The University of Oxford

Engineering Science

Fourth Year Project

PiCom: A Digital Communication Test Bed Based on Raspberry Pi

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Candidate Number:

CANDIDATE NUMBER - ??PAGE COUNT??

Supervisor

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Layout of title page

Trinity Term, 2018

Abstract

Here we shall have our abstract.

Write Abstract

Contents

Todo list

Chapter 1

Introduction

This is what is going on over here.

Figure out how the Intro Chapter will be formatted

1.1 Motivation

Modern digital communication systems are built upon a solid foundation of modulation and coding theory. Over the years, researchers have successfully developed numerous schemes using pen and paper along with computer models. Any such scheme ultimately must be tested on a suitable hardware/software platform to prove their usefulness in practice. Standard software-defined radio test beds can cost thousands of pounds. Although these test beds provide users with advanced development tools, much of their functionality is superfluous to requirement.

A Raspberry Pi is a simple, affordable ARM-based computer module that is capable of interfacing with external peripheral devices through a bank of IO ports. It is also programmable (using Python), and as such has found many uses by hobbyists and electronics/computer engineers in recent years. The purpose of this project is to develop a basic digital communication test bed using two Raspberry Pi modules (one transmitter and one receiver). The test bed will be affordable and the interested student will need to work to a budget to ensure a successful outcome. The project will require a considerable amount of Python programming as well as knowledge of, and a keen interest in, digital communication theory and techniques.

1.2 Background - Literature Review

Explanation of the existing literature [1].

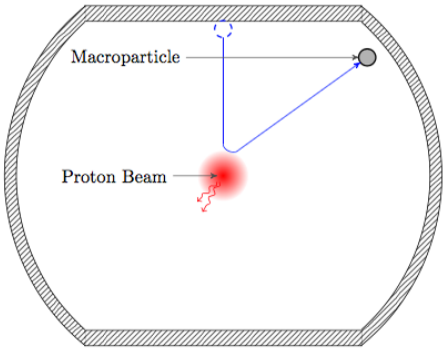

Figure 1.1: UFO Depicted Falling into the Proton Beam

Chat chat chat.

$$\mathbf{F}(t) = (\mathbf{m}(t) \cdot \nabla)\mathbf{E}(t) \tag{1.1}$$

where $\mathbf{E}(t)$ is the electric field in $150\,\mathrm{cT}$.

1.3 (My) Contributions

Chapter 2

The Raspberry Pi

Talk about the RPi.

2.1 Fundamentals

2.1.1 Blablabla

2.2 Architecture

A more in depth study follows in sections **??** and **??**.

2.3 Programming

GitHub link for code at `https://github.com/CamEadie/4YP_PiCom`.

2.3.1 Flowcharts

Chapter 3

Electronic Testing

BLABLABLA.

Write Electro Testing

3.1 Electrical Characteristics of the Raspberry Pi

3.1.1 Max Frequency

3.1.2 Impedance

3.2 Comparing Python and C

3.3 Characterising Components of the Test Bed

Electrical Components:

- Analogue Digital Converter
- Digital Analogue Converter
- Quadrature Sinusoid Generator
- Multiplier/Mixer
- Low Pass Filters

Chapter 4

Communications Testing

Testing Communications and shizniz.

Write Comms Testing

Easily Attainable: Construct a basic wired unidirectional communication test bed complete with a transmitter and a receiver. These units should be synchronised and an appropriate line code (i.e., baseband modulation scheme) should be exploited to convey test data from one device to another.

Medium Complexity: Characterise the performance of the test bed, identifying bandwidth limitations, noise characteristics, and reliability for different modulation and coding schemes. Test specific state-of-the-art modulation techniques recently published in the research literature. (These will be identified by the supervisor).

Advanced: Develop design enhancements that will enable the test bed to be extended to wireless scenarios, including RF and optical wireless systems. Implement these modifications if the budget permits.

4.1 SNR for Different Modulation Schemes

4.2 Error Rate

4.3 Channel Coding

Chapter 5

Conclusion

Here we shall have our conclusion.

Write Conclusion

Bibliography

[1] Neil Dhir, Adam Roman Kosiorek, and Ingmar Posner. “Bayesian Delay Embeddings for Dynamical Systems”. In: *NIPS Timeseries Workshop*. 2017.