Richard Lung & Tomer Karmazin

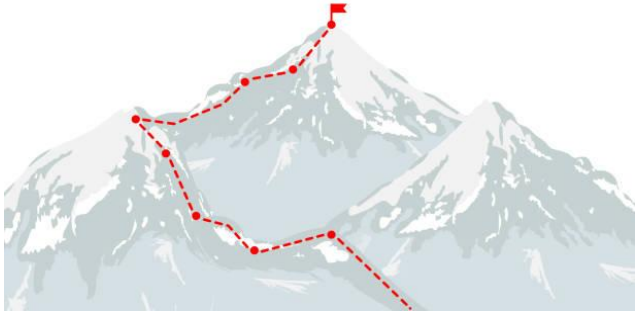

# OffRoad Pathfinder (ORP)

Create Your Perfect Adventure.

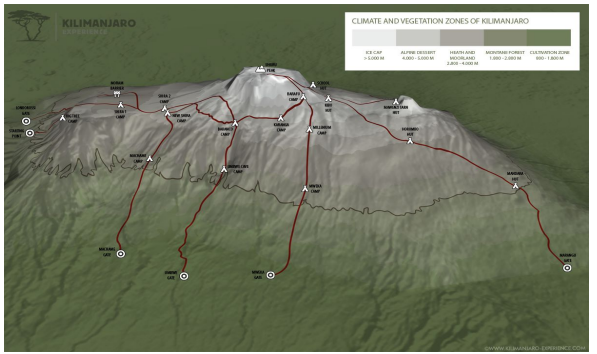
# Problem

Ever gone hiking, off-roading, or exploring the wild wonders of Earth? Chances are, you didn't just dive into the Amazon without a plan, right? But let's face it—route planning can be a pain. Safe, short, easy? It takes hours, days, weeks (even months!) to figure out.

Enter ORP! With just a few clicks, you'll have the dream route you've been looking for—safe, simple, and sorted. Adventure made easy!

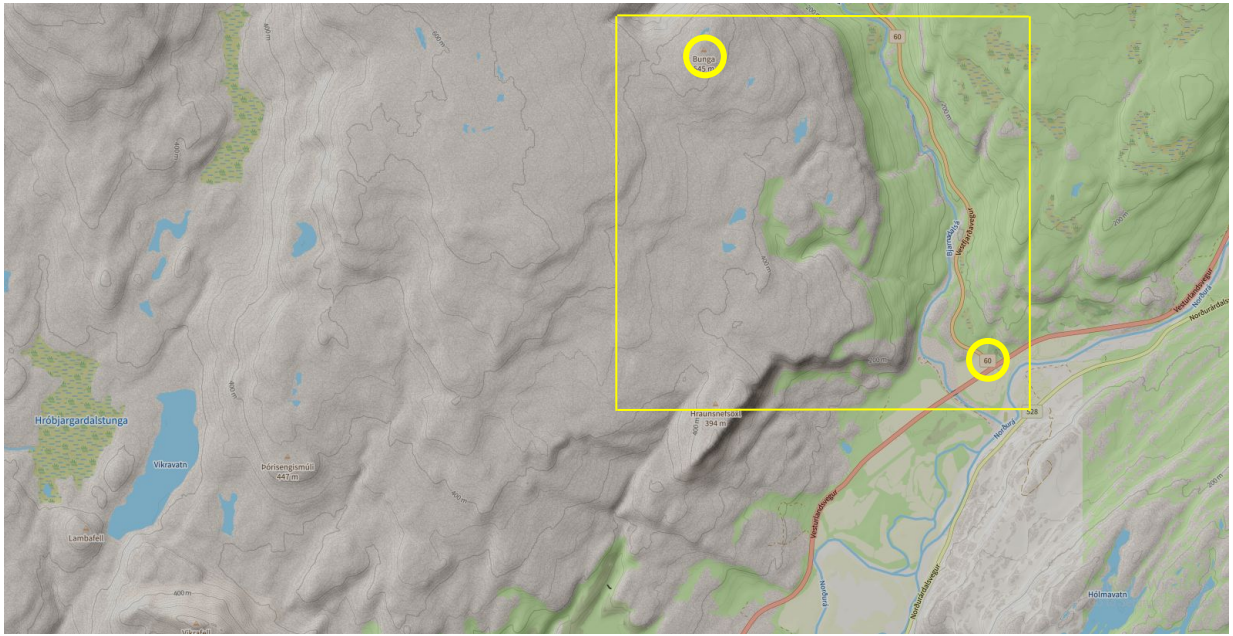


Mt. Kilimanjaro possible routes.



