Low Cost Location Accuracy Improvement

For Developing Countries
INTRODUCTION
Punjab Information Technology Board

- Develop Applications for Govt Departments.
- Semi-Govt. Organization
- Several Development Teams: Android, .NET, GIS, Oracle, Web etc
- GDSG: Geospatial Data Science Team
More than 580 projects are in progress
Majority of the projects record location data through IoT devices e.g., mobiles, tablets, handheld PDAs etc.
PROJECTS
Government Departments

- Education
- Highways
- Livestock/Fisheries
- Police
- Agriculture
- Water and Sanitation
- Judiciary
• The projects usually require location based monitoring activities.
• Processing is computation intensive
• Independent servers for each project.
• Approx. 500k user base is using the location based applications
PROJECT IDEA
PROJECT IDEA

- Consolidated, Centralized and Distributed processing platform to
  - Store
    - Visualize
    - Process
  - Collect
  - Manage
• Spatial Data is Big
  • Velocity
  • Volume
  • Variety
  • Value etc.
• Spatial Big data Computation Intensive
• Big “Location” Data Inaccuracies
BIG Data storage and Processing
Common Platform
Minable Data
Location Services
BIG Data storage and Processing
EXAMPLES
Dengue Activity Analysis Map

No Activity
Insufficient
Sufficient

- Activity of a single day-map of a city.
- Identify the missing areas using location data.
- Computation intensive, processed at the server for day-1.
e-Vaccs
Kids Under 5 Years Vaccination Coverage Map
Kids Vaccinated 15,000,000

October 2014

No Coverage

Coverage

May 2016
COMPONENTS
Components

- Project – Spatial Atlas Repository
- Spatial Services – Analyzing and Visualizing
- Server - Processing
- Repository - Storing
LOCATION SERVICE
LOCATION SERVICE

• Low Cost
  • Customizable
  • Integrate-able
  • Handle Big Data - Cloud

• Location Accuracy Improvement
  • Accuracy – Deep Learning

• Developing Countries
  • Local Solutions
  • Replicable
Low Cost

• Cheap Receiver + Antenna + pi
• Mobiles with Dual Frequency Antenna
• Programming at Receiver level
• Calculations at Mobile Level
• Deep Learning(CNN) on raw location data
• L5 Signal – Beidou and QZSS
• Processing at Server level – Spark Hadoop
- Triangulation
- Correction at receiver end
- Corrections at server end
DETAILS
Server

Map Server

Feature Server

Tile Server

Image Server

Data Server

Location Server
SERVICE
REPOSITORY
REPOSITORY

- No SQL Datasets – MongoDB
- SQL Datasets – PostGres(PostGIS)
- SparkGIS – Spatial Query Processing
- MinIO – Storing data on Cloud
- Data Conversion Component
DATA CLASSIFICATION

- **Institution / Department**
  - LESCO, WASA, Irrigation Department, Agriculture, Health, Dengue, Covid, etc.

- **Placename**
  - Lahore, Peshawar, Kasur, Attock etc.

- **Data Type**
  - Image, Polygon, Raster, Line, Point, Mixed, Measured Line String, More

- **Subject**
  - Boundaries, Census, Transportation, imagery, BaseMaps, EarthCover, Oceans, Landuse, boundaries, Cities and towns, Administrative and political divisions, More
DATA ATTRIBUTES

- Author(s)
- Description
- Publisher
- Collection
- Place(s)

- Subject(s)
- Format(s)
- Year(s)
- Held by
- Preservation record

Data Dictionary