1. Key Stakeholders and Their Roles

Stakeholder	Role	Interest in the Project
Government Agencies	Urban Planning, Environmental Monitoring	Use land type classification for urban development, environmental conservation, and resource management.
Agricultural Organizations	Farmers, Agribusinesses	Utilize land type data for crop monitoring, soil health assessment, and precision agriculture.
Environmental NGOs	Conservation Groups	Monitor deforestation, water bodies, and other environmental changes.
Research Institutions	Academics, Researchers	Use the model and dataset for research in remote sensing, machine learning, and environmental science.
Technology Providers	Cloud Service Providers, Software Developers	Provide infrastructure (e.g., cloud platforms) and tools (e.g., QGIS, TensorFlow) for model development and deployment.
End Users	General Public, Urban Planners, Farmers	Access land type classification results for personal or professional use.
Project Team	Data Scientists, ML Engineers, DevOps, Project Manager	Develop, deploy, and maintain the land classification model.

2. Stakeholder Needs and Expectations

Stakeholder	Needs and Expectations
Government Agencies	- Accurate and up-to-date land type classification for policy-making. - Scalable solutions for large-scale land monitoring. - Easy-to-use tools for non-technical users.
Agricultural Organizations	- High-resolution land type data for precision agriculture. - Timely updates on land use changes (e.g., crop health, soil

Stakeholder	Needs and Expectations
	conditions). - Integration with existing agricultural management systems.
Environmental NGOs	- Reliable data on environmental changes (e.g., deforestation, water body shrinkage). - Tools for monitoring and reporting environmental issues. - Access to historical data for trend analysis.
Research Institutions	- Access to high-quality datasets for academic research. - Open-source model code for reproducibility and further development. - Collaboration opportunities with the project team.
Technology Providers	- Increased adoption of their platforms (e.g., cloud services, software tools). - Feedback on tool performance and usability. - Opportunities for partnerships and co-development.
End Users	- User-friendly interface for land type classification. - Fast and accurate results. - Affordable or free access to the tool.
Project Team	- Clear project goals and timelines. - Access to necessary resources (e.g., data, computing power). - Support from stakeholders for feedback and testing.

3. Stakeholder Engagement Plan

Stakeholder	Engagement Strategy
Government Agencies	- Regular updates on project progress. - Workshops or training sessions on how to use the tool. - Customized reports for specific regions or use cases.
Agricultural Organizations	- Collaborate on pilot projects to test the tool in real-world agricultural settings. - Provide tailored solutions for precision agriculture. - Offer training on interpreting land type data.

Stakeholder	Engagement Strategy
Environmental NGOs	- Share environmental monitoring reports generated by the tool. - Provide access to historical data for trend analysis. - Collaborate on environmental conservation projects.
Research Institutions	- Publish open-source code and datasets for academic use. - Organize joint research projects or hackathons. - Share findings through conferences and publications.
Technology Providers	- Collaborate on optimizing the model for their platforms. - Provide feedback on tool performance and usability. - Explore co-marketing opportunities.
End Users	- Develop a user-friendly interface for the tool. - Provide tutorials and documentation for non-technical users. - Offer customer support for troubleshooting.
Project Team	- Regular team meetings to track progress and address challenges. - Provide access to necessary resources (e.g., data, computing power). - Encourage collaboration and knowledge sharing within the team.

4. Potential Challenges and Mitigation Strategies

Challenge	Mitigation Strategy
Differing Stakeholder Needs	- Prioritize stakeholder needs based on project goals. - Develop customizable features to meet diverse requirements.
Limited Resources	- Seek funding or partnerships to support project development. - Use open-source tools and datasets to reduce costs.
Resistance to Change	- Provide training and support to help stakeholders adopt the tool. - Demonstrate the tool's benefits through pilot projects.

Challenge	Mitigation Strategy
Data Privacy Concerns	- Ensure compliance with data privacy regulations. - Use anonymized data for public access.