# Solution Demo - Manual

Without ORP (Manually):



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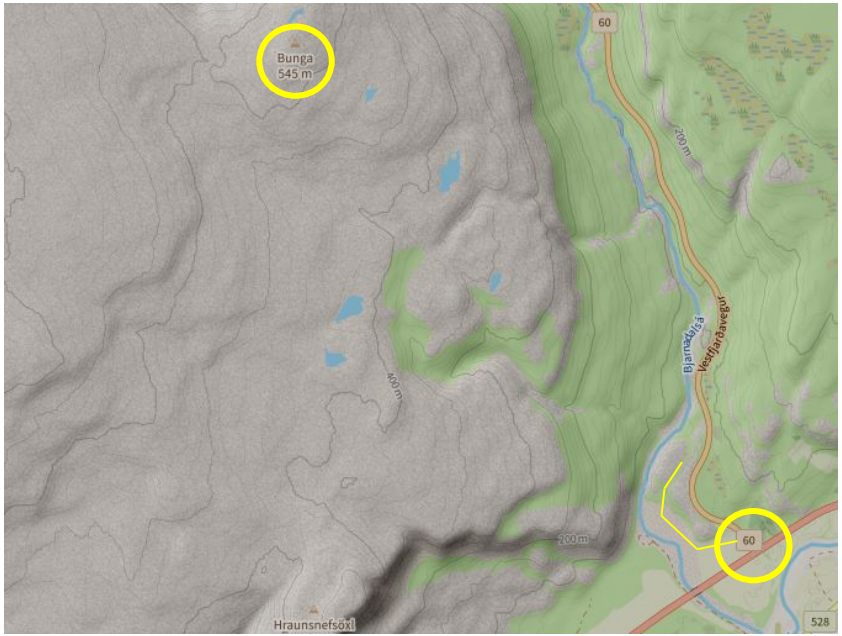
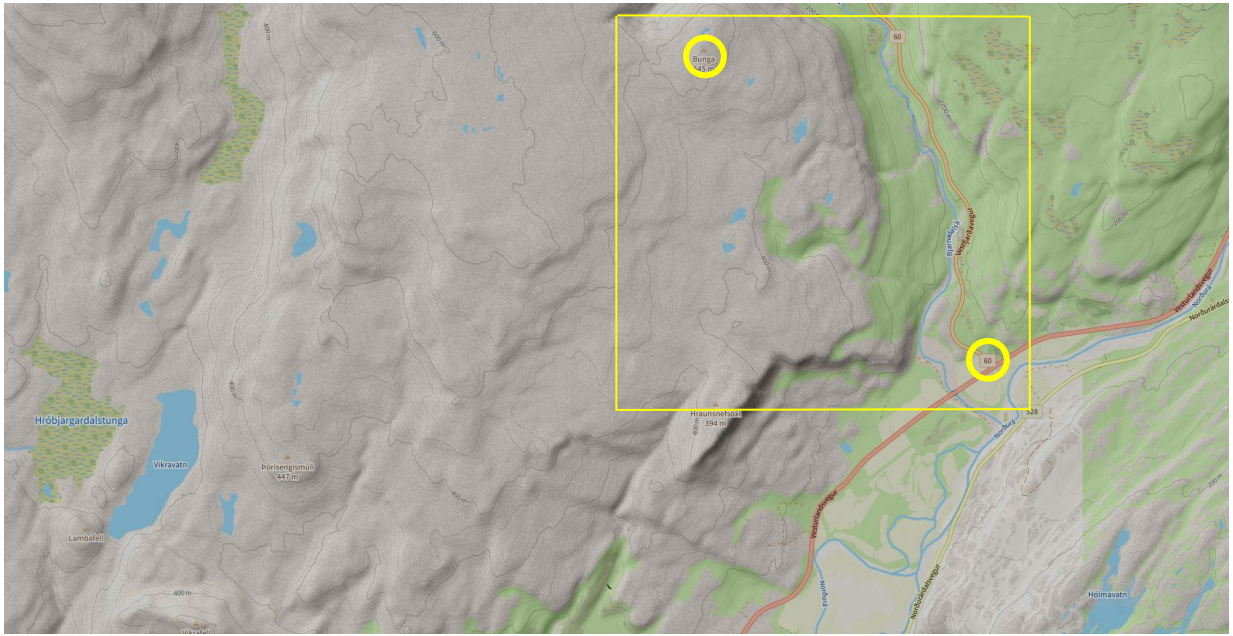



Tidious…
Right?

