# Personal Accomplishments

Since project began, I personally have interviewed three subject matter experts who were all first responders. These interviews were conducted other the phone and provided valuable insights into the problem we are trying to solve. I, along with the rest of my teammates have also conducted research by attending active shooter training. I have also met with Victor Vedovato at 10 Imaging, in order to get some suggestions about the technology we should use. I contributed to the problem definition assignment by writing the first draft of our problem statement and contributing points about our scope and assumptions to the presentation. I helped prepare a presentation for our meeting with the Air Force Research Lab (AFRL) by preparing slides summarizing what I had learned from my interviews, what technologies we were considering using, and our planned schedule for the project. Michaela and I have tested a prospective human sensing technology.

I have been in contact with a DIY radar expert who provided us with some advice on our own radar design before ultimately advising that we buy an off-the-shelf radar board. I have also been in contact with Xethru who makes a radar module designed for presence detection. We are considering buying their development board. I received some data about their signal attenuation when used through walls, and it appears the Xethru will work at least through thinner building materials. I also was advised that we will need to write our own algorithm for detecting targets from a moving platform.

I helped make the decision to order the Ancortek radar over the Xethru radar. I also prepared our project plan slides and presented my share of them. I wrote the concept selection portion of our concept selection report. I described the differences between the technologies we considered and why the one we chose is superior. I reflected on our project plan briefing and prepared a 1000 word report.

From October 26 to November 9, I have created most of our preliminary design review presentation, including adding our concept selection and benchmarking research and reasoning to the PowerPoint. I have also tested the Ancortek radar with their provided GUI and with MATLAB. I was able to use their GUI to demonstrate its through-wall capabilities and created a demo in which we were able to detect a person walking behind a wall. With the MATLAB API I have been able to get raw data from the device, interpret it, and plot it. The data filtering and processing still needs more work to yield satisfactory results comparable to those obtained in our demo with the GUI. This will be my task for the immediate future.

# Planned Activities

In the next four weeks, I will continue experimenting with the MATLAB code in order to get better results from the data processing and filtering. Then I will add these results to our preliminary design review presentation. Then I will create a demonstration of the radar’s functionality with my teammates to show to the Air Force. Once this is done, I can experiment with different algorithms to detect stationary humans behind walls. Also, I can begin working with the MATLAB deep learning toolbox and train a it to recognize a human walking from our radar data. Then I can test the trained AI and confirm its results with a human behind wall.

# Personal Risks, Challenges, and Issues

My personal risks are that I will not be able to write a signal processing code that is able to create results comparable to those achieved by Ancortek. I may not be able to accurately pinpoint a moving object a certain distance. This task is difficult because it requires understanding Fourier Transforms and other signal processing algorithms. I believe I will be able to get this working though because there should be theoretical information about how to process the signal online. Moreover, there are examples provided by Ancortek. The issue is just not all of them work as well as each other and the example with the best performance is not documented and difficult to understand.

# Plan to Mitigate Risks

I plan to mitigate these risks by taking a deep-dive into the example MATLAB code. I will take the time to understand in detail how every line of it works and what it does. This will allow me to gain an understanding of what each change does and how to implement new changes. I will also take the time to research range doppler signal processing online and learn about the theoretical algorithms that are used to do this. That way, I will better be able to understand how and why the MATLAB code works, and I will be able to implement new algorithms of my own based on the theory that I have learned. The MIT course may be useful for gaining this knowledge.