5. Communication Plan

Stakeholder	Communication Channel	Frequency
Government Agencies	Email updates, workshops, reports	Monthly
Agricultural Organizations	Pilot project meetings, training sessions	Bi-weekly
Environmental NGOs	Environmental reports, collaboration meetings	Quarterly
Research Institutions	Open-source code releases, joint research projects	As needed
Technology Providers	Feedback sessions, co-development meetings	Quarterly
End Users	Tutorials, customer support, user forums	Ongoing
Project Team	Team meetings, progress reports	Weekly

2. User Stories & Use Cases – Scenarios Illustrating How Users Interact with the System

User Stories

1. **As a Government Urban Planner**, I want to classify land types in a specific region so that I can make informed decisions about urban development.
2. **As a Farmer**, I want to monitor crop health and soil conditions using land type data so that I can optimize my agricultural practices.
3. **As an Environmental NGO**, I want to track deforestation and water body changes over time so that I can report on environmental issues.
4. **As a Researcher**, I want to access high-quality satellite imagery and land type classification data so that I can conduct academic research.
5. **As an End User**, I want to upload a satellite image and receive a land type classification report so that I can understand the land use in my area.

Use Cases

1. **Urban Planning**:
    - **Actor**: Government Urban Planner
    - **Description**: The urban planner uploads a satellite image of a region and receives a detailed land type classification report. The report helps in planning new infrastructure projects.
    - **Steps**:
        1. Upload satellite image.
        2. Run land type classification.
        3. View and download the classification report.
2. **Precision Agriculture**:
    - **Actor**: Farmer
    - **Description**: The farmer uses the tool to monitor crop health and soil conditions. The tool provides insights into which areas need irrigation or fertilization.
    - **Steps**:
        1. Upload satellite image of farmland.
        2. Run land type classification.
        3. Analyze results to identify areas needing attention.
3. **Environmental Monitoring**:
    - **Actor**: Environmental NGO
    - **Description**: The NGO uses the tool to track changes in forest cover and water bodies over time. The tool generates reports that can be used for advocacy and policy-making.
    - **Steps**:
        1. Upload time-series satellite images.
        2. Run land type classification for each image.
        3. Compare results to track changes over time.
4. **Academic Research**:

- **Actor**: Researcher
- **Description**: The researcher accesses the tool to download high-quality satellite imagery and land type classification data for academic research.
- **Steps**:
    1. Access the tool's open dataset.
    2. Download satellite images and classification data.
    3. Use the data for research and analysis.

5. **General Land Use Analysis**:
    - **Actor**: End User
    - **Description**: A general user uploads a satellite image of their area of interest and receives a land type classification report.
    - **Steps**:
        1. Upload satellite image.
        2. Run land type classification.
        3. View and download the classification report.

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3. Functional Requirements – List of Features and Functionalities

1. **User Authentication**:
    - Users can create accounts and log in to access the tool.
2. **Image Upload**:
    - Users can upload satellite images in supported formats (e.g., GeoTIFF, JPEG).
3. **Land Type Classification**:
    - The system can classify land types (e.g., agriculture, water, urban, desert) from uploaded satellite images.
4. **Report Generation**:
    - The system generates a detailed report with land type classifications and visualizations (e.g., maps, charts).

5. **Historical Data Access**:
    - Users can access historical satellite images and classification data for trend analysis.
6. **API Integration**:
    - The system provides an API for developers to integrate land type classification into other applications.
7. **User Dashboard**:
    - Users have a dashboard to view past classification results, download reports, and manage their account.
8. **Data Export**:
    - Users can export classification results in various formats (e.g., CSV, PDF).

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4. Non-Functional Requirements – Performance, Security, Usability, and Reliability Criteria

1. **Performance**:
    - The system should classify land types within **2 seconds** for a standard-sized satellite image.
    - The system should handle up to **100 concurrent users** without performance degradation.
2. **Security**:
    - User data and uploaded images should be encrypted both in transit and at rest.
    - The system should comply with **GDPR** and other relevant data privacy regulations.
3. **Usability**:
    - The user interface should be intuitive and require minimal training for non-technical users.
    - The system should provide tooltips, tutorials, and documentation to guide users.

4. **Reliability**:
    - The system should have **99.9% uptime** to ensure continuous availability.
    - The system should automatically retry failed classification requests.
5. **Scalability**:
    - The system should scale horizontally to handle increasing numbers of users and larger datasets.
    - The system should support deployment on cloud platforms (e.g., AWS, Google Cloud) for scalability.
6. **Maintainability**:
    - The system should have modular code and clear documentation to facilitate future updates and maintenance.
    - The system should include logging and monitoring tools to track performance and detect issues.
7. **Compatibility**:
    - The system should support multiple satellite image formats (e.g., GeoTIFF, JPEG, PNG).
    - The system should be compatible with major web browsers (e.g., Chrome, Firefox, Safari).