# Solution Demo - ORP

With ORP:



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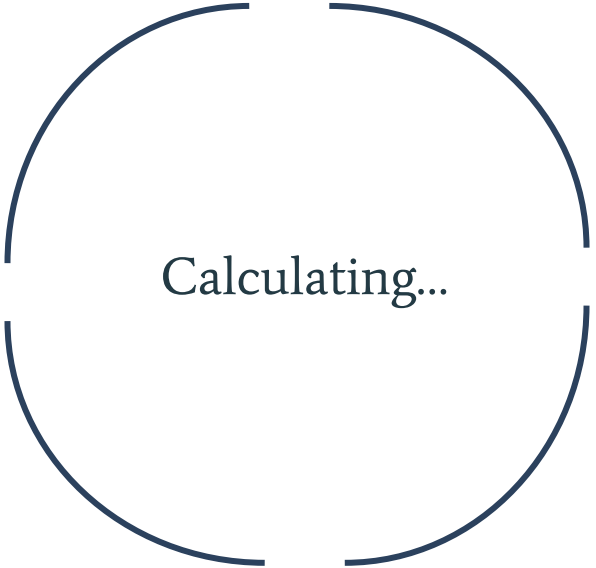
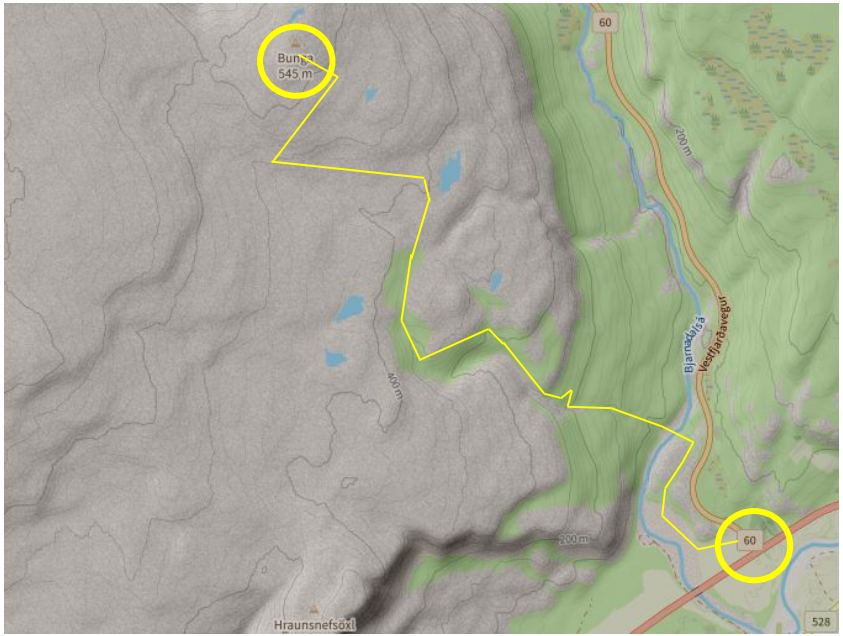


# Solution - ORP

With ORP:

**Route's Diagnostic:**

- Total Distance: 12.2 km
- Sharpest Inclination: 28°
- Lowest Inclination: 12.6°
- Mean Inclination: 16.5°
- Elevation Gain: +478 meters



# Competition


**Maps.me** does allow route calculation, but it's mainly focused on existing paths like driving, cycling, and hiking routes. It offers basic route planning but doesn't create routes through completely uncharted or off-road terrain. Routes are typically calculated based on mapped trails.

**Gaia GPS** allows users to create custom routes, but it doesn't automatically calculate routes in the way Google Maps does for driving. Instead, you manually select waypoints and plot routes for outdoor activities like hiking, backpacking, and off-roading. It's more of a manual planning tool than an auto-routing navigation system.

**Amud Anan** doesn't offer route calculation in the conventional sense. It allows users to explore existing trails and points of interest, but you cannot input starting and ending locations to automatically generate routes. The app is more focused on providing information about trails and places along the way.

# Literature Review


Lv, Zhihong, et al. "Research on Global Off-Road Path Planning Based on Improved A* Algorithm." ISPRS International Journal of Geo-Information 13.10 (2024): 362.

--- A* and its use to find paths on low res satellite photos.

Qureshi, Ahmed Hussain, and Yasar Ayaz. "Intelligent bidirectional rapidly-exploring random trees for optimal motion planning in complex cluttered environments." Robotics and Autonomous Systems 68 (2015): 1-11.

