Project Proposal

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1. Introduction

Analog-to-digital and digital-to-analog communication techniques are the foundation of modern communication systems. Nearly every device used in today's society uses digital, programmable logic to control analog components that interact with real-world physics and limitations. For any student of analog-digital communications, it is extremely relevant to thoroughly understand the design and implementation of a such a system in its entirety.

2. What

> A PAM-based text-messaging system.

For this final project, we will be designing, simulating, and implementing a text-messaging system that uses Pulse-Amplitude-Modulation as the primary ADC technique for encoding and decoding data. The goal for this project is to design the system with a set of realistic limitations, simulate the system using a simulation package like Simulink, and to eventually construct such a system using physical components.

3. Why

The primary goals for this project include:

- Gain practical experience in designing an ADC system
- Understand the practical and physical considerations of implementing a hardware ADC system
- Improve knowledge surrounding radio-frequency design
- Learn more about digital communication protocols (header, sync, data, etc).

4. How

Roughly, the project will have three separate phases:

Design Phase:

> During this phase, we will perform the necessary mathematical steps and generate the relevant assumptions regarding the end-to-end design of the ADC system. This will include speccing out power requirements, error requirements, and thoroughly understanding the underlying ADC techniques.

Simulation Phase:

During this phase, we will shift our focus to simulation the encoding and decoding of a PAM system purely in software. This ensures our assumptions in the design phase are validated and gives us space to tinker without breaking a physical system.

Physical Construction Phase:

In the physical construction phase, we will spec out a part list, identify the various tradeoffs when designing a physical system, capture the schematic, and layout a printed circuit board. We will start by developing the system on a proto-board, and, if time permits, have the end-to-end system manufactured into a final, polished project for showcasing in a portfolio.

5. Timeline

Timeline For the Project

Name	Date
Start Speccing Out System	@Nov 23, 2020
Order Parts	@Nov 25, 2020
Test Out Matlab Simulation of Transmission	@Nov 30, 2020
Start Building Out Hardware	@Dec 3, 2020
Finish Prototyped Hardware	@Dec 9, 2020
Wrap Up Final Iteration and Start Writing Report	@Dec 11, 2020

6. Rough BOM

Proposed Budget

Name	Price	Link
RF Receiver and Transmitter	$10.00	

Aa Name	# Price	Link
N Channel MOSFET - up to debate as we still aren't completely sure if we want to implement PAM and de-PAM in hardware or not	$0.50	https://www.digikey.com/en/products/detail/microchip-technology/LND150K1-G/4902831?s=N4IgjCBcoLQdIDGUAuAnArgUwDQgPZQDa4ArAAwgC6AvjXgEzEgAyAcgCJgUDSYMAcWo0gA
Resistors		Already Owned
Op Amps	$5.00	https://www.digikey.com/en/products/detail/texas-instruments/LM741CN-NOPB/6322
1 uF capacitors	$2.00	

7. Resources

https://www.engineersgarage.com/circuit_design/circuit-design-pulse-amplitude-modulation/

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