

Remotely Operated Intrusion Alarm

Abstract:

Our design team is working with MIT Lincoln Laboratory to create a Remotely Operated Intrusion Alarm. A simpler version of this project exists, which was previously designed by MIT Lincoln Laboratory as a classroom project. However, that system has many shortcomings such as slow processing speed, low accuracy and poor portability. The goal of this project is to prototype a stand-alone radar system that overcomes these faults. The final system detects an intruder and sends a message with information pertaining to the intrusion to the user via text or email.

Introduction:

Goal:

Create a stand alone intrusion alarm with:

- Near real-time processing
- Ability to communicate remotely

Intended Users/Uses:

- Home Intrusion System
- Enhance Classroom version

Assumptions/Limitations:

- Sampling rate
- RAM on the microcontroller
- Inability to classify object detected

Design Objectives:

• Speed:

- Monitor real-time movement
- Alert user within seconds

• Size:

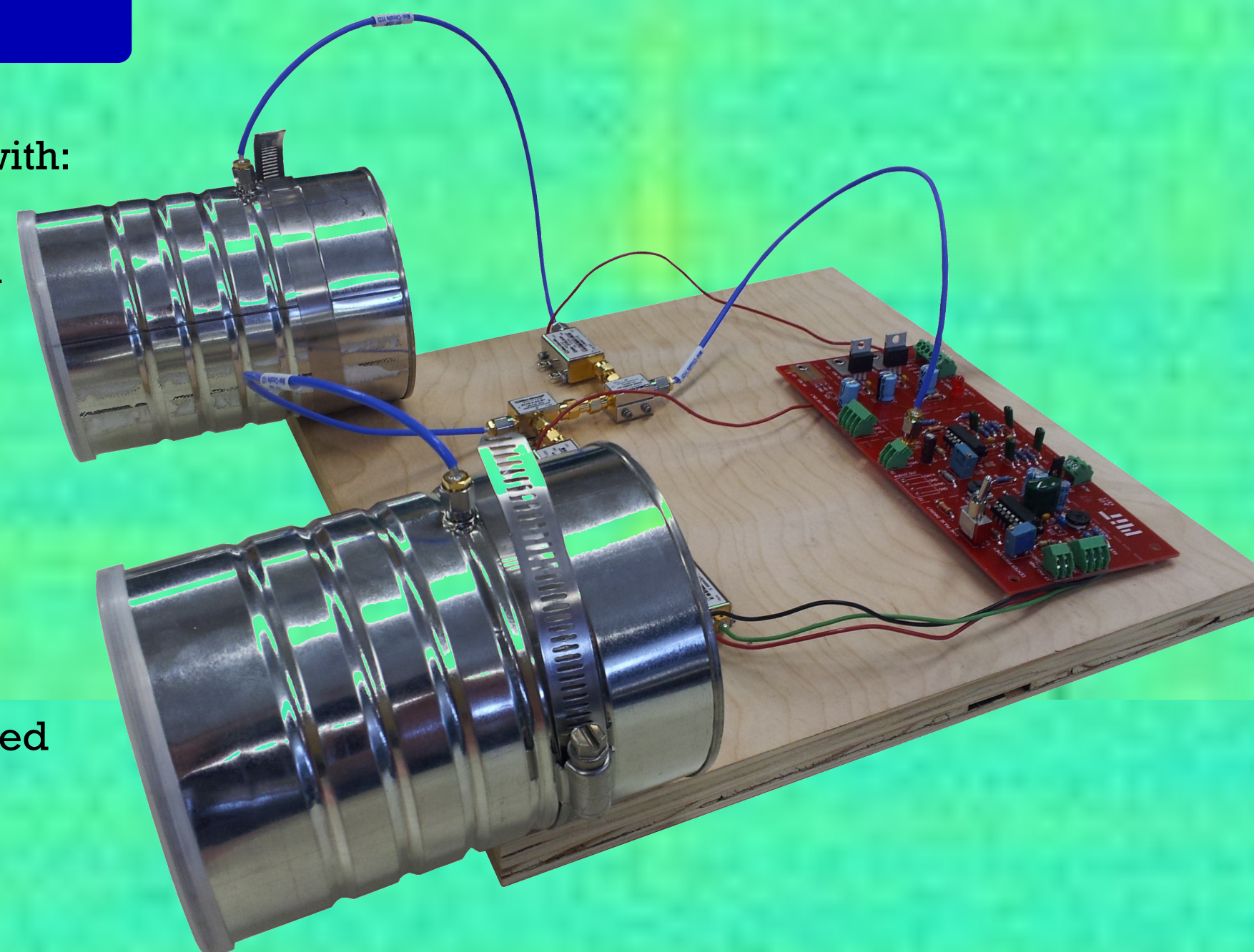
- Small enough to mount discretely in home or office

