Design Specifications
EE542

Hardware

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Table Of Contents

Introduction

A Soft Define Radar (SDR) has multiple applications that use radar signals to measure range, radial velocity and echo location for objects in a defined observed area. Many radar systems encompass a variety of electronic design features such as specific carrier frequencies; transmit durations, antennas, bandwidths and waveforms. This design will be built on a hardware platform that facilitates range and Doppler behavior as test bed. The expectation is that the software can be scaled for any given embedded radar purpose on this hardware platform.

Hardware Block Diagram:

There are four main components of the hardware platform. First, the Radio Frequency (RF) circuit that communicates with the environment. It supports the frequency signals that are propagated into and out of the system. These propagated signals are transmitted and received for processing at various stages of the platform. Second, the Baseband Analog Circuit (BB) allows low frequencies transmit within a defined narrow frequency band without any modulation. Third, this audio card (ADC) interface is expected to convert analog signals to digital signals that are contains that may or may not contain useful data. Fourth, the data receive from the ADC will be computed upon by the microcontroller that will report useful information data.

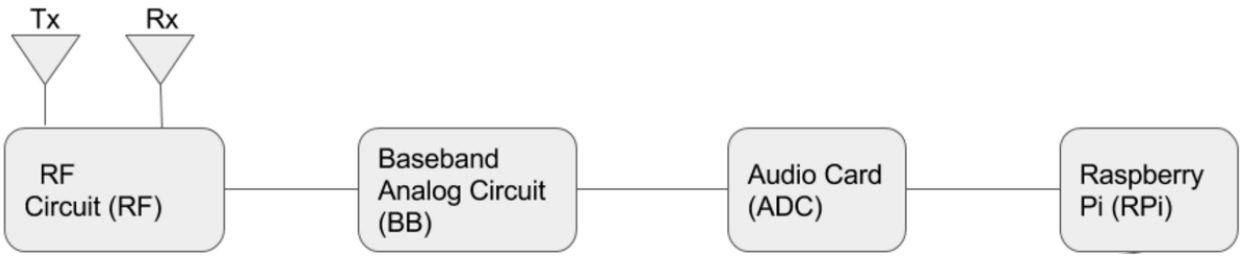

Figure 1: Hardware Platform

System Power Delivery:

- Build prototype power supply.
- Provide power to all circuits for 5V and 12V devices.
- Power supply to operate with a +/- 5% voltage window.
- Verify circuit works electrically.

Figure 2: Equations TBD

RF Circuit Expectations:

- Prototype a circuit that produces a linear ramp which modulates for an amplitude of 2V-3.2V with a ramp rate of 20 ms.
- Prototype a circuit that produces a receive trigger signal synchronized with start of linear ramp.
- Construct antennas.

- Verify circuit works electrically.

Figure 3: Equations TBD

Baseband Analog Circuit:

- Build a prototype circuit basically will filter a continuous wave at 15 KHz this is to prevent aliasing to the ADC input.
- Verify circuit works electrically.

Figure 4: Equations TBD

Audio Card (ADC):

- This will be an off the shelf interface and it must be dual channel.

Figure 5: Equations TBD

Microcontroller (Raspbery PI):

- Deliver sustainable power to the microcontroller.
- Blink a LED when processing the received data. Indicate error if needed.
- Monitor the power supply to ensure a power is good.
- Verify circuits are functioning electrically.

Figure 6: Equations TBD

PCB Design (Non-RF Components):

- PCB stackup.
- Construct schematic.
- Layout the schematic in physical environment.
- Fabricate the PCB and assemble the non-RF parts.
- Verify PCB assembly with electrical test.

Figure 7: Equations TBD

Research Applications

TBD

TBD

TBD

TBD

Figure 8: TBD

Example 1: TBD

Observations

Figure 9: Optimization Detail

Conclusion

Each section of the hardware platform functions as expected electrically and thermally. A Frequency-modulated continuous-wave (FMCW) is transmitted with periodic pulses that has small instantaneous transmit powers.

References

1. TBD

2. TBD