Mapping the World with Google

Overview and Aim of Google Maps

Google Maps is a web mapping service offered by Google that offers satellite imagery, street maps, 360° panoramic views, real-time traffic information, and detailed business listings.

It is one of the most popular map services in the world, with over 2 billion active users.

System Component And Structure.

1. Data Centers
2. Distributed Computing
3. Geospatial Data Management
4. Content Delivery Network (CDN)
5. Real-Time Data Processing
6. Search Infrastructure
7. Caching
8. Load Balancing
9. Security and Compliance
10. Machine Learning and AI

How does the system work

Here is a simplified overview of how Google Maps works:

- Data Collection:

1. Associations & Governments
2. Satellite imagery
3. Street View imagery
4. Data from Images by OCR
5. Our Location data for transportation
6. User contributions

- Data Processing:

1. Image Stitching
2. Data Indexing
3. Routing Algorithms
4. Machine Learning
5. Cloud Storage

Algorithms Used By Google Maps

- Geocoding and Reverse Geocoding:

1. Geocoding
2. Reverse Geocoding

- Routing Algorithms:

1. A* Algorithm
2. Dijkstra's Algorithm
3. Bidirectional Search

- Traffic and ETA Prediction:

1. Machine Learning Models
2. Time-Series Analysis

Algorithms Used By Google Maps

- Recommendation and Personalization Algorithms:

1. Collaborative Filtering
2. Content-Based Filtering

- Image Processing and Computer Vision:

1. 1. Feature Detection and Recognition
2. Semantic Segmentation

- Data Matching and Aggregation:

1. Data Integration and Cleaning
2. Data Deduplication

Main system features

- Navigation

1- Get Directions

2- Explore Street View

- To search for new places

1- Read Reviews 2- View photos

- Other information

1- Get information about a business

2- Get information about public transportation

3- Adding new places

4- Share your location

- Offline Maps

- User Reviews and Ratings-

How the system apply Scalability.

1. Data partitioning.
2. Distributed storage.
3. **Distributed data processing.**
4. Artificial intelligence

How the system apply Openness.

- Open Data Initiatives

- Google Maps Platform
- Open-Source Contributions

- Data Accessibility and Transparency:

- Public Data Sets
- Data Visualization Tools

- Collaboration with Partners and Organizations:

- Partnerships with Local Governments
- Supporting Research and Innovation

- Community Engagement and Feedback:

- User Feedback Channels

By implementing these openness initiatives, Google Maps aims to:

- Empower Developers
- Advance Research and Innovation
- Enhance Data Accessibility
- Improve Map Accuracy and Completeness

How the system apply Transparency.

- Data Minimization and Anonymization:

Google only collects the data they need for their services (data minimization). Additionally, they anonymize user data whenever possible to protect privacy.

- Types of Transparency:

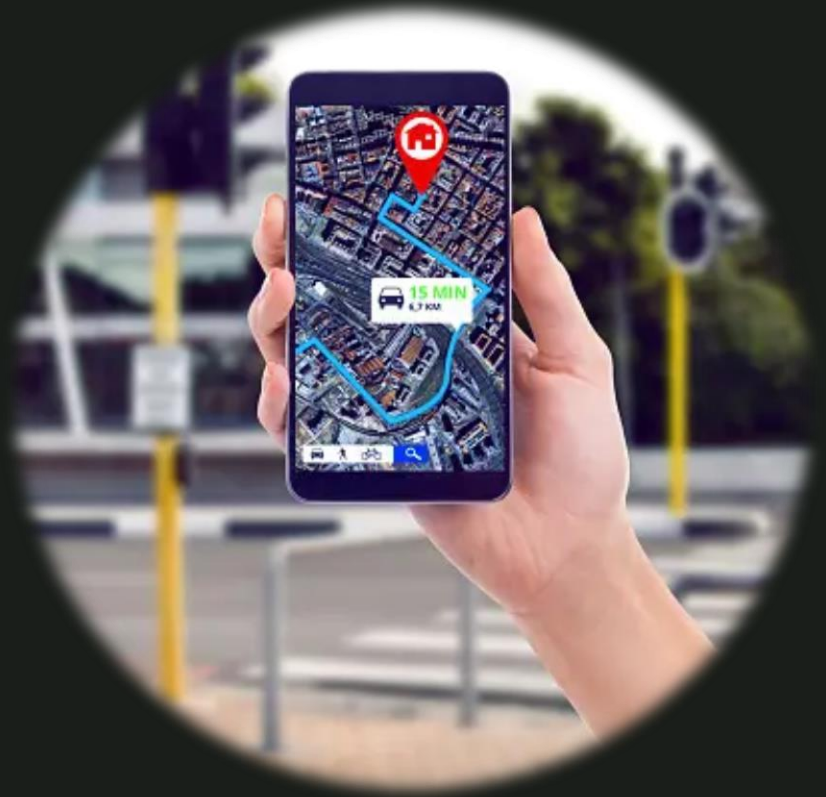
1. Access Transparency
2. Failure Transparency Of an object
3. Location Transparency
4. Relocation Transparency
5. Concurrency Transparency

How the system apply Security.

1. Data Encryption.
2. Access Controls.
3. Monitoring and Logging.
4. Secure APIs
5. Compliance

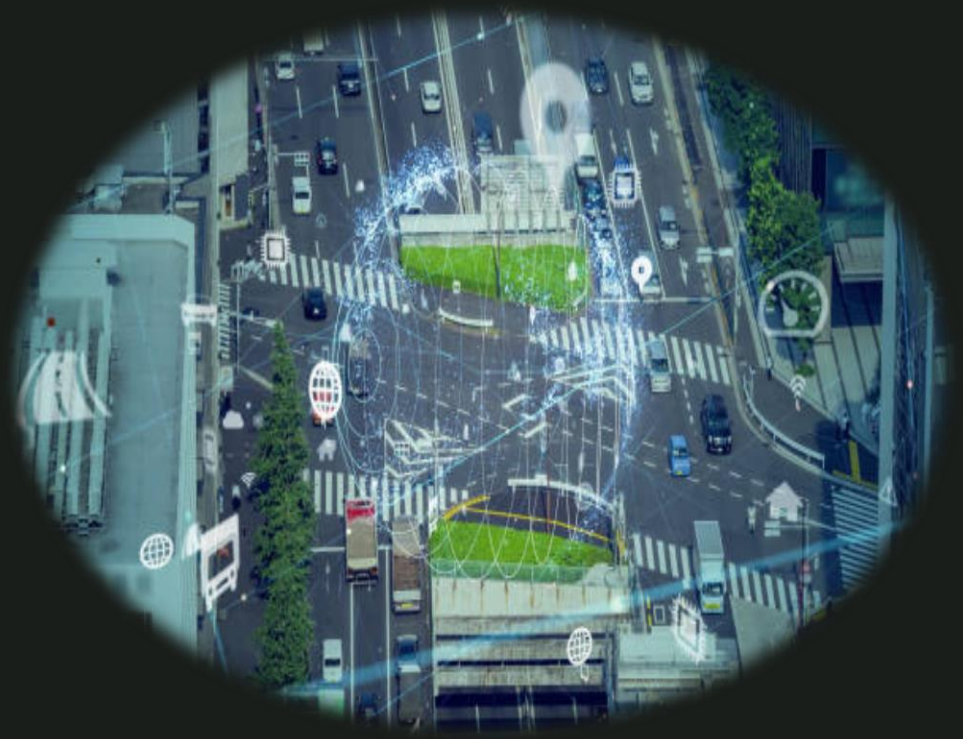
How the system apply Failure Handling.