• Remote Operation:

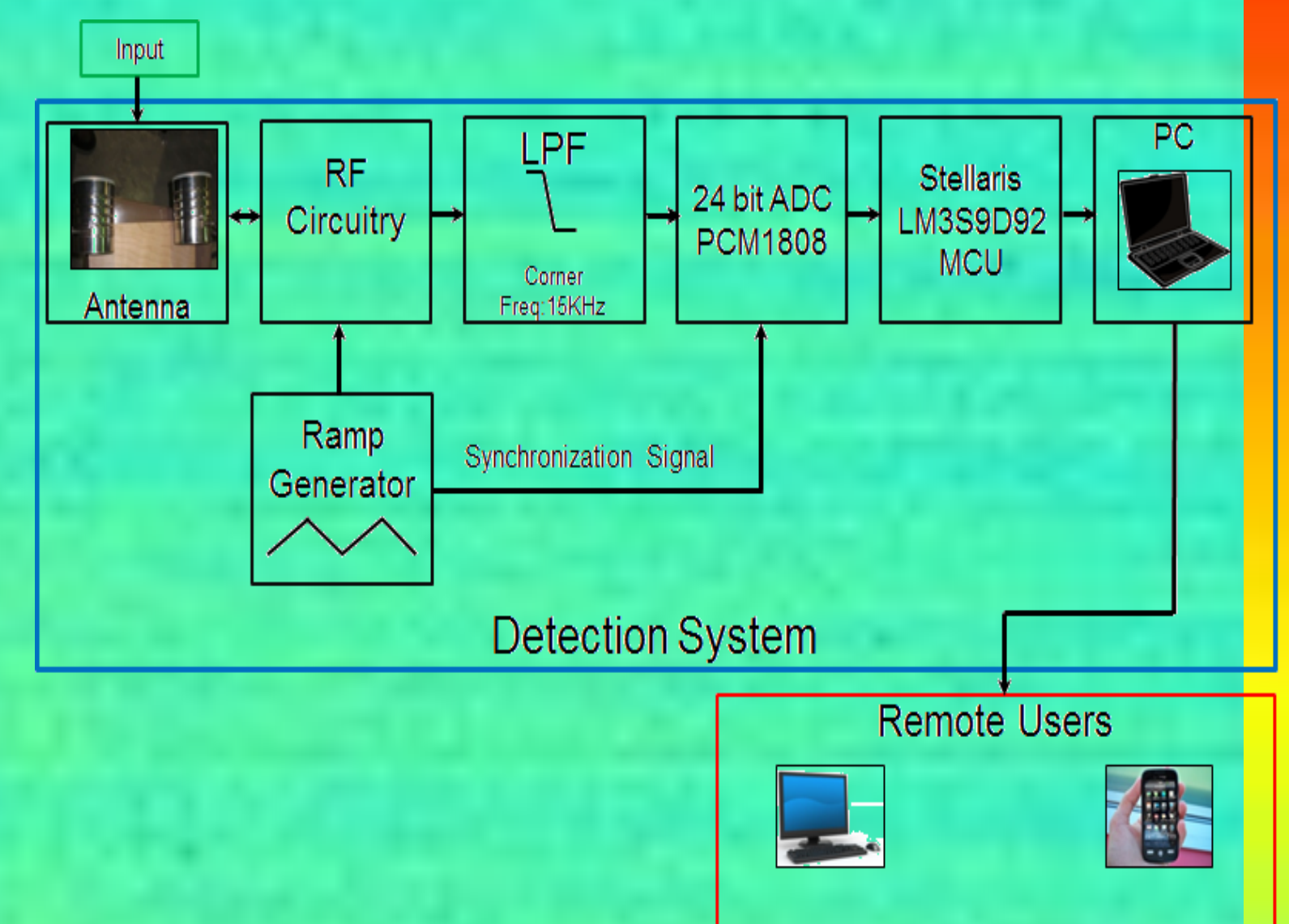
- On board power
- Remote communication

• Reliable Communication:

