Using mmWave radar to detect and count mosquitos

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1. Introduction

Mosquitoes are one of the deadliest animals to humans, acting as vectors for numerous diseases such as malaria, dengue, and Zika virus. Thus, mosquitos monitoring became essential. Traditional mosquito monitoring techniques are often labor-intensive, limited in scalability, and costly. This project aimed to explore the feasibility of using millimeter-wave (mmWave) radar sensors to detect and count mosquitoes. The goal was to design a lightweight, automated, and cost-efficient system capable of supporting disease vector tracking.

2. Objectives and Goals

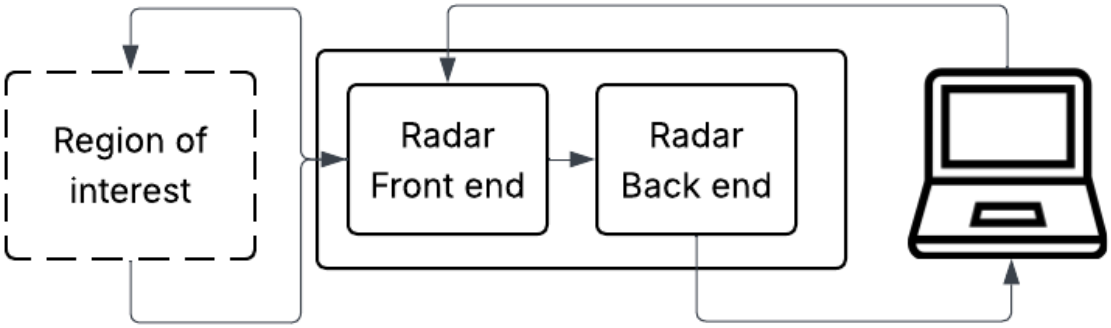
The main project objective is to use millimeter wave (mmWave) radar sensor to detect and count mosquitos as they pass through a selected area. The goal is to build a lightweight, automated, and cost-efficient system capable of monitoring mosquitos using radar, potentially useful in tracking disease vectors.

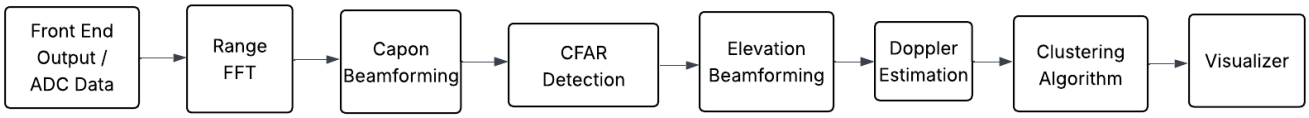
3. Methodology

3.1 System Overview

The system utilizes the IWR6843AoP mmWave radar, which employs **Frequency-Modulated Continuous Wave (FMCW)** signals. The module integrates antennas and a DSP, enabling real-time object detection.

- **Radar Front-End:** Transmits FMCW signals to a designated area.
- **Radar Back-End:** Processes signals to extract features such as position, velocity, and angle.