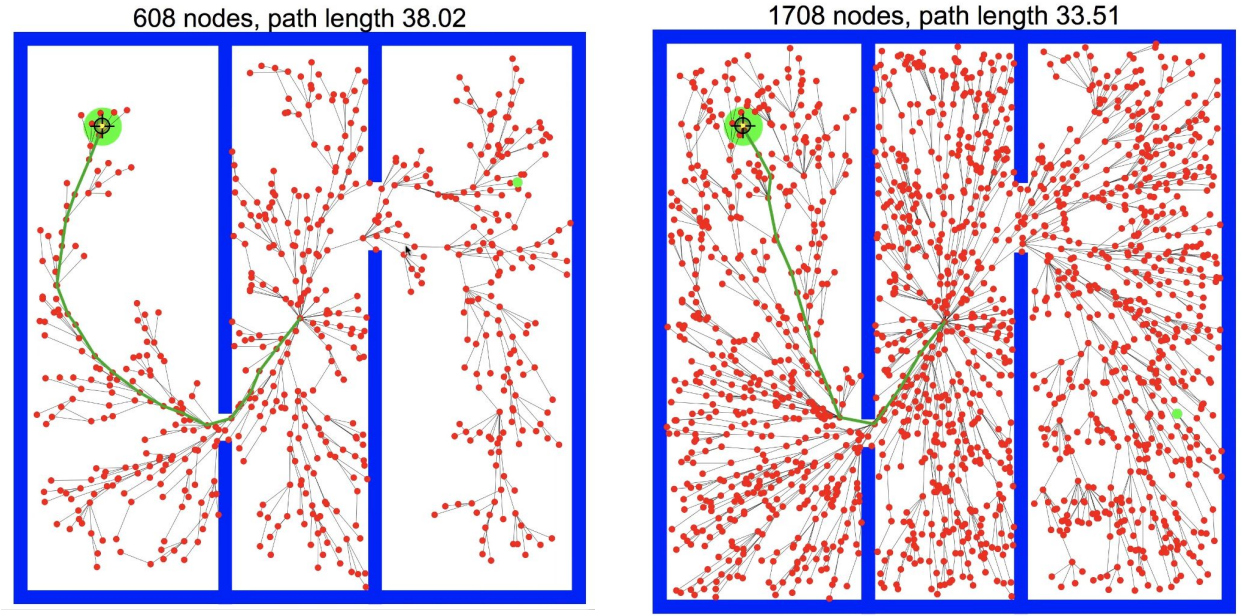
--- Use of RRT*, improvement on A*.

Xu, Yuexue, et al. "Extracting terrain texture features for landform classification using wavelet decomposition." ISPRS International Journal of Geo-Information 10.10 (2021): 658.

--- Use of DEMs to extract terrain features, such as height, angle between two points and classification. Method used is called “Discrete Wavelet Transform” (DWT).

