ReLeaf

AI-Powered Urban Forestry Assistant

Your Smart Tree Planting Advisor for Kuala Lumpur & Selangor

🎯 Problem Statement

Urban areas in Malaysia face:

- **Limited green spaces** and tree coverage
- **Difficulty identifying** optimal planting locations
- **Lack of data-driven** tree planting strategies
- **Poor species selection** for local climate
- **Manual assessment** is time-consuming and costly

💡 Our Solution

ReLeaf combines cutting-edge AI and geospatial technology to:

- ✅ Analyze locations using satellite imagery
- ✅ Assess ground conditions with AI vision
- ✅ Recommend suitable tree species
- ✅ Generate actionable planting reports

All in under 35 seconds!

🛰️ Technology Stack

Core Technologies

- **Google ADK** (Agent Development Kit)
- **Gemini AI** (Vision & Language Models)
- **MCP** (Model Context Protocol)
- **OpenStreetMap** for geospatial data
- **Google Street View API** for ground-level imagery

Analysis Methods

- NDVI (Vegetation Index)
- Shadow Pattern Analysis
- Computer Vision (Gemini Vision)
- Geospatial Mapping

🔬 How It Works - 4 Step Process

Step 1: Location Search 🔍

- User provides building name or landmark
- System searches database of KL/Selangor locations
- Returns precise GPS coordinates

Step 2: Aerial Analysis 🛰️

- Satellite imagery processing (15-20 seconds)
- NDVI vegetation coverage detection
- Shadow patterns for sun exposure
- Priority scoring (0-100)

🔬 How It Works (Continued)

Step 3: Ground Vision Analysis 👁️

- AI-powered Street View analysis (12-15 seconds)
- Detects existing trees and counts them
- Assesses tree health and species
- Identifies obstacles and planting feasibility
- Evaluates sidewalk space and surroundings

Step 4: Smart Recommendations 🌱

- Suitable tree species for tropical climate
- Planting guidance (spacing, timing)
- Priority ranking of planting zones
- Visual reports and maps

What ReLeaf Analyzes

Aerial Data:

- Vegetation coverage (NDVI)
- Sun exposure patterns
- Building footprints
- Street network layout
- Priority zones (80-100 = critical)

Ground Data:

- Existing tree count (mature/young)
- Tree health assessment
- Surrounding context (shops, roads)
- Obstacles (poles, signs, drainage)

🎯 Key Features

📍 Precise Site Assessment

Analyze any location in KL/Selangor by name or landmark

🏆 Priority Ranking

Identify top 5 critical spots (scores 80-100) for immediate action

🌲 Existing Tree Analysis

Count and assess health of current urban trees

🌿 Species Selection

Climate-appropriate recommendations with care instructions

🎯 Key Features (Continued)

📊 Visual Reports

- 6-panel analysis visualization
- Satellite preview images
- Google Maps integration
- Street View links

⚡ Fast & Efficient

Complete analysis in 30-35 seconds

💼 Use Cases

🏛️ Government & Urban Planning

- City-wide tree planting initiatives
- Green space optimization
- Environmental compliance reporting

🏙️ Commercial Properties

- Corporate sustainability programs
- Campus greening projects
- CSR tree planting activities

🏘️ Community Organizations

- Neighborhood beautification

📈 Sample Analysis Output

For each location, ReLeaf provides:

1. **Analysis Map -** 6-panel visualization showing:
    - Original satellite imagery
    - Vegetation detection (NDVI)
    - Shadow patterns
    - Street network
    - Priority scores
    - Recommended planting zones
2. **Critical Spots** (Top 5 locations with):
    - GPS coordinates & area (m²)
    - Priority score

Example Recommendations

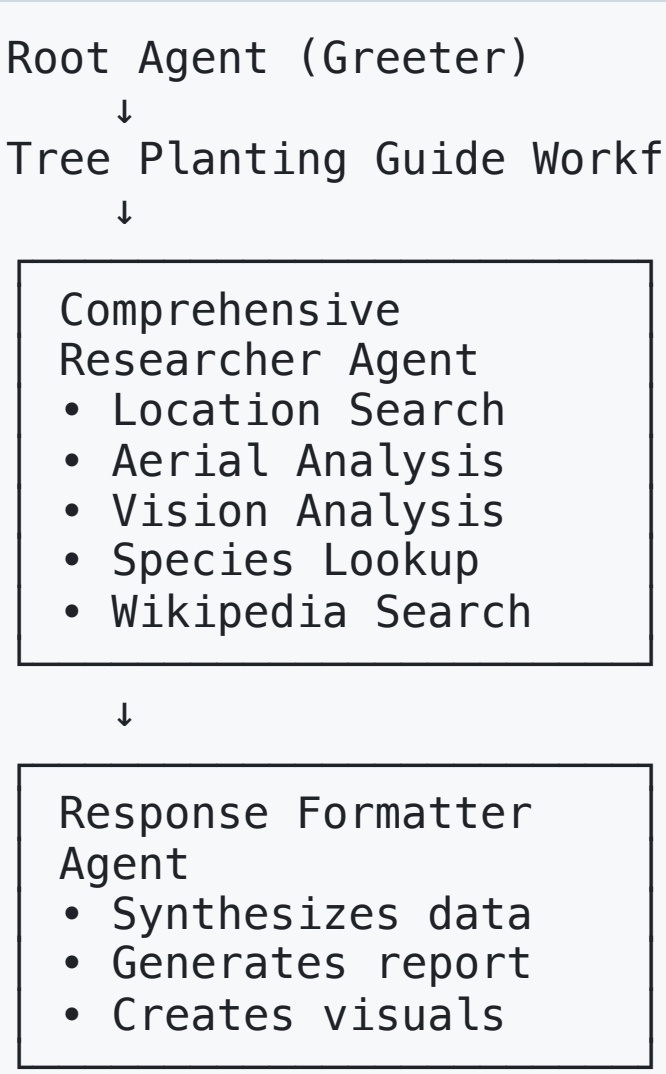
Recommended Species for Kuala Lumpur:

- **Khaya senegalensis** (African Mahogany)
- **Samanea saman** (Rain Tree)
- **Pterocarpus indicus** (Angsana)
- **Peltophorum pterocarpum** (Yellow Flame)
- **Tabebuia rosea** (Pink Trumpet Tree)

Each with specific guidance on:

- Sunlight requirements
- Water needs
- Growth rate & mature height
- Ideal planting season

🎨 Agent Architecture



🔧 Technical Implementation

MCP Tools Available:

1. `search_all_matching_location_based_on_keyword`
2. `analyze_tree_planting_opportunities`
3. `analyze_spot_with_gemini_vision`
4. `get_tree_species_recommendations`

External APIs:

- Wikipedia API (via LangChain)
- Google Street View API
- OpenStreetMap

Cloud Infrastructure:

📊 Impact & Benefits

Environmental Impact:

- 🌍 Increased urban tree coverage
- 🌡️ Reduced urban heat island effect
- 💨 Improved air quality
- 🐦 Enhanced biodiversity

Economic Benefits:

- 💰 Cost-effective planning (vs manual surveys)
- ⏱️ Time savings (minutes vs days)
- 📈 Data-driven ROI tracking
- 🎯 Optimized resource allocation

🚀 Example Usage

User Input:

> "Analyze tree planting opportunities at Menara LGB TTDI"

ReLeaf Output:

1. 🔍 Location found: Menara LGB TTDI (3.1428°N, 101.6330°E)
2. 🛰️ Aerial analysis: 5 critical priority spots identified
3. 👁️ Vision analysis: 12 existing trees detected, 3 spots have high feasibility
4. 🌳 Species recommendations: 8 suitable species with care instructions
5. 📊 Visual report with maps and Street View previews
6. 🔗 Google Maps & Street View links for each spot

🎯 Future Enhancements

Short-term:

- 📱 Mobile app development
- 🗺️ Expanded coverage (entire Malaysia)
- 📊 Dashboard for tracking planted trees
- 🔔 Maintenance reminders

Long-term:

- 🤖 Automated drone surveys
- 🌐 Real-time environmental monitoring
- 🔗 Integration with municipal systems
- 📈 Predictive growth modeling
- 🌏 Regional expansion (Southeast Asia)

🏆 Competitive Advantages

Feature	ReLeaf	Traditional Methods
Speed	30-35 seconds	Days to weeks
Data Sources	Satellite + AI + Street View	Manual surveys
Accuracy	AI-powered precision	Human estimation
Cost	Low (API costs)	High (labor costs)
Scalability	Unlimited locations	Limited by resources
Updates	Real-time satellite data	Periodic surveys

💻 Code Highlights

Agent-based Architecture

- Sequential agent workflow
- Modular tool integration
- State management for context
- Error handling and retries

Key Technologies:

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- Google ADK for agent orchestration
- MCP Protocol for tool integration
- Gemini Vision for image analysis
- OpenStreetMap for geospatial data
```

📞 Demo & Contact

Try ReLeaf:

Ask any location in Kuala Lumpur or Selangor!

Example queries:

- "Analyze Pavilion KL for tree planting"
- "Show me spots near KLCC"
- "What trees are suitable for Mid Valley?"

Processing Time:

- Location search: ~2 seconds
- Satellite analysis: 15-20 seconds
- AI vision: 12-15 seconds

🙏 Thank You!

🌳 ReLeaf

Making Urban Forestry Smarter, Faster, Better

Questions?

Let's grow greener cities together! 🌱

📚 Resources & References

- Google ADK Documentation
- MCP Protocol Specification
- OpenStreetMap API
- NDVI Vegetation Analysis
- Gemini Vision AI
- Urban Forestry Best Practices
- Malaysian Tree Species Database

Project Repository:

`/ReLeaf_Agent`

Built with: Python, Google Cloud, Gemini AI, MCP