Landsat Reflectance Data: On the Fly and at Your Fingertips

TeKnoCrafters

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I Keywords

Landsat, Remote Sensing, Reflectance Data, Web Application, Education, Citizen Science, Data Validation, Geospatial, Satellite Notifications, Interdisciplinary Methodology.

II Introduction

The NASA Space Apps Challenge 2024 invites the development of an innovative web application that enables the comparison of ground observations with Landsat surface reflectance (SR) data. This tool not only has the potential to enrich education and scientific exploration, but also empowers users to become informed and active global citizens in environmental monitoring. The integration of Landsat data, real-time notifications, and data visualization in a single platform facilitates an interdisciplinary approach that promotes experiential learning.

III Methodology

To address the challenge, a multi-stage methodology is proposed:

1. **Initial Research**: Review of Landsat documentation and existing geospatial data applications to identify key features and best practices.

2. **Application Design**:

   - **User Interface**: Create an intuitive interface that allows users to define a target location via coordinates, place name, or map selection.
   - **Notification System**: Implement a system that notifies users about upcoming Landsat passes over the defined location, with customization options.

3. **Data Access**: Integrate APIs and data catalogs to enable acquisition of Landsat SR data and related metadata, as well as cloud cover calculations.

4. **Data Visualization**: Develop interactive graphs representing reflectance data across the spectrum, along with a pixel grid and scene metadata.

5. **Testing and Validation**: Conduct pilot tests with real users to gather feedback and adjust the application as needed.

IV Requirements

1 Satellite Data Interaction

The web application will allow users to effectively interact with data from satellites, such as Landsat, as well as ground observations. Below are the specific requirements for the functionality of the tool.

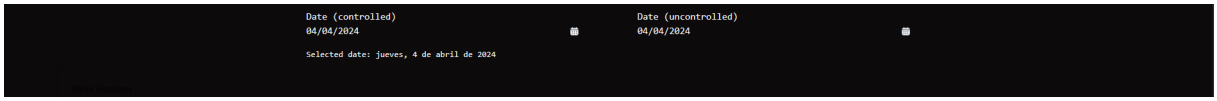
2 User Inputs

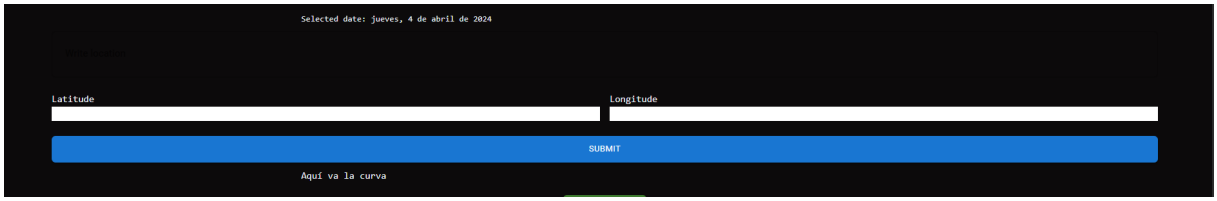
1. **Narrow the Time Series:**

   - Implement a drag functionality that allows the user to select a range of years (yy/yy).
   - Provide a date modal that allows the user to specify an exact date (dd/mm/yy).

2. **Request Location:**

   - **Map Interaction:** Allow the user to select a location by clicking on the map, using a listener to detect the action.
   - **Enter Place Name:** Offer an option for the user to enter the name of a specific place.
   - **Input Coordinates:** Provide a field for the user to input geographic coordinates in (latitude, longitude) format.





3 System Outputs

1. **Update Map:** Display the user-selected position on the map.

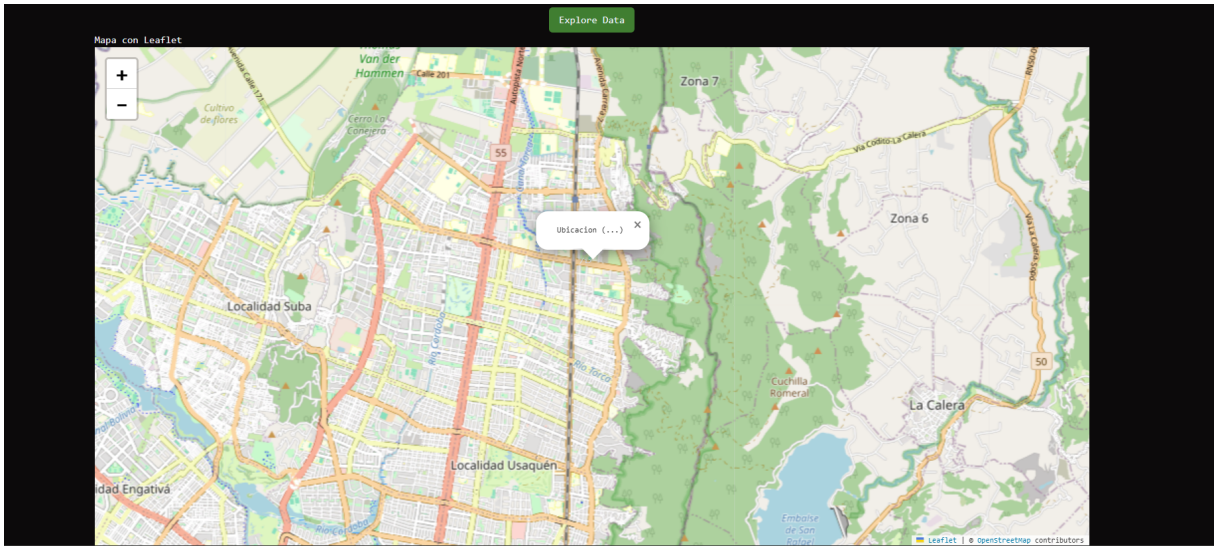
2. **Show Satellite Pass Date:** Indicate the date on which the satellite will pass over the specified position, based on the metadata API response.

