Red Pitaya

Thesis

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CHAPTER 1

Introduction

- Rationale (Why?)
- What is the general approach to solve this problem?
- What has been done so far?
- Results of previous work
- What are we going to do?
- What are the contents of this report?

Part I

System Overview

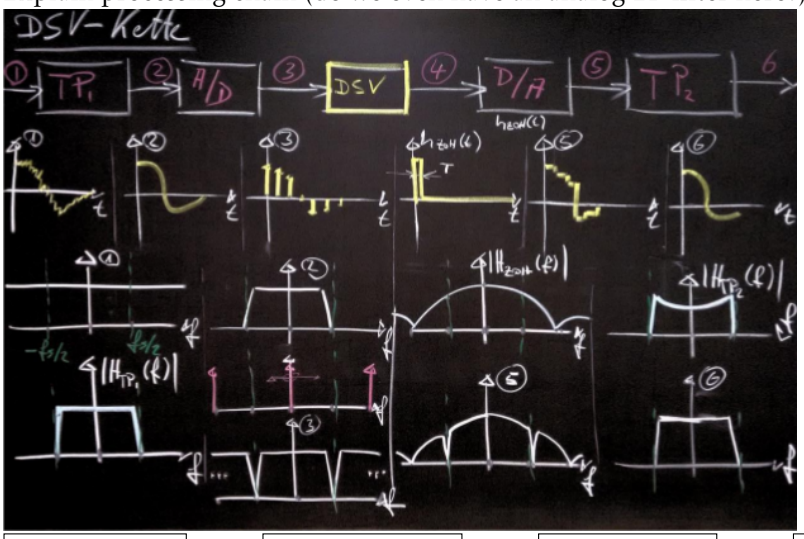
Fundamental question to answer in this part: *What is our system, and what is it good for?*
This information could also go into *Introduction*?
Provide supplementary theoretical background as needed.

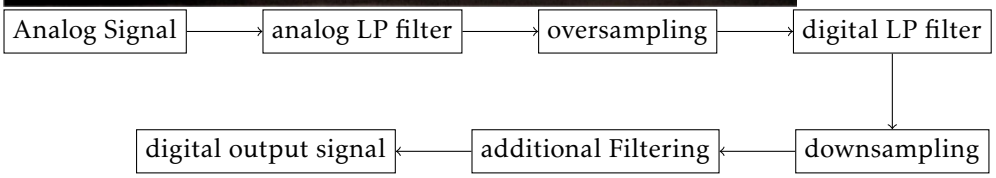
CHAPTER 2

Analog-to-Digital Data Acquisition

- Generic Chapter on some of the basic principles of AD data processing
- Sampling:
  - Sampling in time domain: Multiplication with dirac pulse sequence
  - Frequency doman: Convolution of signal spectrum and dirac pulse spectrum
  - "What is spectrum of dirac pulse sequence?" (dirac pulse sequence)
  - Consequently: Spectrum of sampled signal is repeated for each dirac pulse in the spectrum
  - **Make sure to get distances between pulses as well as heights correct!**
  - Aliasing
  - LP-Filtering (Anti-Aliasing Filter)
  - Potentially mention reconstruction
- Very brief mention of aliasing, low-pass filtering and all that
- Oversampling and Downsampling
- Oversampling: Explain advantage w/r to SNR
- Fancy graphics from Mr. Gut
- How does the Red Pitaya fit into this?
- CIC and FIR filters:
  - Overview (emphasis on CIC)
  - Where to use which, and why?
  - Table/Matrix with advantages and drawbacks for each
  - How does this translate to our system/Why is this important for us?

Explain processing chain (do we even have an analog LP filter here?)





CHAPTER 3

The Red Pitaya Platform

3.1 General Information

General Info about Red Pitaya Project:

- How is the PITA project structured? (logically, license-wise, philosophically)
- Why do we care about this?
- Replacement for scopes (motivation: Why would one use the PITA?)

3.1.1 FPGA

3.1.2 Linux

3.2 Performance and Possible Improvements

- What is the stock solution for downsampling and such? Performance?
- Results of Previous Work
- Consequences for us: Possible paths forward
- System Analysis
- Decision Matrix & Decision
- pgfplots: Ternary diagram?

Part II

Implementation

Implementation can be read independently of previous part, but there should be a red thread from decision to implementation. Deals primarily with design decisions.

Present a diagram with all system components. Then document the components in their respective chapters and sections.

CHAPTER 4

Data Acquisition System

4.1 FPGA

4.2 Kernel Module

```
\begin{tabular}{ll}
    a & b \\
    c & d \\
\end{tabular}
```

Listing 4.1: A `minted` example

CHAPTER 5

Filters

CHAPTER 6

Server

CHAPTER 7

Graphical Front End

Part III

Developer Guide

Documentation for a person who wishes to utilize our system in their work and/or improve upon it?

Make sure to distinguish between *Implementation* and this part. Lines seem a bit blurry to me (R.F.) at the moment (May 17, 2017).

CHAPTER 8

IP Core

Documentation of our FPGA Project (structure, interfaces, registers . . .)

CHAPTER 9

Linux

Kernel module, server

CHAPTER 10

Tool Chain

Vivado, Build Box, ARM Linux, TCL, Makefiles, Libs for building server application

Part IV

User Guide

Documentation for the end user. Primarily concerned with the scope front-end.