**Research on Visualization Techniques for Sensor Positioning**

As part of our project, we are exploring visualization techniques for accurately representing sensor positions using UWB (Ultra-Wideband) technology. Our system relies on the Qorvo DWM3001CDK board, which uses UWB ranging to determine the distance and angle between a mobile device and a UWB anchor. To effectively display this data, we need a good visualization methods that allows users to understand sensor locations in x, y, z coordinates relative to their position.

**2D vs. 3D Visualization Approaches**

* **2D Mapping:** This method is simpler and can be implemented using Google Maps (Flutter/Android), Leaflet.js (Web), or fl\_chart (Flutter charts). A top-down view of the room can be displayed, showing the user’s position and sensor locations as dots or markers.
* **3D Visualization:** More advanced applications can use 3D rendering to represent sensor positions in a real-world space. Tools like ARKit (iOS), ARCore (Android), and Unity with AR plugins allow users to see UWB anchors as 3D objects overlaid in their environment.

**Libraries & Technologies**

For our Flutter-based frontend, the following technologies can be used:

* Google Maps / Flutter Map**:** To display sensor positions on a 2D map.
* fl\_chart**:** For simple graph-based visualization of distance and angle measurements.
* Three.js / Unity (Future Scope)**:** If a fully interactive 3D space representation is needed.

The choice between 2D and 3D visualization depends on the complexity of interaction we aim to provide. For an initial implementation, a 2D top-down map with real-time position updates is the most practical choice. As we refine our system and scale to multiple UWB anchors, AR-based positioning could provide a more immersive and intuitive way to visualize sensor data. Further research and testing with real-world UWB measurements will help determine the most effective visualization technique.