Detection and Classification of Drones Using Analog Devices

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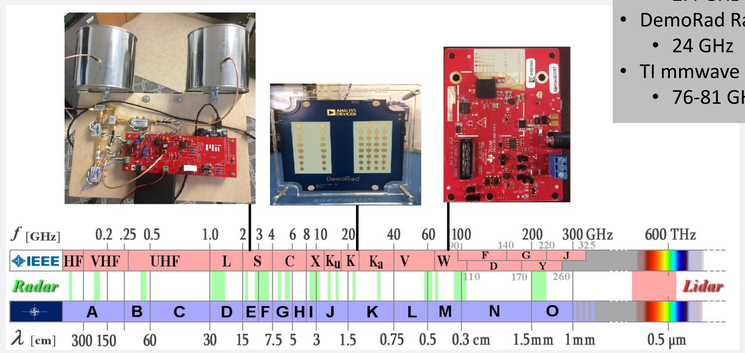
Introduction

Our main research question is whether small, inexpensive, and low-powered radar systems can be used to detect and classify small drones and quadcopters using micro-doppler radar. Such a system could provide the type, size, and origin (commercial or military) of the drone in question, as well as the potential for unique hardware identification. While several commercial systems exist or are in development (Echodyne, 2019) they rely on custom hardware and software tailored for a specific use case. Extending this detection and classification with the use of readily-available low-cost commercial radar systems could provide a cost effective and easily accessible solution.

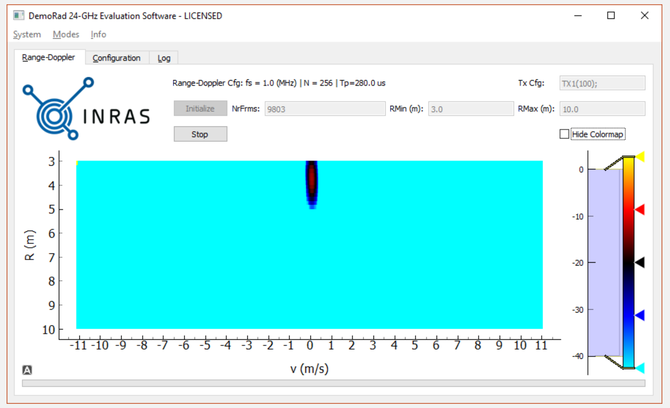
Radar Frequencies



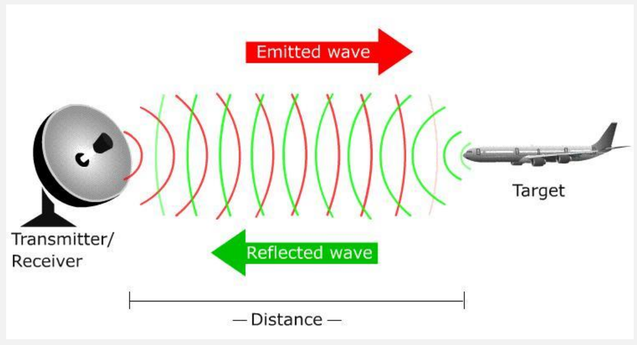
http://www.radartutorial.eu/07.waves/Waves%20and%20Frequency%20Ranges.en.html

- Coffee Can Radar
  - 2.4 GHz
- DemoRad Radar
  - 24 GHz
- TI mmwave Radar
  - 76-81 GHz

Results



How Does a Radar Work?



http://www.electricalelibrary.com/en/2018/05/06/how-radar-works/

Drones

- Parrot Swing
- Parrot Mambo Fly
- Tello
- UFO4000

Discussion

The success of detection of the drones with the DemoRad 24 GHz radar proves that this low powered radar system has some of the abilities needed for the project. However, there was no evidence of distinguishing features of the drones. This could be due to a number of factors, such as axis scaling, low resolution, or lack of sophistication of the programming code.

Project Expectations

The expectation is to determine the range at which detection and classification is possible using a small radar system (Analog Devices Demorad). In particular, we will need to determine the level of detail that can be extracted from the radar signal and how that information be applied to determine the specific characteristics of the drone or quadcopter. Successful completion of the project would be the development of a simple classification system based on the (Radio Frequency) RF output from the radar system.

Acknowledgements

A special thanks to Carol Withers, Lynne Resnick, Members of the SURF staff, Dr. Eric A. Dieckman, Shawn Sandor and Austin Florio for their support for this project.

Works Cited

Echodyne. (2019). Retrieved from https://echodyne.com/

Future Considerations

Manipulation and clarification of the doppler image is a main goal for the future to determine if the resolution can be modified to produce a clearer image in order to determine if the radar can detect distinguishing features of each of the drones. Furthermore, exploring the use of radars with different frequencies could prove to be useful for classification of each drone.