TRANSDEC: Transportation Decision Making

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Agenda
- Project Overview
- Tasks
- Technologies Used
- Milestones & Deliverables

TransDec
- TransDec: a real-data driven and immersive framework that enables on-the-fly spatio-temporal querying, analysis and planning of transportation systems
- Two main focus
  - Moving objects
    - Nearest Neighbor
    - Range Queries
    - Geofence
    - Historical Playbacks
  - Traffic sensors
    - Continuous Monitoring
    - Historical Traffic Patterns
    - TD Shortest Path
- Real-world spatiotemporal data

Traffic Sensor Data
- Provided by RIITS
  - Real-time highway congestion
  - Real-time arterial congestion
  - Events
  - Metro Bus & Train locations
  - CCTV
- Highway sensors spread over 18 highways inside LA
- Total 1523 highway sensors covering 1838 miles
- Update rate every 1 minute
  - Daily 2.2 million rows, 300MB of data (only highway sensors)

Moving Objects
- Provided by USC Transportation office
  - 40 Vehicles
  - Update rate is every 5 seconds
- Moving object trajectory lat/long, speed

Tasks
- A) GUI
- B) Middle Tier
- C) ArcGIS
- D) Hadoop
GUI & Middle Tier

Tasks A & B
1. Real-time data integration from RIITS
   - Traffic Sensor Data for main Streets
   - CCTV
2. Generic Query Interface, “Middle Tier”
3. Temporal Traffic Pattern Analysis
4. Traffic Flow Implementation
5. CCTV Footages
6. Granular Querying

Task A - RIITS Data Integration
- Data is provided in a predefined XML format.
- Traffic sensor data and the CCTV snapshots are updated every minute.
- Congestion freeway inventory data is updated on a daily basis.
- CCTV Inventory data is updated quarterly.

Task B - Query Interface
- A generic Query interface is designed to interact with all the webservices.
- Based on the type of request each of them is called for a specific purpose.
- All the webservices can be accessed through SOAP calls.

Temporal Traffic Pattern Analysis
- Users can adjust the date and time to analyse traffic patterns.

Task A - Traffic Flow Implementation
- Monitoring the movement of traffic in any specific location between various segments.
**Task A - CCTV Footages**

- Users can also view CCTV footages of vehicular flow at various segments.
- If we have multiple snapshots of a particular location, we also show them a video.

**Task B - Granular Querying**

- We can Custom Query any segment of the map to retrieve historical patterns about the vehicular flow.

**Cube Operations**

**ArcGIS Integration**

*What Are we trying to do:*
- Feed ArcGIS with our Data
- Use ArcGIS tools and functions to display our data
- Import our queries to ArcGIS and adjusting them to work with ArcGIS libraries and tools (Current Traffic and Traffic prediction)

**Task C - Getting Started**

- Preparing the programming environment: obtaining the software and installing it.
Task C – Connecting Oracle to ArcGis

- Connecting to OracleDB using a direct Connection
- Utilize ARCTOOLBOX for geoprocessing (extract, overlay, ...)
- Query our data (highway sensors) with ArcMap and mapping it by adding data layers (displaying highway sensors)

Task C - Querying Traffic

- Displaying real-time traffic flow on the map
- Visualizing current traffic and the historical pattern using ArcGIS Analysis tools

Task C - Tracking moving objects

- Tracking moving objects using ArcGIS Tracking Analyst

Task D – Distributed Computing

- GeoSpatial Queries
  - Computationally Complex
  - Time Consuming on large Datasets
- Solution
  - Parallelize the Queries

Task D - Hadoop

- What is Hadoop?
  - A Software Framework to support data intensive distributed applications. It enables to work with thousands of nodes and petabytes of data.
- Why do we need Hadoop?
  - Parallelization
  - Scalability
  - Fault Tolerance
  - Cost Effectiveness
Task D – Execution Flow

Task D - Map/Reduce

- Hadoop File System
- Map/Reduce Model
- Retrieving Hadoop output
- Automating input to Hadoop

Technologies Used

- Oracle Spatial – PL/SQL
- AJAX, Flex
- Java- Servlet, Jsp
- SOAP, XML, WSDL

Deliverables - Vikas

- Understanding and displaying the data from RIITS – 4 weeks
- Including the CCTV footages in the GUI – 4 weeks
- Implementing traffic flow – 4 weeks

Deliverables - Raghu

- Middle Tier implementation – 4 weeks
- Traffic pattern analysis – 4 weeks
- Granular Querying and retrieving results – 4 weeks
Deliverables - Nima

- Installing ArcGIS – 3 weeks
- Loading our data to ArcGIS – 3 weeks
- Querying Traffic - 3 weeks
- Tracking moving objects – 3 weeks

Deliverables - Afsin

- Retrieving output from Hadoop - 9 weeks
- Automating input to Hadoop – 3 weeks

Thank You