Bhuvan
Indian Earth Observation Visualization
http://bhuvan.nrsc.gov.in

Indian Space Research Organisation

UN-COPUOS
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Vision

To evince the distinctiveness of Indian imaging capabilities through online rendering of multi-resolution, multi-temporal and multi-sensor IRS imagery overlaying value added thematic maps on 3D globe whilst serving for societal good.

Integrated into everyday decision making
What is Bhuvan?

• Primarily a EO visualization tool
• Indian remote sensing satellite imagery-based geo-portal, representing in essence, the whole India on a computer
• Enables users to "fly" from space to street level to find geographic information and explore places around India
• Like a video game and a search engine rolled into one – ease of use
• A 3D model of India that lets you grab, spin and zoom down into any place

User Satisfaction is our Mission
Bhuvan: Genesis and Intent

• A Geoportal of Indian Space Research Organisation
• Showcase Indian Imaging Capabilities in Multi-sensor, Multi-platform and Multi-temporal geospatial domain
• A gateway to explore and discover virtual earth in 3D space
• Specific emphasis on Indian region and utility for society
• Premiered in Aug 2009
Highlights

Typical Objectives
• Visualization of IRS images on 3D Globe
• Support for 2D and 3D client tools & utilities
• Display of geospatial raster and vector layers
• Scalable solution, commensurate with the vision
• Optimised solution - Large no. of concurrent users
• System design and architecture – Distributed comp.

Challenges
• Server side - H/W, S/W, Security and Networking..
• Application S/W - Server side & client side dev....
• Database organisation, Standards, implementation..
• Content generation, deployment & management...
• Quality Assurance (s/w, geometry & Radiometry)....
Broad Areas of Development

- Features - client side and server side solutions
- Three Tier Architecture
- Value addition in Client-end functionalities
- Server-end challenges - operations/ services
- Hardware requirements analysis & design
- Metadata preparation and cataloguing
- Raster and Vector data standards & preparation
- Database Organisation and design
- Analysis for optimal performance - simulations
- Road Map - Short term & Long term
Bhuvan Design - Challenges

- Cater to large no. of users concurrently - efficient streaming
- Application software solution - adaptable/scalable
- To meet large concurrent users’ demands - design issues
- Customisation of client-end s/w - Design & development
- Optimal database design, preparation & management
- Multi-resolution, multi-sensor, multi-temporal data mgt.
- High Quality image Geo-referencing – Automation
- Variable sized Tiles/ Mosaics for optimal services
- Radiometric normalisation for virtual seamlessness
- Large volume of data processing/ storage/ updates
- Large number of Vector layers - Themes/ infrastructure
- Vector data overlay on images and query/ info. extraction
- Innovative value addition /research - software & services
Bhuvan Architecture

- Satellite Data
- Elevation Data
- Thematic Data

Optimized Data storage → Data Streaming Application Raster / Vector → Data Security

Load Balancing → Internet → Users

Internet Users Load Balancing
Bhuvan Hardware Set-up

- Power scalable and Storage scalable Architecture
- Four Servers with blade technology - 8 Cores
- Storage Area Network (SAN) Storage - 50 TB
- Active-Active Configuration of server for load balancing and failover situation
- High availability with Failover, SAN and Redundant SAN switch
Salient Features of Application Software

- Powerful Network data server technology to stream massive geographic databases
- Designed by easy scalability of images and vectors
- Works with firewalls and proxy servers
- Enable SSL (Secure Socket Layer Protocol)

- Simple Browser based client even for 3D globe
- Optimized to work with client bandwidth limitations
Databases for Bhuvan

- Multi-resolution pyramid structure
  - Compressed
  - Auto-mosaic same resolution images

- Avoids relational database overheads
  - Structured files
  - No Database
  - No overheads

- Flexible database creation
  - Interactive tools
  - On-the-fly projection transformation
Data on Bhuvan

• Data as per RSDP

  • AWiFS for entire world
  • AWiFS Full India (Three seasons of 2008)
  • LISS-III Mosaic for India (2007)
  • Synthatic L4MX (IRS-1C/1D PAN + LISS-III) covering entire India
  • IRS-P6 LISS-4 covering western part of India
  • OCM Full India mosaic.

  • IRS-P6 L4MX for full India.
  • IRS-P6 L4MX some Foreign cities.
  • Full India LISS-III Mosaic for 2008

Administrative Boundaries
- Country
- State
- District
- Taluk
- Village

Thematic Information
- Wasteland Data
- Soil
- Ground Water Prospects

Value added Information
- Watershed Boundary
- Weather Parameters (AWS)
- Disaster Specific Datasets (Flood & Drought)
Distinctive Attributes

• A complete net-centric 3D visualization solution
• Solution using optimal Web Cache and data streaming Server
• Customised client/browser based utilities
• 3D Visualization in browse
• Create, view, analyze, and share 3D environments
• Highly scalable architecture & open standards
• Feature rich 3D object tools
• Rich thematic information
• Focus on societal applications
• Current events update
Bhuvan Tools and Capabilities
ISRO Bhuvan - Typical Screen shots
Bhuvan goes Global
Part of Vienna city in Bhuvan
Part of Vienna city in Bhuvan