EE/CprE/SE 491
wDAQ System (sddec24-19)
Weekly Report 2

Feb 7 - 13, 2024
Client: Manojit Pramanik and Avishek Das
Faculty Advisor: Manojit Pramanik

TEAM MEMBERS

Adam Shoberg [EE] - Circuit Design & Simulation, PCB Design, Team Communications Leader

Henry Chamberlain [EE] - PCB Design & Construction

Lisa Tordai [SE] - Software Development, Wireless Data Sharing

Vaughn Miller [CprE] - Computer Engineering

SUMMARY

This past week, we looked into some existing wDAQ systems and compared them to our design to see some areas of potential improvement, as well as areas where our team is innovating and surpassing existing designs. We ordered three low-noise amplifier parts and attempted to acquire SPICE models for the amplifiers we wanted to simulate. Also, we searched more thoroughly for ADC components and microcontrollers that matched our ADC's sampling rate, and looked more into WiFi & Bluetooth to find which option provided the fastest protocol. Plans to program and test on the MCU platform are in progress.

ACCOMPLISHMENTS

Adam:

- Researched available components for the device
- Researched similar products to the design project
- Attempted to simulate the LNA using s-parameter models

Henry:

- Ordered components from ETG: Mini-Circuits MAR-3SM+ and MAR-6SM+ amplifiers (from Digikey), 60dB 100k-2GHz 2-stage broadband RF amplifier (from Amazon)
- Requested SPICE files for MAR-3SM+ and MAR-6SM+ amplifiers from Mini-Circuits
- Researched existing wDAQ devices with similar characteristics to our design and compiled a Powerpoint

Lisa:

- Ordered and received parts for Bluetooth test setup
- Found three viable options for wireless communication
- Worked to create LabVIEW VIs for Bluetooth Receiving
- Practiced setting up an Arduino with a Bluetooth Module

Vaughn:

- Researched and compared MCU built-in ADC options, and came to the conclusion that they don't have a high enough sampling rate compared to external options (will go back to external ADC interfacing with MCU)
- Looked into the MCU's with the most horsepower/dollar and with a simple/platform agnostic development environment option
- Installed STM32 toolchain and configuration files

PENDING ISSUES

Adam:

- Unable to receive SPICE files from Mini-Circuits in order to simulate circuits
- Struggling to use Mini-Circuits s-parameter files to simulate MAR amplifiers in NI Multisim

Henry:

- Mini-Circuits will not provide the SPICE files necessary to simulate their circuits in NI Multisim. We are unsure how to simulate circuits using s-parameters.
- The amplifier parts we ordered from ETG have not arrived yet

Lisa:

- Connecting Bluetooth and Arduino to stream data seamlessly
- Decide on which wireless communication device to use on the project

Vaughn:

- Having some issues with the STM32 debugger, looking to fix so I can start uploading code
- Still need to figure out how to interface the CPU with an external ADC

INDIVIDUAL CONTRIBUTIONS

Member	Contributions	Weekly Hours	Total Hours
Adam	Related wDAQ project and product research, research into s-parameter simulation	4	12
Henry	Related wDAQ product research and presentation, ETG parts order, SPICE files inquiry	4	12
Lisa	Researched and gathered data for wireless options, created a mock test setup for potential project use	4	12
Vaughn	Continued research into data flow into ADC, between MCU and ADC, and out of MCU, began programming	4	12

COMMENTS AND EXTENDED DISCUSSION

Adam:

- May need to revert to our original LNA (TI LMH6629) and use multiple amplifiers cascaded together to achieve our desired gain & bandwidth properties

Henry:

- It is difficult to simulate the low-noise amplifier circuits Avishek showed us using NI Multisim without having SPICE files or an understanding of how to use s-parameters.
- We can't do many simulations right now and we can't build the circuits Avishek showed us on breadboards without having the parts in from ETG. Hopefully in the next week or so.

Lisa:

- Need to determine our needs for the wireless communication and decide on an option

Vaughn:

- Setup documentation is fairly sparse but gathering sources is going well and a good configuration makes for easier programming.

ACTION ITEMS FOR UPCOMING WEEK

Item	Member(s) Assigned	Desired Completion
Simulate LNA using SPICE files or s-parameters in NI Multisim	Adam, Henry	02/21/2024
Simulate other LNA designs/components in NI Multisim (if Mini-Circuits parts cannot be simulated)	Adam, Henry	02/21/2024
Build amplifier circuits on breadboard with parts ordered from ETG	Adam, Henry	02/28/2024
Find and agree upon suitable ADC and microcontroller	Vaughn, Lisa	02/21/2024
Determine wireless communication method (WiFi vs. BT) based on speed	Vaughn, Lisa	02/28/2024

SUMMARY OF ADVISOR MEETINGS

Weekly Client Meeting (2/7):

- Discussed previous week's findings on LNA, filtering stages, ADC, and Bluetooth
- Discussed new plan of action for LNA moving forward
    - Avishek showed us a suitable LNA circuit with two op amps inside (MAR-3SM+ and MAR-6SM+) and asked us to order the op amps from ETG to replicate the circuit
    - Also showed us a high-gain (multistage), broadband (up to 2 GHz) RF amplifier
- Modified required bandwidth of signal to pass
    - 1 MHz ~ 10 MHz or 2.5 MHz ~ 7.5 MHz (previously wanted 20 MHz - 120 MHz)
- Modified requirements for ADC
    - Single differential input
    - Sampling rate should be in the range of 10 MS/s ~ 50 MS/s, maximum of 100 MS/s
- Discussed tasks & desired deliverables for 2/14 meeting
    - SPICE files for MAR amplifiers
    - Amplifier parts order from ETG
    - Further research into ADC and microcontroller components
    - Research to find the best option for wireless connection (WiFi vs. Bluetooth)

Biweekly Joint Client & Advisor Meeting (2/9):

- Caught up with Prof. Manojit and Avishek on recent accomplishments
- Discussed requirements for updating project website and submitting weekly reports
- Discussed which questions are better for client/advisor vs. senior design instructors/TAs