Web and Mobile GIS Applications Development

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Geographical Information Systems (GIS)

GIS: A Formal Definition

- A system for capturing, storing, checking, integrating, manipulating, analyzing and displaying data which are spatially referenced to the earth

- A powerful set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world

- GIS = Maps + Database
Geographical Information Systems (GIS)

Component of GIS

**Input**
- Data Acquisition
  - Remote Sensing
  - Field Sampling
- Analogue data conversion
  - Scan and Digitize

**Management & Analytical Modules**
- Management
  - Data storage
  - Data Retrieval
  - Query
- Analytical Modules
  - Data conversion
  - Data manipulation
  - Modeling

**Output**
- Output
  - Visual Presentation
  - Maps
  - Reports
Geographical Information Systems (GIS)

Elements of GIS

- A system of hardware, software, people, data, organization and institutional arrangements for collecting, storing, analyzing and disseminating information about the areas of the earth.
GIS Platforms

Number of users

Cost

Functionality

Internet Viewer
Web mapping apps, Google maps, ArcGIS & Autodesk servers

Hand-held
ArcPad, Onsite, MapXtend, Car Navi, Android, iOS

Desktop
QGIS, uDig, gvSIG

Professional
ArcGIS, GRASS GIS, Auto Desk
Web & Mobile GIS

- Potential of GIS is not fully realized in terms of data accessibility, integrity and collaboration among various departments

- The Internet (make it open for accessing)

- Smart phones

- Why mapping on internet?

- Why mapping on mobiles?
What is Web GIS?

Web GIS is a type of distributed information system. The simplest form of web GIS should have at least a server and the client (a web browser, a desktop application or a mobile application)
Web GIS functions

- Web mapping (Visualization)
  - Common and important function of web GIS
- Query
  - Ask for information about features displayed on map
  - Point based queries on map data
- Collecting/Editing geospatial information
  - Allow down-to-top information flow
  - Crowd sourcing up-to-date information
- Dissemination of geospatial information
  - Wide distribution of information
  - Seamless: No need to know servers & to copy huge data sets
- Analysis
  - Provide customized analytical functions
Advantages of web GIS over desktop GIS

- Global accessibility
  - Web removes the constraint of distance
- A large number of users
  - Desktop GIS supports one user at a time, while web GIS supports dozens and hundreds of users simultaneously
- Better cross-platform capability
- Low cost as averages by number of users
  - Investment on server side implementation only
- Makes spatial data accessible to non-technical people
  - User friendly websites
- Unified update
  - Simplifies software and application code versioning and upgrades
- Diverse applications
What is Mobile GIS?

Mobile GIS is the expansion of a geographic information system (GIS) from offices to any place around the globe, it makes your GIS accessible at every location.

Mobile GIS integrating various ICTs
Mobile GIS functions

- Mobile mapping (Visualization)
- Query
- Real-time tracking and location identification using GPS
- Real-time data collection from field
- Limited map processing
- Augmented Reality (AR) using camera, GPS, compass and GIS data
Advantages of mobile GIS

- Mobile solutions that are easy to use and inexpensive can eliminate technology boundaries, allowing greater access and input from field personnel.

- It enables users to obtain, edit & analyse geographical information in the field and helps in faster decision making.

- The use of mobile GIS helps in improving the quality and speed of data collection and stimulates the real-time collaboration between field and office staff.
Server Side Implementation
Spatial DBMS

Shapefiles / Geodatabases (ESRI), GeoTiff, HDF

KML/KMZ (Google Earth), GeoRSS/GeoJSON, GML

PostgreSQL/PostGIS, Oracle, MSSQL Server

Web Services
- WMS – Web Mapping Services (image)
- WFS – Web Feature Services (vector)
- WCS – Web Coverage Services (raster)
Server Side Implementation
Mapping / GIS Server

ArcIMS
ArcGIS Server
GeoServer
MapServer
Autodesk MapGuide
Server Side Implementation
Mapping Application

- ESRI WebADF/JavaScript API
- ArcGIS Extension
- Google Maps API
- Google Earth API
- Bing Maps API
- Yahoo Maps API
- OpenLayers API
Server Side Implementation
Data Handling Web Services

- PHP
- Java
- .NET (VB & C#)
- Python
Server Side Implementation
Web Server

Apache

Apache Tomcat

IIS (Windows)
Web GIS Client

- **Web Users**
  - Web browsers including Internet Explorer, Mozilla Firefox, Google Chrome
  - Connected through wired/wireless internet

- **Mobile Users**
  - Mobile browsers of Android, iOS, Windows, Symbian and Black Berry
  - Web views of native platforms
  - Connected through wireless internet, GPRS, EDGE, 3G/4G

- **Desktop users**
  - Desktop customized mapping applications accessing through LAN/WAN
Mobile GIS Client

- Smart phones (GPS + Camera + 3G & 4G)
  - Android
  - iOS
  - Windows
  - Symbian
  - Black Berry

- Development Environment and Programming Languages

- Software Development Kits

- Data Store
  - SQLite
  - Spatial Lite
Web GIS Applications
Dengue Information Management & Analysis System (DIMAS)

PostgreSQL/PostGIS + GeoServer + OpenLayers
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Dengue Information Management & Analysis System (DIMAS)

PostgreSQL/PostGIS + GeoServer + OpenLayers
Web GIS Applications
Dengue Information Management & Analysis System (DIMAS)

PostgreSQL/PostGIS + GeoServer + OpenLayers
Web GIS Applications
National Environmental Information Management System (NEIMS)

ArcGIS Server + MS SQL Server
Web GIS Applications
Karachi GIS (Demo)

PostgreSQL/PostGIS + GeoServer + OpenLayers
Web GIS Applications
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Mobile GIS Applications
Dengue Information Management & Analysis System (DIMAS)

Android + Google API
Mobile GIS Applications
Dengue Information Management & Analysis System (DIMAS)

Android + Google API
Mobile GIS Applications
Lahore Tourism Guide (Demo)

Android + Google API
Mobile GIS Applications
Lahore Tourism Guide (Demo)

Android + Google API
Mobile GIS Applications
Karachi GIS (Demo)

Android + Google API

- **Districts**
- **Towns**
- **UCs**
- **Roads**
- **Infrastructures**

Distance and duration
Distance and duration
Distance and duration
Distance and duration
Distance and duration
Mobile GIS Applications
Karachi GIS (Demo)

Android + Google API

Hospital search within 10km distance
View/update information
Route navigation with direction
Camera view
Thank You