FERMILAB-SLIDES-24-0204-AD-STUDENT

Oscilloscope Data Push Program

Jason Osei-Tutu, Wilbur Wright College—CCI Intern

Jose Berlioz Rivera, Fermi National Accelerator Laboratory

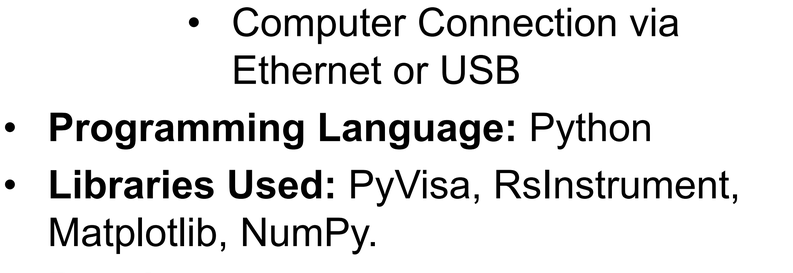
Introduction

Data acquisition (DAQ) is a complex and costly process. Creating DAQ systems for analyzing a system requires expensive electronics and a dedicated team of engineers for support, posing a challenge for users who readily need data.

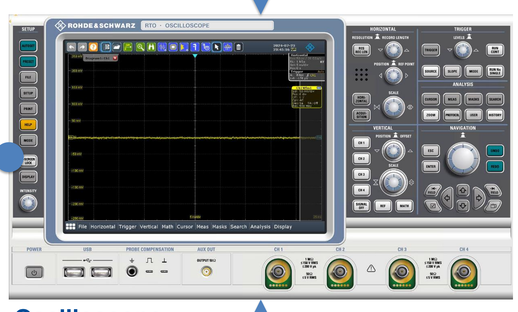
This project is a proof of concept to create a temporary or “one-off” DAQ system using equipment commonly available to every team. We aim to automate the data acquisition process from the Rhode & Schwarz RTO 1044 oscilloscope, convert the acquired binary data into floating point values, and store the results in a csv file format. By developing a Python program, to handle these tasks, we seek to reduce the manual effort involved in data collection, significantly increasing efficiency.

Methods

- **Equipment**
  - Rhode & Schwarz 1044 Oscilloscope
  - Computer Connection via Ethernet or USB
- **Programming Language:** Python
- **Libraries Used:** PyVisa, RsInstrument, Matplotlib, NumPy.
- **Development:**
  - Created a Python class for managing data conversion and acquisition.
  - Implemented functions to:
    - Set trigger options.
    - Acquire data from specified channels
    - Save waveform data to CSV.
    - Plot waveforms



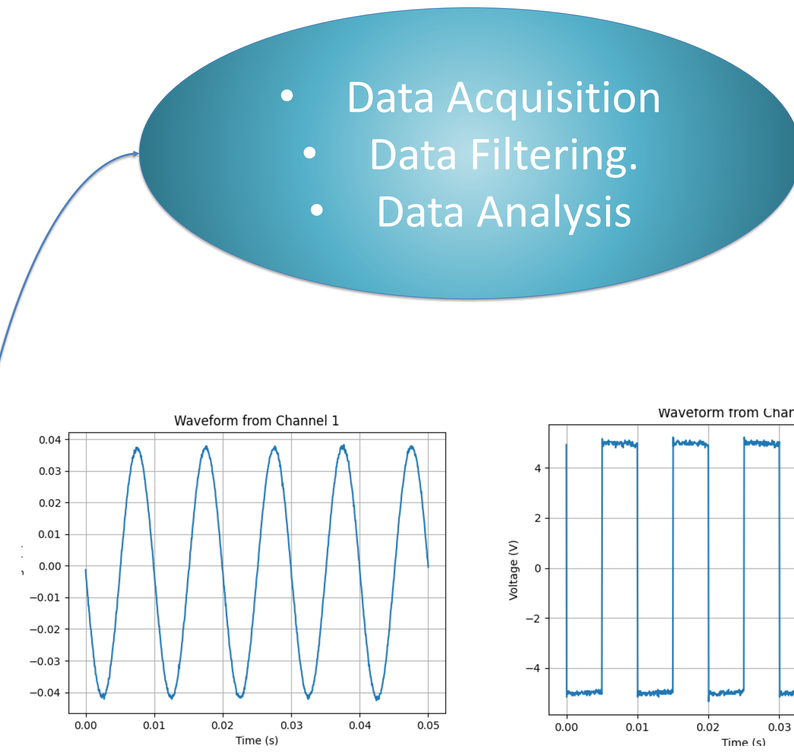
Function Generator With Wave Settings.