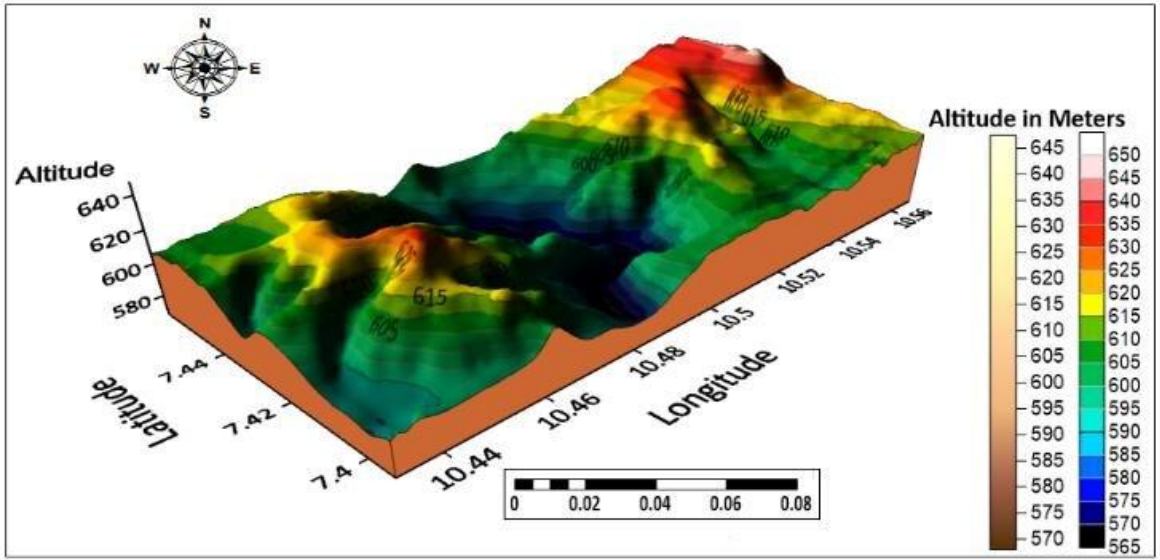
# Literature Review

**RRT* Algorithm:**



# Literature Review

**DEM:**



# System Requirements

ORP

**Functional Requirements:**

- **Create Route between Start & End points and present it visually.**
- **Display Route Characteristics (Distance, Inclination, Elevation Gain…)**
- **Create Trip as a collection of Routes.**
- **Upload files specific location for Route planning.**
- **Provide filter options for Routes and Trips we already have.**
- **Share Routes and Trips on social media.**

**Non- Functional Requirements:**

- **Create a Route under 7 seconds/ Trip Instantly.**
- **Each Route max 5 points of interest, 20x20 km max area of search (might be changed in the future).**
- **Handles different file sizes.**
- **Store data information for future uses & ease of access.**

# Detailed Design

Web application : Client-Server architecture

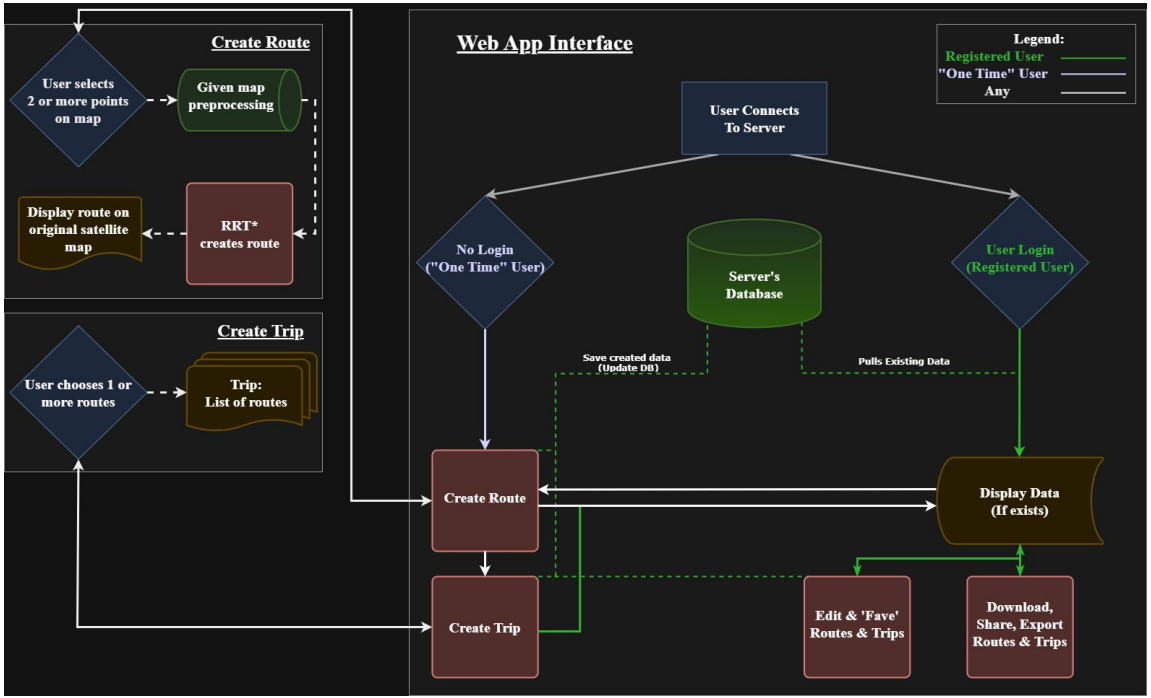
- HTML ,CSS, JavaScript for frontend purposes & API from relevant sources for map presentation.
- PostgreSQL/MongoDB as a database for both user data and path calculations relevant data.

Path calculation and DEM :

- Python for satellite image preprocessing (ready image for RRT*). - Boundaries, ‘walls’.
- Python for Algorithmic calculation using RRT*/IB-RRT*.
- Display map with calculated path of Route drawn on the map.

# Detailed Design

ORP




# Thank You!

Questions?