

# Best Bike Paths (BBP)

Road Condition Monitoring & Route Planning System

Kaifei Xu · Shinuo Yan · Yanglin Hu

Politecnico di Milano - Software Engineering 2

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# System Overview

## Architecture

**Frontend** - Streamlit + Folium Maps

↕ REST API

**Backend** - Python + FastAPI

↕

**External** - OSRM Routing |  
OpenStreetMap

## Live Demo

### Cloud Deployment

<https://huxuyan-fq8a9pdhxknpmuird65kfg.streamlit.app>

## Key Features

- Road condition monitoring & reporting
- Intelligent route planning with quality scores
- Community-driven weighted voting system
- Privacy-by-design (GDPR compliant)

## Dashboard

Total Segments

0

Total Reports

0

Total Trips

0

Total Active Users

0

## Current Weather ↔

Condition

Clear

Temperature

18.9C

Wind Speed

5.5 km/h

Rain Chance

0%

Great conditions for cycling!

## Key Metrics

- Total Segments
- Total Reports
- Total Trips
- Active Users

## Live Weather

- Temperature & Conditions
- Wind Speed
- Rain Chance
- Cycling recommendation

# Route Planning - Input

## Route Planning

Plan your cycling route with real road geometry

### Origin

Search origin location

Search

Latitude: 45.4781, Longitude: 9.2275

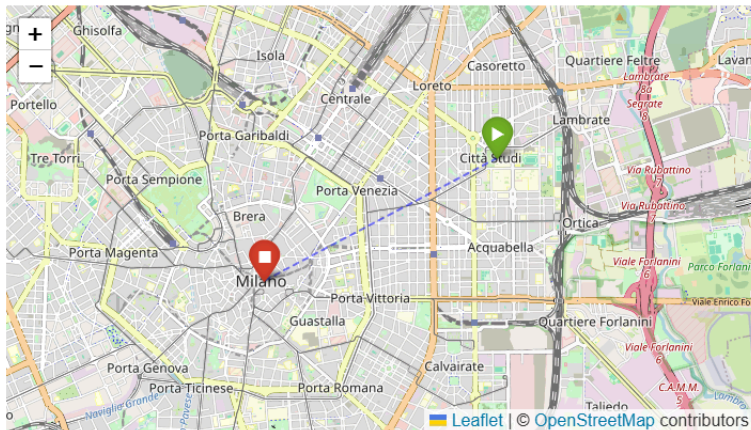
### Destination

Search destination

Search

Latitude: 45.4642, Longitude: 9.1900

Click on the map to set location, or drag the markers



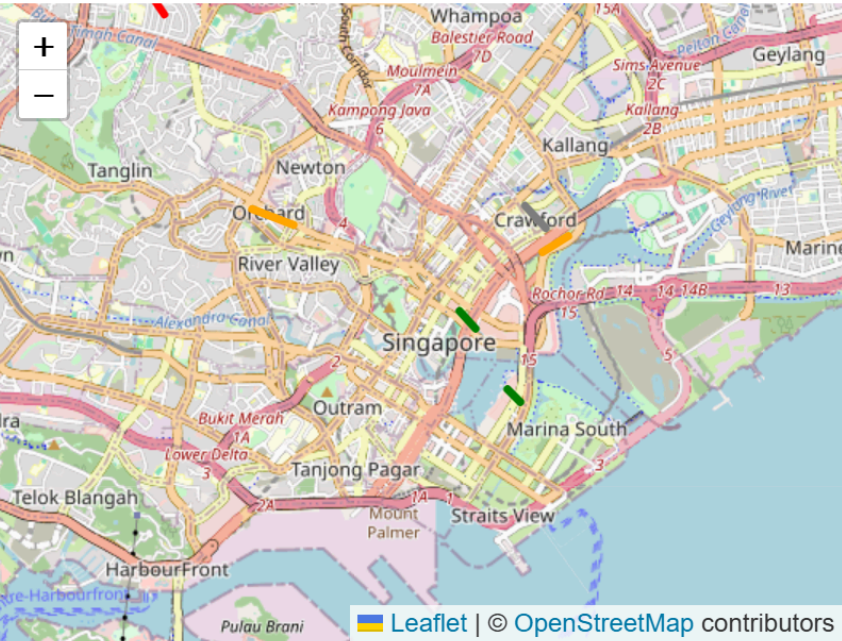
## How to Use

1. **Search** origin
2. **Search** destination
3. Select **mode**:
  - Safety First
  - Shortest
  - Balanced
4. Click **Find Routes**

## Weather

Sunny, 19.1°C  
“Great for cycling!”

