UAV Path Planning Based on Dynamic Programming Algorithm On Photogrammetric DEMs

TEAM MEMBERS :

23PD05 - DANUSHREE R S
23PD21 - NACHAMMAI S N
23PD32 - RITUJAA B G

In this project, Dynamic Programming methods are applied to artificially created Digital Elevation Models (DEMs) to create a framework for autonomous Unmanned Aerial Vehicle (UAV) path planning. The method tackles the problem of identifying the best, collision-free routes in 3D landscapes.

The Diamond-Square technique, which generates realistic elevation data with adjustable roughness parameters and predefined obstacles like mountains and hills. Both 4-connected and 8-connected movement patterns are supported by the path planning, which uses Forward Dynamic Programming with a cost function that accounts for slope penalties, elevation change penalties and distance.

Three stages of optimisation and smoothening are applied to the resulting paths: redundant point elimination, cubic spline interpolation and simple smoothing using neighbour averaging.

Plotly was used to create an interactive visualisation system that offers cost maps, optimised routes and 2D and 3D landscape representations. Through a widget-based interface, users may modify parameters such as slope penalties, elevation weights, start positions, goal positions, smoothing factors and terrain roughness.

With waypoint reductions of about 40–60% and shorter travel distances by 10–20%, the path planning is better after optimization. This project provides a practical solution for UAV navigation in 3D environments by providing efficient path planning.

AUTHORS AND AFFILIATIONS:
A. Mokrane, A. Choukchou Braham, and B. Cherki, “Laboratoire d’Automatique de Tlemcen (LAT), University of Tlemcen, Tlemcen, Algeria.”