

# Project Proposal

GEOPATH VISUALIZER

AI PROJECT

DATE: 18/12/2025

## Project Title

**GeoPath Visualizer:** AI Search Algorithms for Real-World Navigation.

## Team Information

- **Team Name:** The Wayfinders
- **Team Size:** 6 members
- **Course:** Introduction to Artificial Intelligence
- **Level:** 3

## Project Description

We will develop an interactive application that implements and visualizes search algorithms on real-world maps. The application will solve pathfinding problems between two locations using different search strategies, allowing users to see how each algorithm explores and finds paths.

# Problem Domain

We selected **Real-World Pathfinding** as our problem domain. We will use real city maps from OpenStreetMap to create navigation problems. Users can select any location worldwide, set start and end points, and watch algorithms find paths through actual road networks.

## Algorithms to Implement

### Uninformed Search:

1. Breadth-First Search (BFS)
2. Depth-First Search (DFS)
3. Depth-Limited Search (DLS)
4. Iterative Deepening Search (IDS)
5. Uniform-Cost Search (UCS)

### Informed Search:

1. **A Search\*** - We will design Euclidean distance heuristic for geographical coordinates

# Implementation Details

## Technology:

- **Language:** Python
- **Libraries:**
  - Tkinter (for GUI)
  - TkinterMapView (for maps)
  - OSMnx (for map data)
  - NetworkX (for graphs)

## How It Works:

1. User selects a location (city)
2. System downloads map from OpenStreetMap
3. User sets start and end points on map
4. User selects algorithm to run
5. System visualizes algorithm finding path
6. Results show path and performance metrics

## Visualisation Features:

- Real map display
- Color-coded nodes (path)
- Step-by-step execution
- Performance statistics

# Evaluation Metrics

We will compare algorithms based on:

- Path length (shorter is better)
- Execution time (faster is better)
- Nodes explored (fewer is better)
- Solution quality (optimal or not)

## Expected Challenges

1. Handling large real-world maps
2. Making algorithms efficient enough
3. Creating clear visualisations
4. Designing good heuristic for A\*

## Team Work Distribution

- Algorithm Implementation: 4 members
- Map Processing: 2 members
- GUI Development: 2 members
- Testing & Documentation: 6 members

# Timeline

- **Day 1-2:** Setup and basic algorithms (BFS, DFS)
- **Day 3-8:** Advanced algorithms (UCS, A\*) and GUI
- **Day 8-10:** Integration, testing, and documentation
- **Final Submission:** December 19, 2025

## Deliverables

### 1. Source Code:

(  GitHub - youssef-darrag/real-world-path-visualizer )

### 1. README File with instructions (In the Repo)

### 2. Project Report (PDF) with:

- Implementation details
- Algorithm analysis
- Performance comparison

### 3. Team Contributions document

## Learning Outcomes

- Hands-on experience with AI search algorithms
- Understanding algorithm trade-offs in practice
- Experience with real-world data processing
- Team project development skills

# Why This Project?

This project applies theoretical search algorithms to practical, real-world problems. It makes abstract algorithms concrete through visualisation. Users can see exactly how different search strategies work on actual maps, helping understand their strengths and weaknesses.

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**Date:** December 2025

**Course:** Introduction to Artificial Intelligence