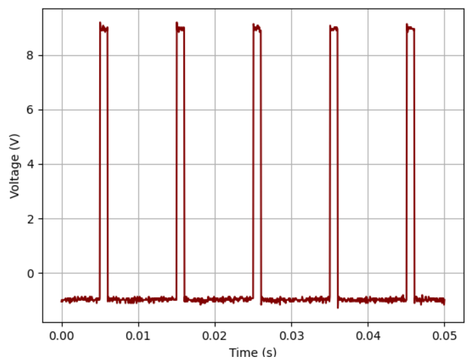


Oscilloscope With Wave Data

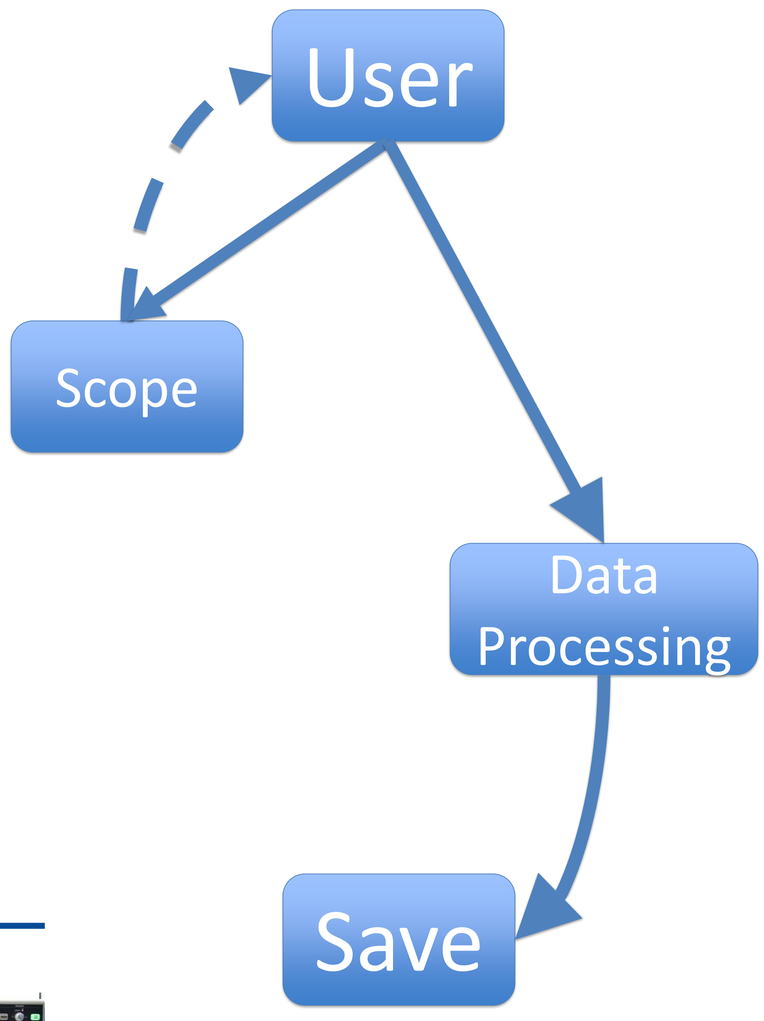
```
def main():
    try:
        # Initialize the connection to the oscilloscope
        instr = RsInstrument('TCPIP::192.168.1.100::INSTR', True, True)
        instr.visa_timeout = 30000  # Increased timeout to handle larger data transfer
        instr.opc_timeout = 40000

        # Clear status and reset the instrument
        instr.write_str("*CLS")
        time.sleep(0.5)
        instr.write_str_with_opc('*RST')

        # Set up single acquisition for 50ms
        instr.write_str("ACQ:POIN:AUTO RECL")  # Define Horizontal scale by number of points
        instr.write_str("TIM:RANG 0.05")  # 50ms Acquisition time
        instr.write_str("ACQ:POIN 1000000")  # Assuming a high number of points for high resolution
        instr.write_str("CHAN1:RANG 2") # Horizontal range 2V
        instr.write_str("CHAN1:POS 0")  # Offset 0
        instr.write_str("CHAN1:COUP AC")  # Coupling AC 1MOhm
        instr.write_str("CHAN1:STAT ON")  # Switch Channel 1 ON

        # Trigger Settings
        instr.write_str("TRIG:MODE AUTO")  # Edge Trigger mode
        instr.write_str("TRIG:SOUR CHAN1")  # Trigger source CH1
        #instr.write_str("TRIG:SLOP POS")  # Trigger type Edge Positive
        instr.write_str("TRIG:LEV 0.04")  # Trigger level 40mV
        #instr.write_str('TRIG:POSITION:0.5')
        instr.query_opc()  # Using "OPC?  query waits until all the instrument settings are finishe

        # Arm the oscilloscope for single acquisition
        instr.visa_timeout = 40000  # Acquisition timeout - set it higher than the acquisition tim
        instr.write_str("SING")
        instr.query_opc()  # Using "OPC? query waits until the instrument finished the Acquisition
```

Python Program containing class structure and algorithm

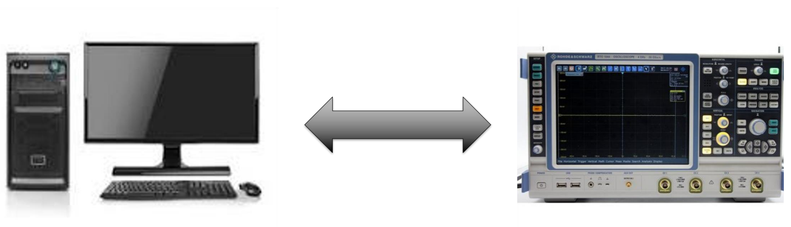




Images of processed and filtered waveform data.



Manual representation of Wave Data Collection



- Data Acquisition
- Data Filtering.
- Data Analysis

Save Data

Results

- **Efficiency:** The automation process increases data collection efficiency.
- **Customization:** The flexibility of the program allows the user to personalize the type of acquired data.
- **Accuracy:** Ensured precise data conversion from binary to floating points.
- **Storage:** Storing of data in a desired path by user.

Summary

- **Achievements:**
  - Developed a Python program to automate data acquisition from an R&S oscilloscope.
  - Successfully implemented functions for data handling and visualization.
- **Future Work:**
  - Integrate cloud database storage for continuous data collection.
    - Enhance real-time processing capabilities.

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