TRANSDEC: Transportation Decision Making

Fall'09-CS599
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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 1183 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 an 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.

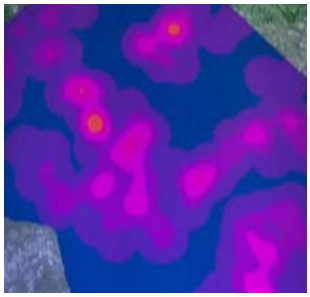
Task B -Query Interface

- 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

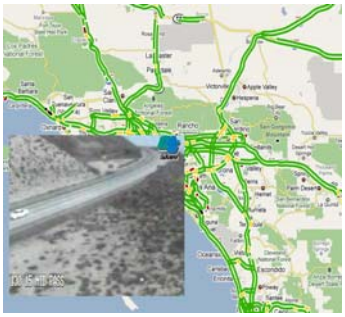
- Users can adjust the date and time to analyse traffic patterns

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 segements.
- If we have multiple snapshots of a particular location we also show them a video.

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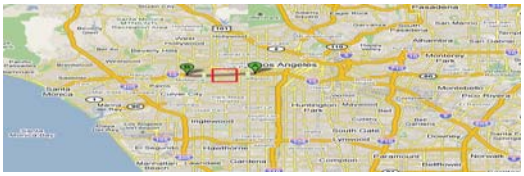
Task B - Granular Querying

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



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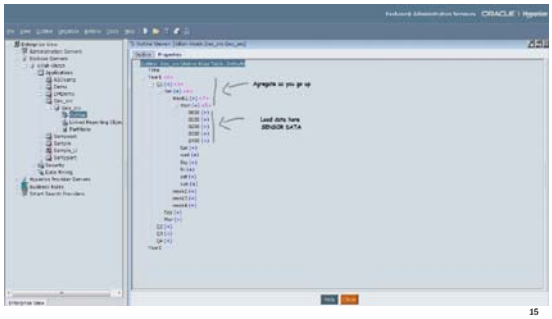
Cube Operations



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ArcGis

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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)

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Task C - Getting Started

- Preparing the programming environment: obtaining the software and installing it

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Task C – Connecting Oracle to ArcGis

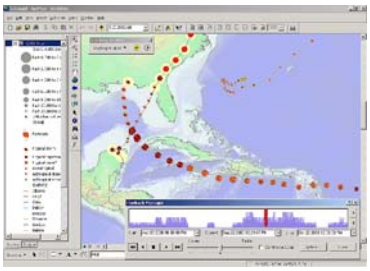
- Connecting to OracleDB using a direct Connection
- Utilize ARCTOOLBOX for geoprocessing (extract,overlay,..)
- Query our data(highway sensors) with ArcMap and mapping it by adding data layers (displaying highway sensors)

Task C - Querying Traffic

- Displaying realtime 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 Arc GIS Tracking Analyst



Hadoop

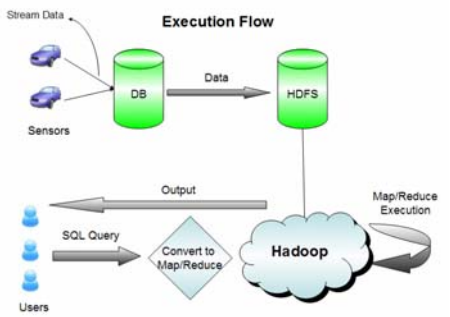
Task D–Distributed Computing

- 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
- Retreiving Hadoop output
- Automating input to Hadoop

Technologies Used

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

Week/Tasks	1	2	3	4	5	6	7	8	9	10	11	12
RIITS	Vikas											
CCTV FOOTAGE				Vikas								
TRAFFIC FLOW									Vikas			
MIDDLE TIER	Raghu											
PATTERN ANALYSIS					Raghu							
GRANULAR QUERYING									Raghu			
SOFTWARE ENVIRONMENT	Nima											
ARCGIS				Nima								
QUERYING TRAFFIC							Nima					
TRACKING MOVING OBJECTS									Nima			
HADOOP File System	Afsin											
MAP MODEL				Afsin								
HADOOP OUTPUT ANALYSIS								Afsin				
AUTOMATING HADOOP I/P										Afsin		

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 retreiving 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

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

Thank You