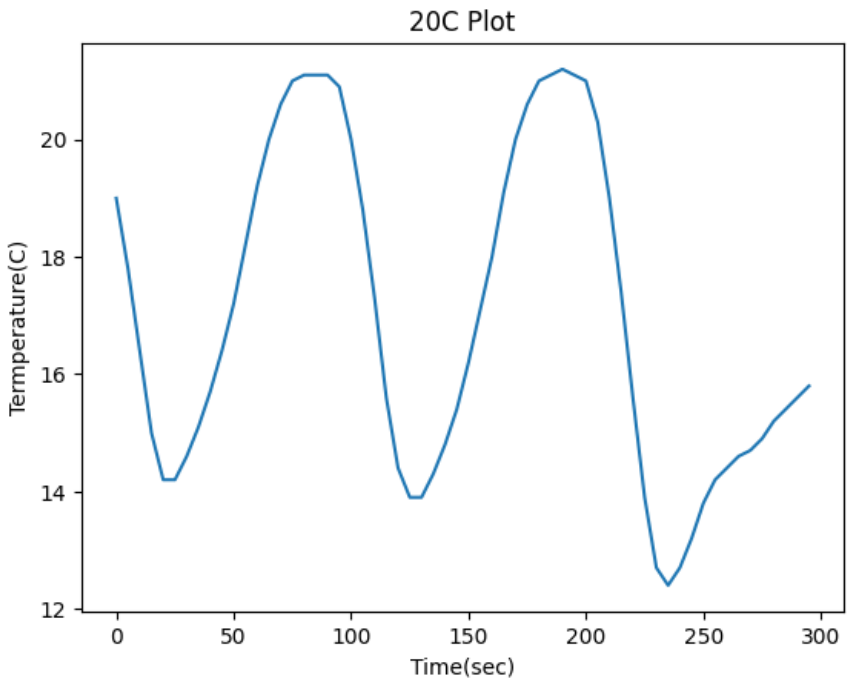
The Solution -> How !?:

- Oscillation during the heating/cooling
  - AutoTune-off
- How to know if there is an error in the 30s
  - Whether the hardware switch is on
    - Check if the temperature change after starting the program
  - Whether it is going in the right direction
    - Compare the delta between the current temp and the target temp
- How to handle the overshooting
  - Make sure it converges for 30s

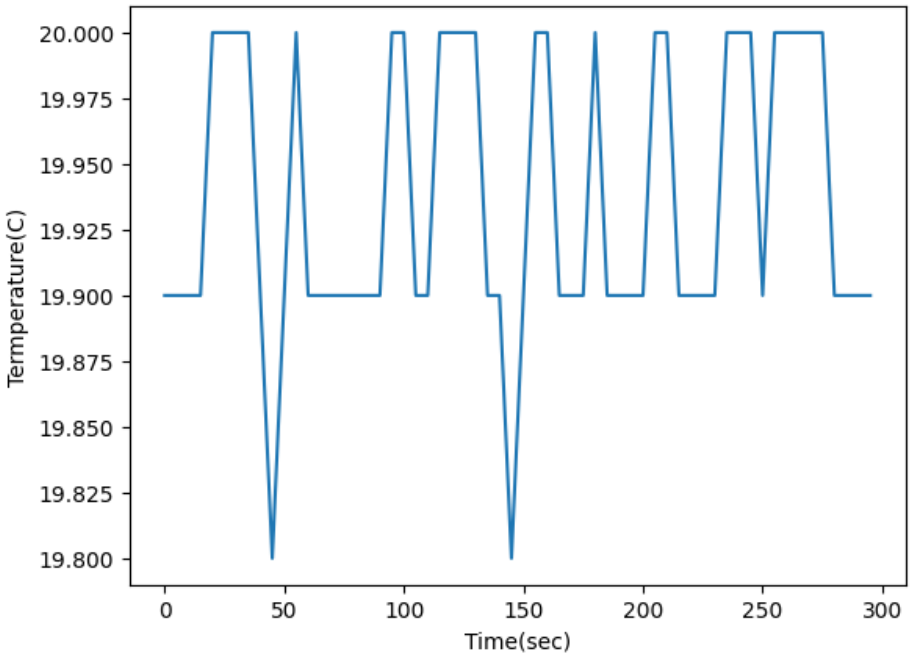
Accomplished Projects

2. Temperature Chamber

Before



After



Accomplished Projects

3. Digital Multimeter

The Problem? Why?

- Read Temperature from DMM
- Different Models support different Thermo Probes

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Accomplished Projects

3. Digital Multimeter

The Solution -> How !?:

- Read Temperature from DMM
  - Create GetTemperature() Function in C#
- Different Models support different Thermo Probes
  - “Switch” Statement to choose ThermoProbe for different models

```
public enum ThermoProbeType
{
    /// <summary>
    /// This Enum is only used for Temperature measurement
    /// No need if other measurement are performed
    /// Command:
    /// <probe_type>: {FRTD|RTD|FTHermistor|THERmistor|TCouple}. Default: FRTD.
    /// <type>: 85 (only possible value for RTD/FRTD), 5000 (only possible value for THERmistor/FTHermistor), or E, J, K, N, R, T (TCouple).
    ///
    /// 34420A uses THERmistor|FRTD|TC
    /// 34450A uses THERmistor
    /// 34460A and 34461A only use FRTD|RTD|FTHermistor|THERmistor
    /// 34465A and 34470A only use FRTD|RTD|FTHermistor|THERmistor|TCouple
    /// </summary>

    fourWireRTD_85,
    RTD_85,
    fourWireThermistors_5000,
    thermistors_5000,
    thermoCouple_J,
    thermoCouple_K,
    thermoCouple_E,
    thermoCouple_T,
    thermoCouple_N,
    thermoCouple_R,
    // Additional probe for 34420A only
    thermoCouple_S,
    thermoCouple_B
```

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Key takeaways

1. Be Proactive
2. Take the Responsibility
3. Try First
4. One Problem/Thing at a time
5. Be Precise/Easy to Understand

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What skills do I learned

1. C#
2. GitHub
3. Python Programming Practice
4. Instrument Interface
5. Batch Script

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Acknowledgment

- Shawn
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Q&A