- Communicate with devices around the world
- Reliable detection, low false triggers



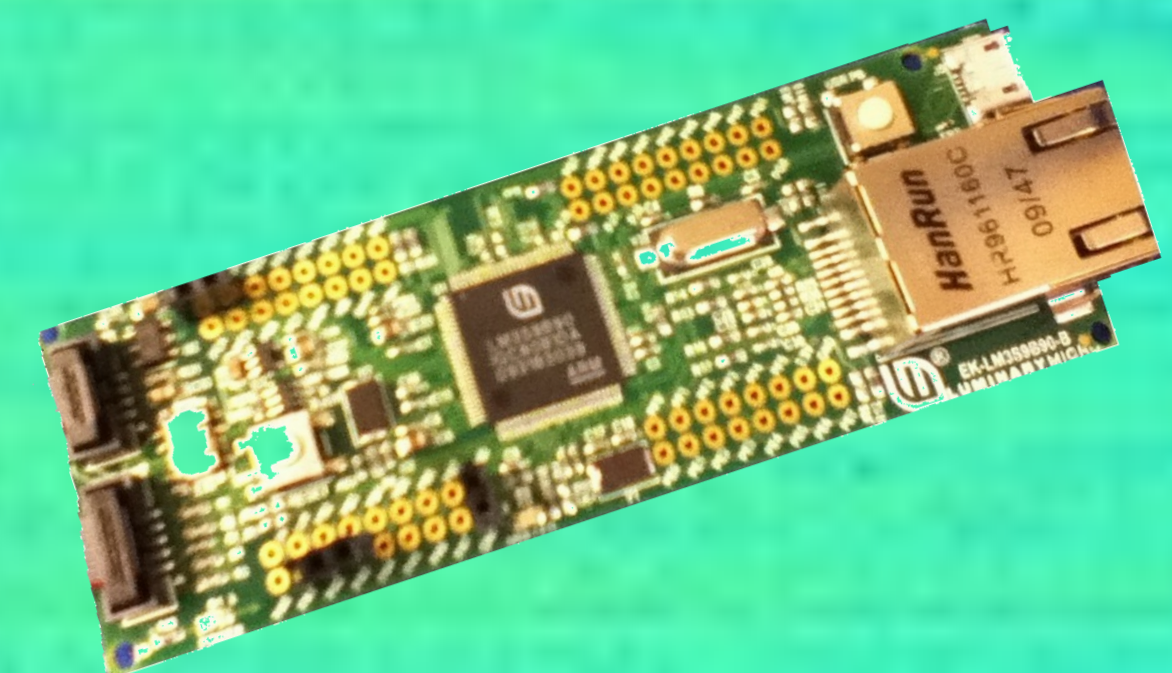
Technical Approach:



1. An FMCW radar gathers range information about objects in the monitored area.
2. Analog data signal is converted to digital signal for processing.
3. Microcontroller forwards digital signal to a PC via Ethernet for processing.
4. The PC computes and compares successive Fourier transforms.
5. Changes in the Fourier transforms correspond to changes in the monitored area and significant changes are interpreted as an intrusion.
6. Intrusion message is sent to remote users.

Final Project Results:

- Information is sent to the DSP via I²S and then forwarded to the PC via Ethernet.
- The PC performs necessary processing. Processing could be done on a microcontroller with more available memory, but the 90kB available memory is not enough to store the data.
- The Fourier transforms and speed and range calculations are successful on a computer-generated frequency sweep.
 - However, the raw signal from the radar has amplitude variations that are not uniform across the spectrum. As such, digital interpretation of the data is inaccurate. If improvements could be made to the hardware to reduce this amplitude variation, the information could be processed.



Budget:

Design:	Amount (\$)
Antenna/Radar	\$ 289.03
Integrated Circuits	\$ 35.80
Discrete Components	\$ 97.75
TOTAL	\$ 422.58



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