**Draft Report – Week 2**

**Project Title:** Campus Graph Modeling for Autonomous Navigation

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**Week:** 2

**1. Introduction**

During Week 2, the focus shifted from data collection and graph construction to **validation and testing** of the campus graph model. The key objectives were to verify the accuracy of the coordinate-based nodes, test the connectivity of the graph, and evaluate baseline pathfinding algorithms. This phase ensures that the constructed network is both reliable and usable for autonomous navigation simulations.

**2. Methodology**

1. **Graph Validation**
   * Cross-checked landmark coordinates with satellite imagery and ground-truth references.
   * Verified continuity of paths to ensure no missing or disconnected segments.
2. **Graph Visualization**
   * Used Python libraries (matplotlib, networkx, and geopandas) to generate visual maps.
   * Nodes (landmarks and path points) were plotted with distinct markers.
   * Edges (paths) were rendered with line segments for clear route representation.
3. **Pathfinding Algorithms**
   * Implemented **Dijkstra’s Algorithm** for shortest-path calculations.
   * Implemented **Breadth-First Search (BFS)** to validate reachability between nodes.
   * Compared outputs to ensure consistency across methods.

**3. Results**

* **Connectivity Check:**
  + All major landmarks were found to be reachable from the Main Gate.
  + No isolated subgraphs were detected.
* **Visualization:**
  + Generated a preliminary **campus navigation map** showing key landmarks and interconnecting paths.
  + Verified that plotted routes align with actual campus pathways.
* **Shortest Path Testing:**
  + Example 1: *Main Gate → Hostel*
    - Distance: ~540 m (via In-Out Path + Hostel connector).
  + Example 2: *Block A → Block B*
    - Distance: ~180 m (via A–B Connector Path).
  + Example 3: *Food Court → Cricket Ground*
    - Distance: ~320 m (via Food Court Path + Sports Connector).

**4. Challenges**

* Some path nodes were too densely packed, requiring **path simplification** to avoid redundant edges.
* Minor discrepancies in coordinate precision were observed between overlapping paths.
* Visualization needed adjustments for better readability when nodes were clustered.

**5. Week 2 Deliverables**

* Verified correctness of landmark and path node coordinates
* Validated connectivity across the campus graph
* Implemented and tested baseline pathfinding algorithms (Dijkstra, BFS)
* Generated preliminary graph visualizations
* Documented results for further refinement

**Appendix A – Graph Visualization**

Png in file