3. **Show Metadata:** Through a modal or pop-up window, present metadata related to the selected position, including:

   - Date of satellite pass over the location.
   - Additional model information for the specific point.

4. **Metadata Download:** Provide a button or accordion to allow the user to download metadata in useful formats such as Excel, CSV, Parquet, or JSON.

5. **Additional Options:** Participants are encouraged to incorporate additional features, which will depend on their creativity and willingness.



4 Extra Features

1. **Grid Visualization:** Display the selected position in a 9x9 pixel grid.

2. **Data Filtering:** Implement a filter that excludes satellite data if cloud cover at the position exceeds 15

3. **Temperature Data:** Present temperature data related to the selected position.

4. **Path Generation:** Develop a function that generates the satellite's path over time for the specified position.

V Challenge Goals

1 Local Impact

The application will promote learning and education about remote sensing in local communities, offering an accessible and practical resource for students and citizens. Features:

- **Educational Activities:** Integration of interactive tutorials and guides on how to use Landsat data in school projects.

- **Data Access:** Ability to conduct local experiments using real-time data to assess environmental changes, strengthening scientific understanding.

- **Community Collaboration:** Promotion of citizen science projects where users can share their findings and validate data.

2 Global Connection

It will provide access to Landsat data to users around the world, facilitating collaboration among citizen scientists, researchers, and professionals.
Features:

- **Multilingual Interface:** The application will offer support in multiple languages to reach a global audience.
- **Collaboration Platform:** Implementation of forums and discussion spaces where users can share data, methods, and experiences.
- **Integration with Other Data Sources:** Ability to access data from other satellite missions (such as Sentinel-2), fostering a more holistic approach to Earth observation.

3 Storytelling and Inspiration

The tool will allow users to tell stories about environmental change, inspiring actions at both local and global levels for conservation and sustainable resource use.
Features:

- **Story Visualization:** Tools to create visual narratives using interactive maps and data graphs.
- **Case Studies:** Presentation of real-life examples of how Landsat data has influenced environmental policies or community projects.
- **Challenges and Contests:** Organization of competitions for users to present their stories and results, fostering engagement and active participation.

4 Mission

This challenge contributes to NASA's mission of enhancing our understanding of Earth's systems through education and public engagement.
Features:

- **Integration of Scientific Knowledge:** The application will include resources that connect users with current research and discoveries in remote sensing and the environment.
- **Training Events:** Opportunities for educators and scientists to share their knowledge through webinars and online workshops.

5 Galactic Impact

It will contribute to long-term scientific research by offering a model that can be adapted to other space missions and global challenges.
Features:

- **Open Database:** The collected data will be available for researchers and scientists for future studies, expanding the application's impact.
- **Adaptability:** Modular structure that allows for the inclusion of new features and data from future missions.

6 Use of Technology

It will leverage cutting-edge technologies to provide real-time data, thus improving informed decision-making.
Features:

- **Mobile Application Development:** Optimization for mobile devices, allowing access in the field and in situations with limited connectivity.
- **Real-Time Interaction:** Notifications and instant updates on satellite passes and data availability, facilitating dynamic access to information.

7 Art and Technology

Data visualization will be designed to be not only informative but also visually engaging, combining art with science.
Features:

- **Intuitive Design:** Visually appealing interface that makes data interpretation easy and accessible.
- **Infographics and Visualizations:** Creation of interactive infographics that allow users to explore data visually and comprehensibly.

8 Better Use of Data

It will promote effective use of open data, encouraging transparency and collaboration in data science.
Features:

- **Open Data Access:** Facilitation of access to Landsat data and other relevant datasets without restrictions, fostering research and learning.
- **Analysis Tools:** Integration of tools that allow users to perform data analysis directly within the application, promoting more efficient use of information.

9 Better Use of Science

It will integrate rigorous scientific methods into education and research, increasing the accuracy of data validation.
Features:

- **Validation Protocols:** Include guidelines on how to effectively validate data, promoting scientific rigor.
- **Training in Scientific Methods:** Educational resources on data collection and analysis techniques that can be used by users to enhance their scientific understanding.

VI References

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