The WeatherShare Project: Aggregation and Dissemination of Weather Information for Public Safety

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Big Sky Montana
Monday, August 14th, 2006
12:30 pm
Session B4: Innovative Data Collection and Sharing

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Related Sessions:

Session G2: Using Existing Technology in New Ways
Tuesday, August 15th, 2:45 pm
Abstract:

In cooperation with the California Department of Transportation, Montana State University’s Western Transportation Institute has developed a “proof-of-concept” data aggregation and dissemination system to collect and provide public safety officials with current and historical weather data.

Through the use of a rich, interactive user interface and customizable profiles, the system provides users with a flexible system for monitoring current conditions and evaluating sensor operation and prospective deployment. Users may also set custom alerts to indicate when certain events such as high winds or sub-freezing temperatures occur.

Quality control procedures have been implemented to flag questionable sensor readings.

This presentation will provide an overview of the system and anticipated system enhancements.
WeatherShare Background

- Covers a 20-county, Northern Calif. region with >2,000 miles of highways.
- 11 Caltrans RWIS stations and >700* other weather stations
- A component of the Redding Incident Mgmt. Enhancement (RIME) program.
- Phase I Stakeholders include:
Goals of WeatherShare

• To streamline and integrate currently available road weather data from Calif. RWIS sites, Calif. Dept. of Water Resources (CDWR) stations, and other sources available into a single source, where relevant information is accessible by incident responders and the traveling public.

• This system will allow users to make informed and efficient assessment of current road weather conditions for: incident management, highway maintenance, emergency medical services (EMS), traveler information, and possibly homeland security applications.
Systems Engineering Process

- Phased approach
  - Phase I: Prototype system
  - Phase II: Full system
- Follow the V model on a small scale
V Model

Concept of Operations

High-Level Requirements

Detailed Requirements

High-Level Design

Detailed Design

Implementation

Assessment

Operations & Maintenance

System Acceptance

Subsystem Verification

Integration & Test

TIME
WeatherShare Concept / Information Flow

- Caltrans D-2 RWIS Station
- Caltrans D-1 RWIS Station
- Caltrans D-3 RWIS Station
- CDEB Weather Station
- CDEB Weather Database
- CDEB Weather Station
- CDEB Weather Database
- CDEB Weather Station
- CDEB Weather Database

- Data Quality Control Process
- Data Passed QC?
- Yes
- No
- Data Flushing & Error Reporting
- WeatherShare Data Acquisition Module
- Query
- Data

- Considered for future expansion
- Other info: such as incident data, camera images, reported road conditions, fire info, and environmental sensitive areas

- Incident Management GUI
- Maintenance and Snow Removal GUI
- Emergency Response GUI
- Traveler Information GUI
- Homeland Security Applications GUI

- Caltrans D-2 Redding TMC Staff
- D-2 RWIS Monitor and Maintenance Staff
- CDF/CHP/SHASC/EMS Dispatch Staff
- Traveling Public
- Homeland Security Staff
Data Sources, Update Frequency & Sensor Readings

- **CDEC(420 stations):** every 15 minutes

- **MADIS(39 stations):** every 30 minutes
  - Air Temperature, Relative Humidity, Avg Wind Speed, Avg Wind Direction, Max Wind Gust Speed, Max Wind Gust Dir, Dewpoint Temp, Atmospheric Pressure, Fuel Moisture, Fuel Temperature, Precipitation Rate, Precipitation in 24 Hours.

- **MesoWest(229 stations):** every 15 minutes
  - Air Temperature, Relative Humidity, Avg Wind Speed, Avg Wind Direction, Max Wind Gust Speed, Atmospheric Pressure, Solar Radiation.

- **District II RWIS(11 stations):** every 30 minutes
  - Air Temperature, Dewpoint Temp, Max Temp, Min Temp, Avg Wind Speed, Max Wind Gust Speed, Avg Wind Direction, Max Wind Gust Dir, Relative Humidity, Precipitation Intensity, Precipitation Rate, Accumulate Precipitation, Visibility.
Multi-tier System Architecture

Data Presentation
- HTML Client
- Adobe SVG Plug-in 3.0

Business Logic
- Data Parsing: Fetch data and parse into MySQL database
- Quality Control: 3 Levels Quality Control for weather data
- User Privilege System: User management, User profile system
- SVG mapping: Dynamic generate the SVG layer for air temp. wind, etc.

