REMOT
Real-time Environmental Monitoring & Observation Technology
John Kim
Talk Outline

- What does it do?
- How does it work?
- Google Maps
- Issues & Lessons
What is REMOT?

http://fsp.sdsu.edu
A hack system to display real-time data from heterogeneous data networks
Use Google Maps to find a reserve or a site.
Use Google Maps to find an observatory
Display real-time data

Real-time Environmental Monitoring and Observation Technology
SMER Bug Trail Weather Observatory

About REMOT:
- Intro to REMOT
- Network
- Infrastructure
- Technology Transfer
- Future Directions

Latest Data
Data time: 2007-04-10 15:55:00
Air Temp 14.1 °C
Atmospheric Pressure 963.9 mb
Peak Wind Speed 1.7 m s⁻¹
Relative Humidity 78.0%
Solar Radiation 536.3 W m⁻²
Total Precipitation 6.0 inches
Wind Direction 286 degrees
Wind Speed 0.7 m s⁻¹

Nearest Web Camera Observatory
Gorge Camera Observatory has 3 cameras:
Gorge Axis1
Gorge Axis2
Gorge Axis3

Latest 24 Hours Data
2007-04-09 16:00:00 to 2007-04-10 16:00:00

- Air Temp (°C)
- Atmospheric Pressure (mb)
- Peak Wind Speed (m s⁻¹)
- Relative Humidity (%)
Browse camera images
Special Web Applications
How does it work?

FSP

ROADNet

SHWOP

GCRG

FSP
FTP server

FSP
ROADNet node

SIO-CRD
Webserver

GCRG
MySQL db

FSP
Webserver
1. ROADNet data: use VORB queries
2. Data on FTP & web servers: transfer to FSP MySQL db
3) Build database to represent conceptual framework

4) Map data streams onto conceptual framework

ROADNet: Network-Station-Channel
MySQL: Database-Table-Field
Database schema for Conceptual Framework

**Reserve**
- Name
- Lat/lon

**Observatory**
- Reserve_ID
- Name
- Lat/lon
- Type
- Operator

**Sensor**
- Observatory_ID
- Name
- Equipment_ID
- Operator
- Measurement unit
- Num decimals

**Equipment**
- Make
- Model
- Version
- Description
- Price
- Power draw
- Interface
Database schema with data stream tags

**Reserve**
- Name
- Lat/lon
- **ROADNet net**
- **MySQL database**

**Observatory**
- Reserve_ID
- Name
- Lat/lon
- Type
- Operator
- **ROADNet sta**
- **MySQL table**
- **ROADNet** or **MySQL**?

**Sensor**
- Observatory_ID
- Name
- Equipment_ID
- Operator
- Measurement unit
- Num decimals
- **ROADNet chan**
- **MySQL field**

**Equipment**
- Make
- Model
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REMOT Sample Query

“Display sensor data from SMER Gorge”

1. Find SMER
2. Find Gorge observatory
3. Find all its sensors
4. Assemble net-sta-chan or database-table-field
5. Query ROADNet or MySQL
REMOT Virtual Sensors

Reserve
- Name
- Lat/lon
- ROADNet net
- MySQL database

Observatory
- Reserve_ID
- Name
- Lat/lon
- Type
- Operator
- ROADNet sta
- MySQL table
- ROADNet or MySQL?
- MySQL formula table

Sensor
- Observatory_ID
- Name
- Equipment_ID
- Operator
- Measurement unit
- Num decimals
- ROADNet chan
- MySQL field
- Is virtual?

1. Is it virtual?
2. Find formula in formula table
3. Apply formula to MySQL table

Et01 (evapotranspiration)

\[ \text{Et01} = \frac{((1+1.608*(((H2OVOLT*120+400)*18)/(1013.25*1000)/(2.8704*(273.16+\text{AIRTEMP}))))*((WEC OVAR*120*18)+(((H2OVOLT*120+400)*18)/(\text{AIR TEMP}+273.16))*WHCOVAR)))/1000000000*864000000}{1000000000} \]
Google Maps API

Pro:
• Free
• Interactive
• Map vs. satellite view
• in Javascript

Con:
• Free
• Interactive
• Map vs. satellite view
• in Javascript
OK, so Google Maps *is* kinda cool

AJAX:
- Google Map itself
- Your own asynchronous updates
- KML & Simple GML

Custom Overlays & Controls

New Marker Manager
Basic steps for using Google Maps API

Embed Javascript in webpage to:

1. Create Map
   a. centered at <lat> <lon>
   b. specify width & height
   c. zoomed to level 13

2. Specify accessories: zoom tool, map type button

3. Create marker at <lat> <lon>
   a. Attach specific icon
   b. Attach specific HTML for bubble
REMOT Issues & Lessons

- Ad hoc data transfer methods are unreliable and inefficient (e.g., the scrapes)
- ORB/VORB/SRB is great! But queries are slow
- Plotting is slow (JPGraph)
- Keep data query model separate from geographic model
- Use Object-oriented code
REMOT Issues & Lessons - GUI

- Overlapping icons
- Browser Incompatibilities
- Satellite images a security risk?
- Embedded lat/lon coordinates a security risk?
- Some people just don’t get Google Maps
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