Hello, my name is Randy and I will be sharing what I have done for this ECEN 403 project.

Throughout the course of the semester, I have met my milestones and have performed the following tasks:

1. Generating simulation data of cow movement
2. Researching and implementing optimal sensor placement for triangulation

and

1. Implementing triangulation algorithm under noisy distance measurement conditions.

Firstly, cow movement data was generated by using data from the Starkey Project. This dataset records movement of various animals such as elk, deer, and cattle. However, the data is very sparse as measurements are taken once every 5 days. To improve this, a mean reverting random walk system was fitted. This system, called the Ornstein-Uhlenbeck process is a mean reverting extension of the Wiener process. We chose this model because experts in this field agree that cattle tend to group in cliques. Notice the sophistication of the model as the cattle gradually separate into two cliques in the simulation.

Secondly, Sensor placement was done so that they may provide maximum area of coverage with minimal sensors. As our system requires 3 measurements from different sensors to find the location of an object, a 3-coverage system was implemented. This system had 3 layers of sensors on top of each other. Each producing maximum coverage by placing them sqrt(3) times the effective range of the sensors apart. From this simulation, we found out that with the current sensor range we are getting right now, 250 meters, we would need 2000 sensors to cover a 100 km^2 area. However, if we are able to get a sensor range of 2 km, as advertised by the provider, this number reduces to only 50 sensors.

Thirdly and, finally, triangulation under noisy conditions was done such that the estimate of the cattle’s position is the point of minimum distance between the circles constructed by the distance measurements. This optimization problem is convex, and we can use convex optimization techniques such as gradient descent using the least squares method. Here we chose the non-linear least squares method for this simulation.

I hope you enjoyed my presentation. Please let me know if you have any questions or comments in the comments section below, or, you can contact me through my personal contact, which I will provide below. Thank you!

<https://youtu.be/GD-po7wXn5k>