Web GIS Based Disaster Portal Project

ESRI INDIA
Contents

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• Product Technology Used
• KSNDMC Application – Architecture
• Tool Developed
• Benefits for the End User
• Problems faced during implementation and how it was overcome
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Requirements Overview

- Data Model Design to receive data from the Rain Gauge and Weather Stations installed in field at 15 minutes X 24 X 7 interval.
- Web App for Disaster analysis
- Data import tools for integration with IMD, CMMACS and SAC
- SMS / Alert Mechanism
- Report & Map Generation
- Tools to calculate Drought Analysis and Crop Insurance
Product Technology Used

- ArcGIS Server 9.3
- ArcGIS Web ADF
- ArcSDE 9.3
- ArcGIS Desktop 9.3
- Oracle 10g
- .NET Framework 2.0
Upgraded to Technology

- ArcGIS Server 10.2
- ArcGIS JavaScript API
- ArcGIS Desktop 10.2
- Oracle 11g
- .NET Framework 3.5
KSNDMC Rain gauges (2561) & Weather Stations (370) Network
Functional Block Diagram of KSNDMC Application
Tools Developed:

- KSNDMC Web Application - Support basic Map functionality
Tools Developed:

- KSNDMC Web Application - Display intensity of Rain and information and rendered as graphics on Map
Tools Developed:

- KSNDMC Web Application -
  - Support to view intensity of rain by location
Tools Developed:

- KSNDMC Web Application -
  - Support to view weather parameters by location
Tools Developed:

- KSNDMC Web Application - Support query to view intensity of Disaster affected location by rendering Map generated on browser
Tools Developed:

- KSNDMC Web Application -
  - Support query to perform analysis on station performance
Tools Developed:

- KSNDMC Web Application -
- Support query to view Alerted locations
Tools Developed:

- KSNDMC Web Application - Support to view Moisture Index maps generated through browser
Tools Developed:

- KSNDMC Web Application - Support to view Earthquake affected location on browser
Tools Developed:

KSNDMC Web Application -
KSNDMC Web Application:

- One point access to manage Master data
KSNDMC Web Application:

- Support Data download received from Rain and weather gauge
KSNDMC Web Application:

- Support to view & manage agriculture data

### Generate CWB Report

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Generate using: Hobli

![CWB Report Table](image)

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Patterns of colors indicate non-availability of rainfall data of hoblis for that stage.
Tools Developed:

- **Report & Map Generation**
  - Generating interpolated maps using thiessen polygon techniques using dynamic data received from Rain and Weather Gauges installed in field

- **Type of Maps Generated**
  - Rainfall distribution maps
  - Temperature & Humidity distribution maps
  - Anomalies and Soil moisture index maps for drought calculation
  - Forecast maps
Get the Station wise Actual Rain Data

Calculate Weighted Average Rain Value (Based on Thiessen Polygon Method)

Maps

Charts

District wise Wt.Avg Rain

Taluk wise Wt.Avg Rain

Hobli wise Wt.Avg Rain

Daily State Report (HTML)

HTML to PDF conversion

Send Mail to Users

Web App
Tools Developed:

- KSNDMC Daily State Report -
Actual & Forecast rainfall Maps auto generated
Humidity & Temperature Maps auto generated
Forecast Maps auto generated

- Cloud Fraction Forecast Map
- Relative Humidity Forecast Map
- Rainfall Forecast Map
- Temperature Forecast Map
- Wind Speed & Direction Forecast Map

Karnataka State Natural Disaster

Karnataka State Natural Disaster Monitoring Centre

Date of Forecast: 18/05/2014
Forecast Period: 0530 hrs of 18MAY2014 to 1730 hrs of 18MAY2014

Disaster Monitoring Centre

Date of Forecast: 18/05/2014
Forecast Period: 0530 hrs of 18MAY2014 to 1730 hrs of 18MAY2014

INDEX
12 Hours Wind Pattern
- 0.0 - 8.0
- 8.1 - 12.0
- 12.1 - 16.0
- 16.1 - 20.0
- 20.1 - 24.0
- 24.1 - 28.0
- 28.1 - 32.0
- 32.1 - 36.0
- 36.1 - 40.0
- 40.1 - 44.0
- 44.1 - 48.0

 Disclaimer: The forecast provided is a model based estimate and actual results may vary. The estimates are based on historical data and are intended for general guidance only.
• Each station current parameter value can be seen on the map.
• By default for every 1 minute, next map will come.
• User can navigate between maps using Next and Back buttons.
• User can pause current map.
User can navigate from tabular data to location on map.
Batch Tools Developed

KSNDMC

Data download
- HTTP (XML)
  - TRG Data
  - TWS Data
- FTP (Excel Sheet)
  - CMMACS Forecast
  - SAC Forecast
- MAIL (Excel Sheet)
  - IMD Forecast

