

# ECE-202 project proposal

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This project aims to implement a kalman filter to estimate the orientation of the Arduino chip (Arduino 33 BLE sense) using the on-board 9DOF IMU (LSM9DS1).

Using euler angles, the orientation of the Arduino chip is defined by three independent angles: yaw, pitch, and roll relative to the world frame (inertial frame).

The reasons for using Arduino 33 BLE sense are:

1. It includes a 9DOF (accelerometer+gyroscope+magnetometer) IMU which is essential to the filter estimation.

The pitch and roll angle can be easily estimated with a complementary filter and a 6 DOF IMU (accelerometer+gyroscope). However, since a 6 DOF IMU doesn't provide the necessary information for estimating yaw position. Even the slightest noise and biases in sensor reading can cause estimated yaw position to drift.

The additional magnetometer onboard the Arduino 33 BLE sense chip provides the critical information (earth magnetic field as a reference) for the filter to de-drift yaw position and output accurate orientation estimation.

2. The additional bluetooth functionality means that the Arduino chip can be deployed remotely and output orientation estimations via bluetooth protocol.

3. Minimal wiring.

Timeline:

Week #	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10
Task	Formulate filter and simulate in MATLAB	MATLAB simulation	Naive implementation on Arduino	Improve code performance	Improve performance and test wireless communication	Final demo
Event			Mid-term presentation			Final presentation