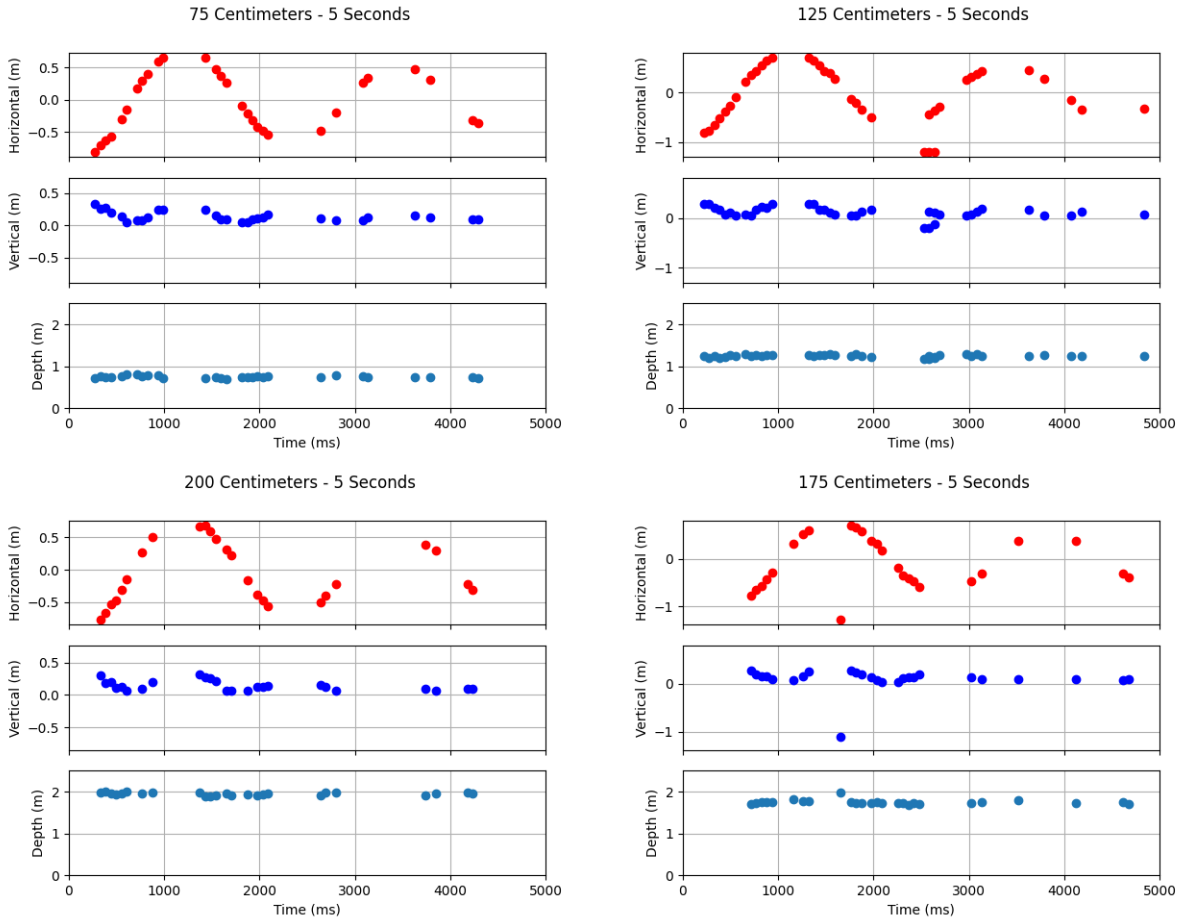


3.2 Experimental Setup

A pendulum-based model was used to simulate mosquito movement. A rod with a screw attached at the end was swung in front of the radar at varying distances. The radar's point cloud outputs were captured and analyzed using custom Python scripts. Multiple trials were conducted to determine the maximum detection range.

4. Results

The figures below show representative outputs from the experimental runs at various ranges. At the start of each measurement, the point cloud appears denser, reflecting higher target velocity during the initial swing phase of the pendulum motion. As the oscillation progresses and the rod loses momentum, the point cloud density decreases correspondingly.



6. Tools and Resources

- **Hardware:** Texas Instruments IWR6843AoP mmWave sensor
- **Software:** STM32CubeIDE, TI mmWave SDK, MATLAB, Code Composer Studio, Visual Studio Code, FFmpeg
- **Languages:** C, C++, Python, Go

8. Conclusion

This project successfully demonstrated that mmWave radar technology can be used to detect and count mosquitoes. The developed system shows promise as a foundation for

automated vector monitoring platforms, potentially reducing reliance on traditional trapping and manual counting methods.

Future work may involve:

- Enhancing detection algorithms to distinguish mosquitoes from other insects.
- Integrating machine learning models for classification and improved accuracy.