Weather reports
- Daily State
- Weekly State
- Weekly District wise
- Monthly State
- Monthly District wise
- Seasonal State
- Seasonal District wise
- Annual State
- Annual District wise

SMS
- Daily State wise Rainfall
- Daily Taluk, Hobli, GP level Rainfall
- Daily District wise Weather
- Daily BBMP Rainfall SMS
- Daily Forecast
- Special Alerts (Cyclone, Flood, etc)

Others
- Drought Maps
- BBMP Daily Rainfall Maps
- District wise Forecast Rainfall Distribution
- Forecast Vs Actual Maps & Table
- Dynamic Maps for Any Time & Date
- Time Series Charts (Actual Vs Normal Rainfall)
- Crop Insurance
- Rainfall Runoff Analysis

MAIL (Excel Sheet)
- IMD Forecast
Drought Analysis Tool

Drought Guidelines
- 2009 GOI Guidelines
- Gore Guidelines

Period Range

Drought Conditions
- MAI
- Cum. RF
- Dry Spell: No of Week, Season

Report Type
- State
- District
- State+Dist

MAI Stands for Moisture Adequacy Index. If Cumulative MAI < 50% for the duration, it is considered as Drought Affected.

If Cumulative Rainfall is (-20%) compared to Normal Rainfall then it is considered as Drought Affected; The duration of period for calculating Cumulative Rainfall must be in same season.

If Rainfall is (-50%) compared to Normal Rainfall, it is Considered as Dry Spell.
Drought Maps generated for year 2013

Karnataka State Drought Map – SW 2013

Chitradurga District Drought Map – SW 2013
Generating Maps from Archived Database

User has to select the Spatial Location

User has to select the required Map

User has to select the particular Date & Month between any two Years for the selected time

User will enter the title of the map
Crop Insurance Calculator

- Select Insurance Company (ICICI, HDFC, AIC, Reliance, etc)
- Select the Index (Deficit RF, Excess RF, Weather Conditions)
- Select the number of Phases (Maximum of 5 Phases)
- Select the number of years of Calculation (Max of 10 Years)
- Select the Location
- Select the Crop Type
- Enter the Time Duration
- Enter the Thresholds
- Enter the Rates & Maximum Payout
- Enter the Benchmark Rainfall/Temp Value
- Enter Premium
- Export for Each Phase
- Export Final Payout

Total PayOut

Submit
Export
Exit
Crop Insurance Report

Crop Affected due Deficit & Excess Rainfall for the past 10 Years

<table>
<thead>
<tr>
<th>DISTRICT</th>
<th>TALUK</th>
<th>HOBLI</th>
<th>CROP</th>
<th>COMPANY</th>
<th>INDEX</th>
<th>YEAR</th>
<th>PH1 RF (mm)</th>
<th>PH1 (rs)</th>
<th>PH2 RF (mm)</th>
<th>PH2 (rs)</th>
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Crop Insurance Report

Crop Affected due Deficit & Excess Rainfall for the past 10 Years

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<td>2012</td>
<td>25</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>BAGALKOTE-18</td>
<td>BAGALKOTE-1802</td>
<td>ALL HOBLIS</td>
<td>CHILLI IRR</td>
<td>CHOLA</td>
<td>EXCESS</td>
<td>2013</td>
<td>25</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
## Crop Insurance Report

### Crop Affected due Deficit & Excess Rainfall for the past 10 Years

<table>
<thead>
<tr>
<th>YEAR</th>
<th>YEAR_Period</th>
<th>DEFICIT_Total</th>
<th>EXCESS_Total</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>2013-2014</td>
<td>735.98</td>
<td>0</td>
<td>735.98</td>
</tr>
<tr>
<td>2012</td>
<td>2012-2013</td>
<td>6107.164</td>
<td>0</td>
<td>6107.164</td>
</tr>
<tr>
<td>2011</td>
<td>2011-2012</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>2010-2011</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2009</td>
<td>2009-2010</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2008</td>
<td>2008-2009</td>
<td>15503.6</td>
<td>0</td>
<td>15503.6</td>
</tr>
<tr>
<td>2007</td>
<td>2007-2008</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2006</td>
<td>2006-2007</td>
<td>7322.56</td>
<td>0</td>
<td>7322.56</td>
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<tr>
<td>2005</td>
<td>2005-2006</td>
<td>980</td>
<td>0</td>
<td>980</td>
</tr>
<tr>
<td>2004</td>
<td>2004-2005</td>
<td>2979.2</td>
<td>0</td>
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</tbody>
</table>

### PERIOD Table

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>TOTAL PAYOUT(RS)</th>
<th>AVERAGE PAYOUT(RS)</th>
<th>PREMIUM (RS)</th>
<th>%PAYOUT TO PREMIUM</th>
<th>Years Compared</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-2013</td>
<td>33628.504</td>
<td>3362.8504</td>
<td>11760</td>
<td>28.6</td>
<td>10</td>
</tr>
</tbody>
</table>
Generating Time Series Charts from Archived Database