## Road Segments



### Segment List

## Features

- **Interactive map** with markers
- **Create segments** via search
- **Track obstacles**

### Add New !

Road Name

e.g., Via Roma

Start Point

Search place

e.g., Via Roma 1

Search

45.4780, 9.2270

End Point

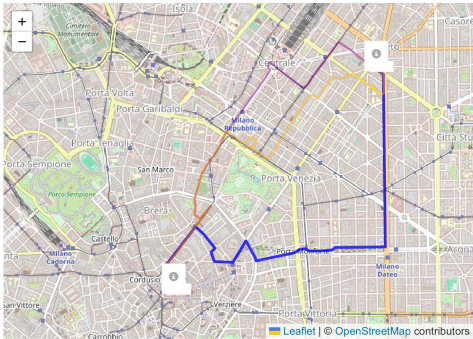
Search place

e.g., Via Roma 1

## Status Colors

●	Optimal
●	Fair
●	Poor
●	Maintenance

# Route Planning - Results



## Route Details

Route A: Recommended, Best Surface		
Distance	Duration	Road Quality
4.95 km	10 min	100/100
Tags: Recommended, Best Surface		
Route B: Alternative, Best Surface, Fastest		
Distance	Duration	Road Quality
4.42 km	10 min	100/100
Tags: Alternative, Best Surface, Fastest		
Route C: Alternative, Best Surface		
Distance	Duration	Road Quality
4.95 km	12 min	100/100
Tags: Alternative, Best Surface		

Route Options: Recommended · Best Surface · Fastest · Alternative

# Road Segments - List View

Sign Out

NAVIGATION

Dashboard

Route Planning


Segments

Reports

Trips

Auto Detection

Settings



Leaflet | © OpenStreetMap contributors

Segment List

	ID	Road Name	Status	Obstacle
0	1	Bayfront Avenue	Optimal	-
1	2	Raffles Boulevard	Optimal	-
2	3	Nicoll Highway	Fair	-
3	4	Beach Road	Under Mainten	pothole
4	5	East Coast Park Connector	Optimal	-
5	6	Orchard Road	Fair	-
6	7	Bukit Timah Road	Poor	rough surface
7	8	Tampines PCN	Optimal	-

45.4780, 9.2270

End Point

Search place

e.g., Via Roma 100, Milano

Search

45.4790, 9.2280

Status

Optimal

Obstacle

e.g., pothole

Create Segment

Searchable table - ID, Road Name, Status, Obstacle Type

# Condition Reports - Community Voting

Sign Out

VIGATION

Dashboard

Route Planning

Segments

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Auto Detection

Settings

Select Segment

Bayfront Avenue (ID: 1)

Road Condition

Suboptimal

Medium

Optimal

Notes

...

Submit

Share ☆ ✎ ↺

Select Segment

Bayfront Avenue (ID: 1)

No reports yet

< Manage a

## Submit Reports

1. Select segment
2. Slide condition bar
3. Add notes (optional)
4. Submit

## Weighted Voting

< 7 days	1.0
7-30 days	0.7
> 30 days	0.3
+Confirm	+0.2



# Trips & Auto-Detection

BBP Road Monitor

Language

English

alice

Logged in

Sign Out

NAVIGATION

Dashboard

Route Planning

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Reports

Trips

Auto Detection

Settings

BBP Road Monitor v2.0

Backend: <https://huoyan.onrender.com>

## Trip Management

Start New Trip      Your Trips

Origin

Search origin

e.g., Milano Centrale

Search

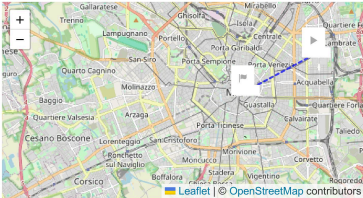
Destination

Search destination

e.g., Duomo Milano

Search

Drag markers or click map to adjust locations



Origin: 45.4780, 9.2270

Destination: 45.4640, 9.1900

Create Trip

BBP Road Monitor

Language

English

alice

Logged in

Sign Out

NAVIGATION

Dashboard

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Reports

Trips

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Settings

BBP Road Monitor v2.0

Backend: <https://huoyan.onrender.com>

## Automatic Road Condition Detection

Real-time road surface analysis using device sensors

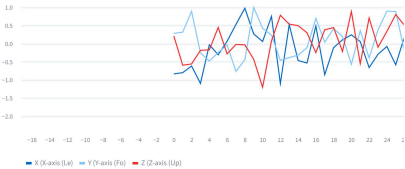
Current Location

GPS Active  
Lat: 45.660200      Lon: 9.122700  
Speed: 0 km/h      Altitude: N/A m