1. Redundancy and Backup.
2. Automated Failover.
3. Monitoring and Alerts.
4. Disaster Recovery.

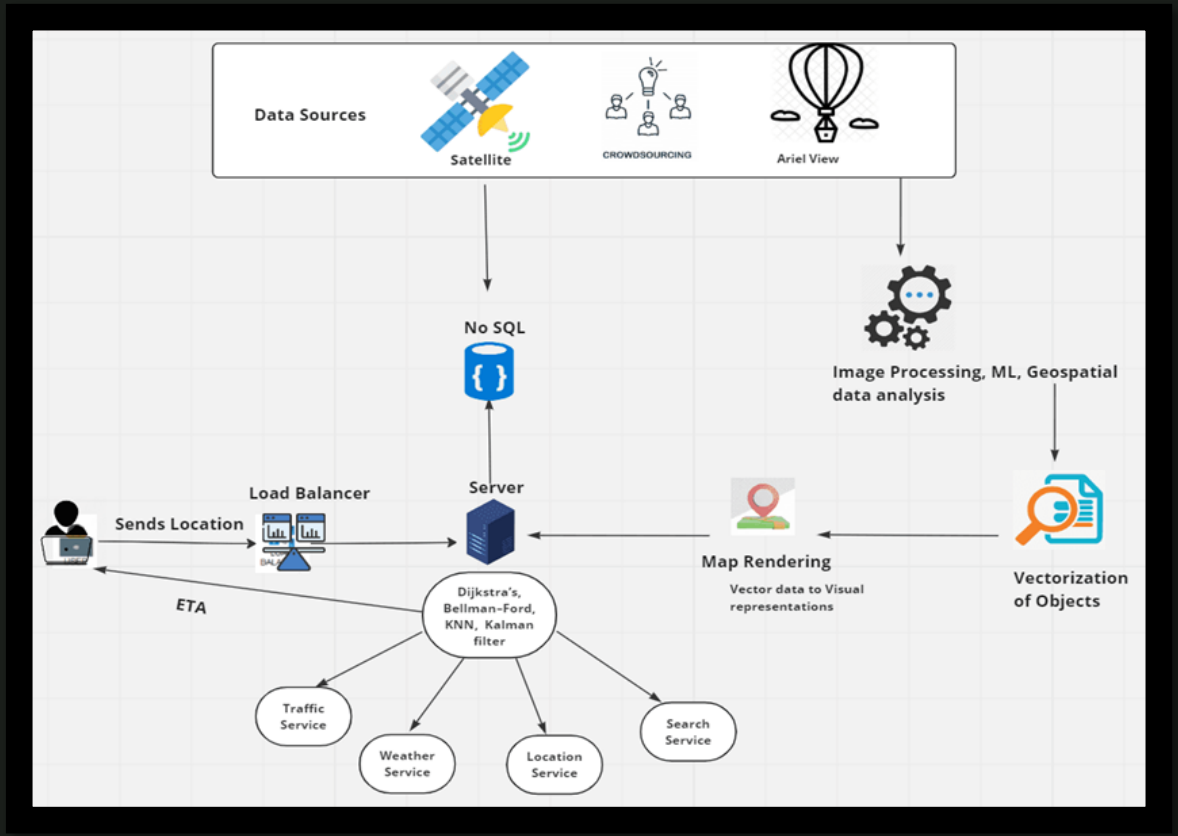


How the system apply Load Balancing.

1. Global Load Balancers.
2. Dynamic Scaling
3. Caching.
4. Intelligent Request Routing.



Conclusion


Data Sources
Satellite
CROWDSOURCING
Ariel View
No SQL
Image Processing, ML, Geospatial data analysis
Load Balancer
Server
Sends Location
Map Rendering
Vector data to Visual representations
Vectorization of Objects
ETA
Dijkstra's, Bellman-Ford, KNN, Kalman filter
Traffic Service
Weather Service
Location Service
Search Service

Thank You.

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