Select Raintype (Actual / Wt Avg)

Select RainValue (Daily / Season Cumulative)

Enter the Time Duration

Enter the Title Names

Select the Spatial Type

---

Percentage Departure of Rainfall from Normal for Karnataka State over the period of 40 Years during North East Monsoon (October-December)
Benefits for the End User

- An ordinary man gets the real time information instantly.
- Farmers get ready to face and take preliminary actions with Forecast Rainfall information.
- Government authorities get the Weather report on Daily, Weekly, Monthly, Seasonal and Annual basis.
- KSNDMC suggests the Government to issue the insurance payment for crops on Excess, Deficit Rainfall & Weather Conditions through Crop-insurance tool.
- KSNDMC reports to the Government about Drought affected areas.
- Through Weather Dash Board, common man gets the real time weather information on his finger tip (Both Spatially and temporally).
- KSNDMC employees are regularly monitoring, data downloading and data editing via internal portal.
Problems faced during implementation and how it was overcome

- In Web ADF, Rendering interpolated maps on browser with hatch symbol not supported due to decimal values in interpolated raster grid code values, after doing research for 20 days identified this. ArcGIS Software does not support decimal grid code values and converted grid code values to rounded values.

- In 10.1 ArcGIS JavaScript API, no support for rendering maps with hatch symbol type, we overcome this issue by using Picture Marker Symbol by creating picture of hatch symbol of required design and rendered on browser.
Challenges Faced during implementation

- Generating auto-mode customized alerts/early warnings/advisories based on the high density and high resolution near real-time data collected from telemetric systems of KSNDMC instead of current semi-auto mode.
- Issue timely auto alerts/early warnings, advisories related to natural disasters to government bodies and community via SMS/help desk/email/social media/web portal.
- Ensuring data integrity for delayed/no response TRG and TWS.
- Building an interactive system to conveniently manage TRG and TWS stations, perform analysis, search, compare current and forecasted data.
- Integrating historical data with data from newly installed TRG and TWS stations.
Applications Out Reach

- Daily State Weather Report send to concern Government Authorities through mail.
- Public can view weather information instantly through web portal (https://www.ksndmc.org). More than 120000 people visited the website since it was developed.
- A Glance on Alerts issued during the Year 2013 below.

<table>
<thead>
<tr>
<th>SMS Type</th>
<th>SMS Count - 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISTRICT Rainfall</td>
<td>182805</td>
</tr>
<tr>
<td>Taluk Rainfall</td>
<td>1532217</td>
</tr>
<tr>
<td>Hobli Rainfall</td>
<td>458033</td>
</tr>
<tr>
<td>Gram Panchayath</td>
<td>2472488</td>
</tr>
<tr>
<td>Regions Forecast</td>
<td>22154</td>
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<tr>
<td>District Forecast</td>
<td>287949</td>
</tr>
<tr>
<td>Taluk Forecast</td>
<td>918916</td>
</tr>
<tr>
<td>Hobli Forecast</td>
<td>326925</td>
</tr>
<tr>
<td>District Weather</td>
<td>182382</td>
</tr>
</tbody>
</table>

SMS Count – 2013 (No of Users x No of SMS In a day x 365 days)
Appreciation from KSNDMC

- Daily State Weather Report is Fully Automized which eliminates the Hours of Man work.
- The Telemetric Weather Stations (TWS) usually send 15min interval Data. The client appreciated that the system is designed to give 1 min interval Data when the Wind speed exceeds 5 m/s.
- Client was very happy on development of comparison of Forecast Rainfall data with Actual Rainfall Data. (Super-impose on Actual Rain Data).
- With the help of Crop Insurance tool, Client saved Hundreds of Man Hours. (Need to calculate the term sheets for 747 hoblis x 12 Crop types x 6 Companies)
- Rainfall Runoff Analysis done with High Intensity Rainfall Data. It pictorially depicts the runoff co-efficient per hectare per year which was well appreciated by client.
Appreciation from KSNDMC

- KSNDMC Director well appreciated on Dynamic maps of Weather Dash Board (It dynamically updates for every 15 minutes data).
- TRG/TWS Monitoring system is highly helpful for the KSNDMC employees to regularly update the status of Telemetric Stations.
- KSNDMC appreciated the work of Internal Portal through which the users can download, update and analyze the weather data dynamically.
- KSNDMC Director appreciated about the migration of existing applications and database from ArcGIS 9.3.1 to ArcGIS 10.2
The KSNDMC GIS is currently in operation and has been a success story where for the first time GIS-enabled early warning and spatial decision support system for disaster management has been developed and made operational in the Indian government.
Questions & Discussion
Thank You