Data Storage
- MySQL Server
- XML/ SVG
System Hardware Configuration

- Dual Intel(R) Xeon(TM) CPU 2.40GHz
- Hard drives: 80 GB x 2
- 1 GB memory
System Software Configuration

- Debian Linux (kernel 2.4.25)
- Apache v 1.3.33-2
- MySQL v 3.23.49-8.8
- Perl v 5.8.4-5
- PHP4 v 1.3.10-2
- SSH v 3.4p1-1
The WeatherShare Interface

- HTML
- JavaScript
- SVG (Scalable Vector Graphics) – requires Adobe SVG plug-in
- Broadband connectivity preferred
WeatherShare URL: www.weathershare.org
The WeatherShare User Interface
Primary Map: Recent Temperature Reports
Primary Map: Recent Wind Readings
Can Filter by Data Source:

- California Data Exchange Center (CDEC)
- MesoWest
- Madis
- Caltrans
Caltrans’ RWIS Stations
Details from Dunsmuir I-5 Station

Network: Caltrans District 2 Road Weather Information System
Station Name: Dunsmuir, I-5 Siskiyou
County: SISKIYOU
Elevation: 2500 Feet
Longitude: -122.27000
Latitude: 41.21000
Air Temp. Avg/Max/Min: 45.9 / - / *F
Relative Humidity: 51 %
Dew Point: 28.6 °F
Avg/Gust Wind Speed: 5.0/ 6.8 mph
Data Can be Viewed in Context

- Example: The Lyons Valley station in Lake County was producing some “interesting” readings.
Further Detail: Lyons Valley Station

Network: MESOWEST/RAWS
Station Name: LYONS VALLEY
County: LAKE
Elevation: 3199 Feet
Longitude: -123.07360
Latitude: 39.12580
Air Temp. Avg/Max/Min: 123.0/-/ - *F
Authorized Users

- Public has general access.
- Authorized users have access to further information and functionality.
Investigate Lyons Valley Further

**Weather Information Query Results - Microsoft Internet Explorer**

*Updated at 12:15:00 PM PST Tuesday, March 29, 2005*

**Network:** MESOWEST/RAWS

**Station Name:** LYONS VALLEY

**County:** LAKE

**Elevation:** 3199 Feet

**Longitude:** -123.07360

**Latitude:** 39.12580

**Air Temp. Avg/Max/Min:** 123.0 / - / - °F
Select date range for historical data:

```
Station Name: LYONS VALLEY
County: LAKE
Elevation: 3199 Feet
Longitude: -123.07360
Latitude: 39.12580
From(YYYY/MM/DD): 2005/01/01
To(YYYY/MM/DD): 2005/03/29
Submit
```
Data Viewed in MS-Excel
Caltrans’ Surface & Pavement Temps

- Air Temp. Avg. Max/Min: 50.7 °F
- Relative Humidity: 41%
- Dew Point: 27.6 °F
- Avg. Gust Wind Speed: 6.8/11.2 mph
- Avg. Gust Wind Direction: 0/5
- Precip. Accum in 24hrs: 0.000 in

### Pavement Data

<table>
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<tr>
<th>Sensor Id</th>
<th>Status</th>
<th>Surface Temp.</th>
<th>Pavement Temp.</th>
<th>Freeze Point</th>
<th>Chemical Factor</th>
<th>Chemical %</th>
<th>Ice %</th>
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<td>32</td>
<td>- °F</td>
<td>49.0 °F</td>
<td>-</td>
<td>95</td>
<td>-</td>
<td>-</td>
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<tr>
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<td>70.4 °F</td>
<td>- °F</td>
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<td>-</td>
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<tr>
<td>2</td>
<td>33</td>
<td>70.2 °F</td>
<td>- °F</td>
<td>-</td>
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</tr>
</tbody>
</table>
Alerts/Thresholds
Wind Alerts = Blinking Arrows
Quality Control

- Multivariate linear regression is being implemented for Level 3 quality control
- Results are experimental
- No uniform standard for this
- It has already proven useful.
- Requires further investigation.
Six Faulty Stations Identified:

- Temperature anomaly at Lyons Valley station.
- Two portable stations have been moved.
- Elevation was identified incorrectly by a provider.
- Two stations identified as questionable by providers.
Preliminary to Phase 2

We have:

– A working, proof-of-concept system.
– Detailed concept of operations, requirements.
Next Steps – Phase 2

- Prepare System for Statewide Coverage and Deployment
- Enhance Alert Capability
- Improve Reporting Capability
- Add Weather Forecasts and Alerts
- Continue to Work and Usability and Utility Issues
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  - Ian Turnbull
  - Many Others
- Other Stakeholders
  - Norcal EMS
  - CDF
  - Shascom
  - Others