**Background**

UAV capabilities continue to improve as the drone industry and the technology develops. With malicious intent, drones can pose a serious threat to national security as well as personal privacy. Drone Scout is an X-band radar system capable of detecting a small drone and identifying several of its features.

**Design Specification**

- Operates X-band radar at 9 GHz
- Performs Short-Time Fourier Transforms (STFT) on the incoming radar data
- Analyzes the STFT results to determine drone presence in the radar’s target
- If a drone is present, further analyzes the results to extract features of the drone such as propeller tip velocity, blade length, and RPM
- Continually updates display with results

**System Block Diagram**

- Radar signals are amplified and routed to the PYNQ
- Potentiometers allow adjustments to the gain and DC offset of the amplifier circuits
- UI switches and LEDs are routed through the board

**Printed Circuit Board**

- PYNQ-Z1 Development Board
  - Dual-core ARM Cortex-A9 CPU
  - Artix-7 FPGA
  - 512MB DDR3 memory

- Pmod AD1
  - Two channels, 12-bit precision
  - 1 MSPS throughput rate
  - SPI interface protocol

- AD620
  - Gain range of 1 to 10,000
  - Adjustable ground reference voltage at output
  - Potentiometers set the gain and DC offset for one channel

**Feature Extraction Results**

- The plot above shows the STFT, a 2D representation of the radar signal’s frequency magnitudes over time
- By identifying patterns in the STFT, we determine the presence of a drone, along with some of its features

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