Spatiotemporal Tile Indexing Scheme

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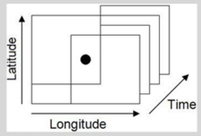
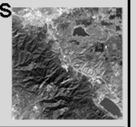
Problem Background

- Past decade witnessed
  - Increasing number of operational satellites
  - Satellites brought
    - ✓Spectral coverage
    - ✓Spatial coverage
    - ✓Temporal coverage
- Difficulty increased in meta data management, and data discovery



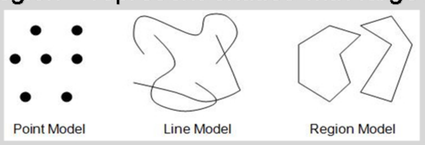
Research Objective

- Create a system that can read meta data from satellite images (or ancillary data) to store in a spatiotemporal database that generates
  - Efficient search and data discovery
  - Easier access to the meta data
  - Faster results
  - Improves data management
- Current application for the system
  - Geographic satellite images from
    - ✓Moderate-Resolution Imaging Spectroradiometer (MODIS)
    - ✓Advanced Wide Field Sensor (AWIFS)

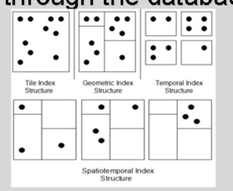


Research Background

- Database - large collection of interrelated data
- One database record = one object
- Spatiotemporal objects have
  - Identifier
  - Spatial attribute
  - Timestamp
- Data types of a spatial attribute are
  - Point – represent location of entities
  - Line – represent networks
  - Region – represent entities with large areas



- Indexes:
  - Ensure fast access to database records
  - Based on a search key
  - Avoid sequential scan through the database
  - Structures
    - ✓Tile
    - ✓Geometric
    - ✓Temporal
    - ✓Spatiotemporal

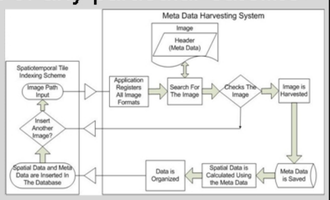


System Architecture

- System Components
- Meta Data Harvesting System
  - Database Management System
  - Spatial Database Server
  - Delivery or Data Access System

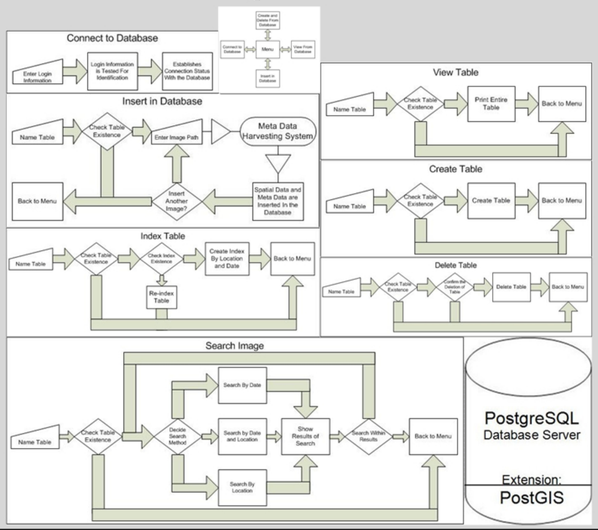
Meta Data Harvesting

- Meta data - data that provides information about data.
- Harvesting - process of extracting the meta data from the ancillary data sources
- Features
  - Uses GDAL open source library
    - ✓Supports 50/60 image formats
    - ✓Not dependent of any particular satellite or sensor
- Meta data elements
  - Pixel size
  - Image size
  - Central meridian
  - Latitude of origin
  - Last modified date



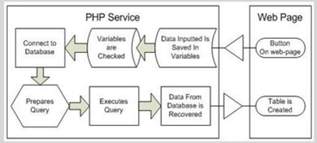
Spatiotemporal Indexing Scheme

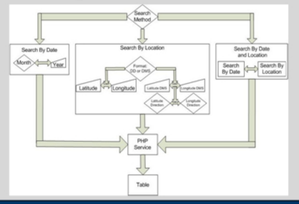
- Features
  - Connect to database
  - Create, delete, view, and index table
  - Harvest meta data to insert in table
  - Search for images



Web Service

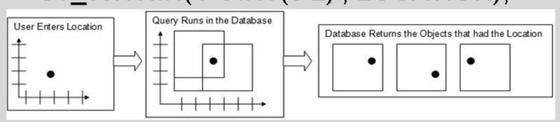
- Advantages
  - Easy access
  - Easy to use
  - Only one database
- Features
  - Option for search parameters
    - ✓Date
- ✓Location
    - ✓Date and location
  - Format for location parameter
    - ✓DMS format
    - ✓Decimal degrees format



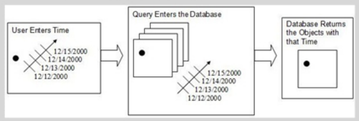


Querying the Database

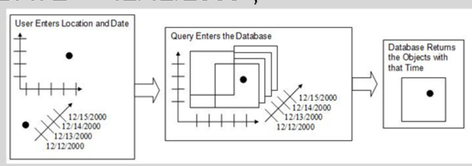
- Spatial Query retrieves all objects whose geometry contains a given point. Example:
  - SELECT * FROM <table_name> WHERE ST_WITHIN('POINT(3 2)', LOCATION);



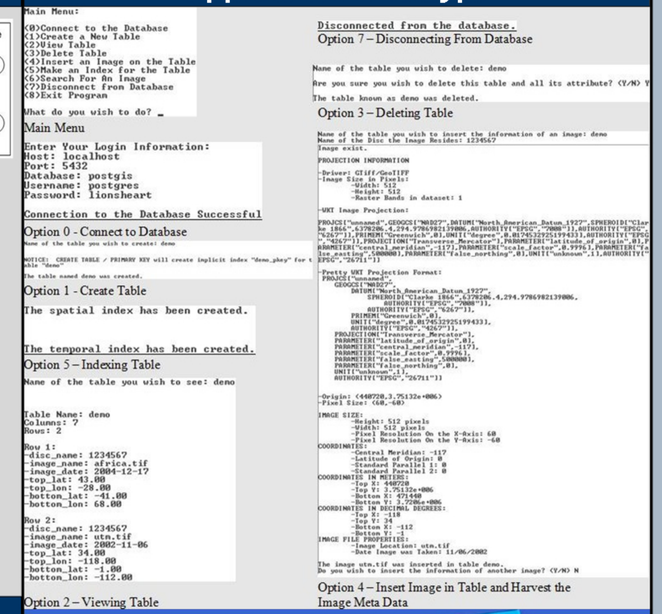
- Temporal Query retrieves all objects whose time has to do with an event. Example:
  - SELECT * FROM <table_name> WHERE DATE = "12/12/2000";



- Spatiotemporal Query retrieves all objects whose time has to do with an event and whose geometry contains a given point. Example:
  - SELECT * FROM <table_name> WHERE ST_WITHIN('POINT(4 2)', LOCATION) AND DATE = "12/12/2000";



Application Prototype



Conclusion and Future Direction

- System enables a much easier data management of satellite images.
- System can be extended to
  - Other kinds of search criteria like
    - ✓Cloud coverage percentage
    - ✓Forestation percentage
  - Interface other data formats
  - Meta data search through the network

References

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