Sensor Data

X-axis (Left/Right) | Y-axis (Forward/Back) | Z-axis (Up/Down)

No sensor data recorded yet



Peak Acceleration  
1.27 m/s<sup>2</sup>

Road surface is smooth

Submit Detection

Apply to Segment

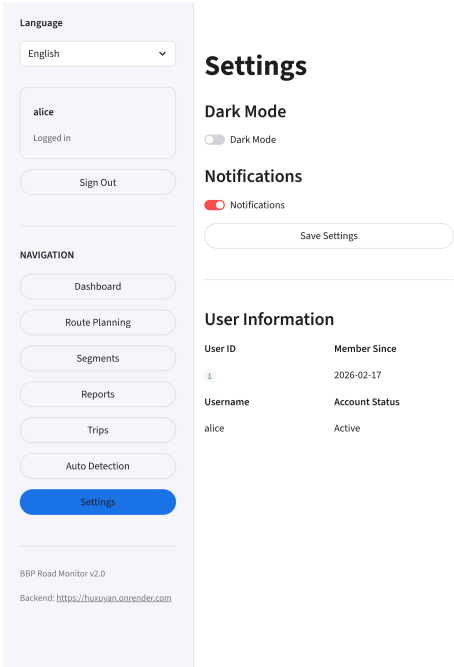
Bayfront Avenue (ID: 1)

Submit Detection

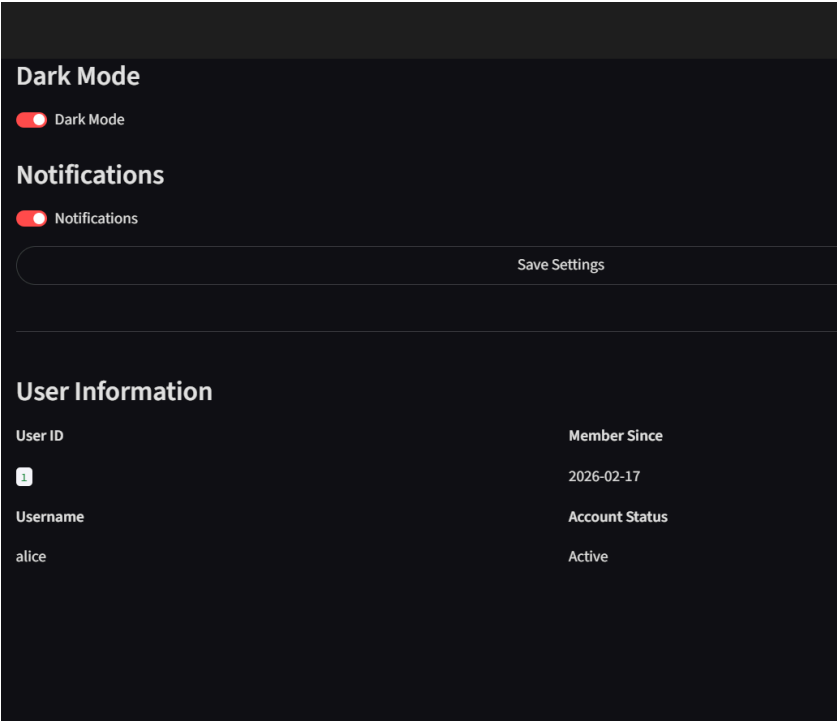
**Trip Management** - Create trips, track cycling journeys with privacy protection ( $\pm 150\text{m}$  blur)

**Auto-Detection** - GPS + Accelerometer detects bumps automatically

# User Settings - Personalization



*Light Mode*



*Dark Mode*

## Options

- **Language:** EN / 中文 / IT
- **Theme:** Light & Dark
- **Notifications**
- **Profile** editing

## Privacy

- Location blur:  $\pm 150\text{m}$
- Coord truncation
- GDPR compliant

# Summary & Highlights

## Features

- Dashboard
- Road Segments
- Condition Reports
- Route Planning
- Trip Recording
- Auto-Detection
- User Settings

## Tech Stack

- Python 3.10+
- FastAPI
- Streamlit
- OSRM Routing
- Folium/Leaflet
- OpenStreetMap

## Privacy

- Location blur  $\pm 150\text{m}$
- Coord truncation
- Trip sanitization
- GDPR compliant

## UX Design

- 3 Languages
- Dark/Light Mode
- Mobile Ready
- Geocoding Search

# Thank You!

Questions & Live Demo

Try it now: <https://huxuyan-fq8a9pdhxknpmuird65kfg.streamlit.app>

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