Community Remote Sensing Scheme for Severe Weather Alerts using Doppler Weather Radar Data on Mobile Platform

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Abstract

Peninsula region of India is periodically ravaged by severe weather events like the Bay of Bengal / Arabian ocean cyclones. Other regions especially in north eastern India are annually affected by severe thunder storms locally known as KalBaishakhi or the Norwesters which causes floods, landslides etc. resulting in loss of life both human and animal (like cattle etc.) which lead to huge economic losses as well. The population mostly affected being rural. Effective communication of the impending severe weather threats to the remote areas well in advance especially at community level has great potential for reducing the impact of such severe natural hazards.

Even though the electronic media like radio and TV broadcasts disseminate warnings, the update rates are not commensurate with the lead times needed for implementing effective measures for reducing the loss of life. The proliferation of the cell phone network in India has provided the opportunity for ensuring community awareness scheme, especially in the rural areas by providing the direct access to information on impending disasters. This paper describes one such initiative successfully demonstrated using the remote sensing data from the ground based Doppler weather radar (DWR) systems especially of severe cyclones using the mobile GPRS scheme.

This is a three stage architecture composed of the mobile node, the intermediate web server, and the radar systems located at various locations within the country whose data transfer scheme is based on the wireless/mobile and Internet communications. Mobile clients use handheld devices such as PDA or a cellular phone, to transmit and receive multimedia information via the GSM/GPRS network.

The mobile applications necessary for the running and displaying of weather related information on mobile devices have to be net centric, which could support sharing of information among various devices. Web services, web browsers, the Java computing architecture, and wireless communications are some of the technologies that have been leveraged in the development of the mobile weather alert systems. In addition to textual information, the weather alert system disseminates weather observation and forecasts using basic multimedia and value added services to enable the public to better appreciate the spatial and temporal evolution of the weather conditions through a web application. Mobile based weather information computing, system architecture design, its implementation and application feasibility is the prime focus of this paper.

Indian space department have deployed several Doppler weather radars for monitoring of weather at different locations within the country .Processing meteorological data spatially, and presenting them on geographical

displays for both weather analysis and alert message delivery to citizens is the major aim behind this approach, Weather related information which usually varies with time could be detected using Doppler weather radars and analyzed that includes display of radar images, maps showing the local weather conditions. The data from these radars can be used to enhance the public weather services.

Experience with the hosting of the existing weather intelligence applications compatible to different platforms has been encouraging to, there is a lot of scope for location based services making use of radar data and mobile technologies that can be developed to facilitate members of the public to make intelligent weather-related and location-specific decisions for themselves, hence Mobile technologies are expected to be of great help in weather alert systems to a significant extent which could facilitate emergency services within the country.

Architecture

System architecture of weather alert system proposed in this paper has been laid on a generic web centric approach, which requires a web service to be implemented to pass weather data from the mobile device to a surrogate server using generic HTTP communication protocols. The data from the weather monitoring stations will update the remote server using Linux based rSynch. When the data is received by remote server where the Java based web application is running will fetch and update the database and if there is any critical situation is found at processing time, it will alert all the providers to send the information to the mobile users. Process such as data push and pull, java catcher and database management at the server end are used to retrieve weather information from a the radar stations communicating over HTTP communication platform using which the data has to be processed and displayed in Java based applications executed on the mobile device that makes use of the GSM/GPRS technologies for its communication. A web browser on the web enabled mobile /PDA can be used in conjunction with the wireless mobile communications to query a remote web server to provide a weather effects decision aid. This decision aid can also be made available as a standalone PDA application (i.e., no runtime connection to a server required) by hosting the relational database containing the spatial and temporal weather effects information on a secure digital card in the mobile device. This relational database can be synchronized with the server database using wireless synchronization, having a speed limitation due to the size of the database that would take a significant amount of time for transferring of data. Operational model of the proposed system is shown in the figure.

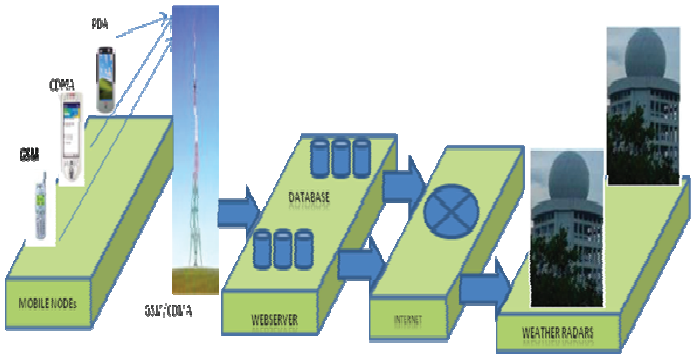

Fig 1: Block Diagram

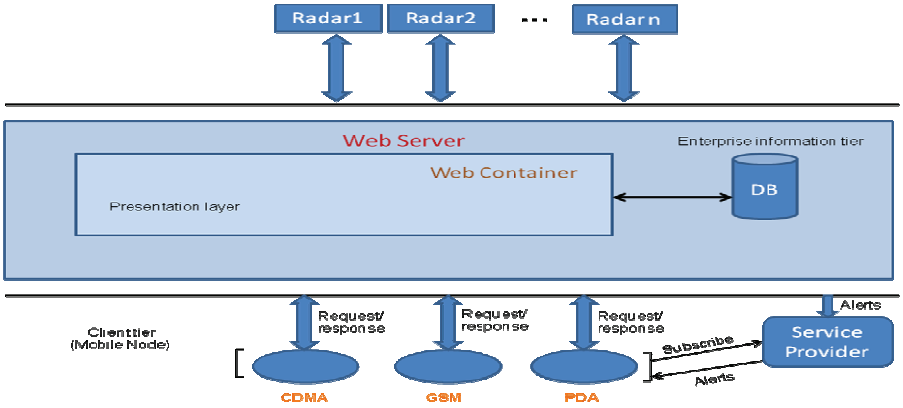

Fig 2: Layered Architecture Diagram

A demonstration of this initiative was made using data from ISRO's DWR located at SDLC - Satish Dhawan Space Center, Sriharikota space port.

Fig 3: Subscriber Unit Display

Future Efforts

The development and implementation of the technology as outlined above can be viewed as the first step in providing a truly mobile and net centric weather alert system with the help of the Doppler weather radar network deployed in the country, as is being planned by Govt. of India.

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BIODATA OF AUTHOR

Shri. G.Viswanathan, Director (Rtd.) - ISRAD / ISRO. G.Viswanathan, born in 1945 at Chittoor in Andhra Pradesh, graduated in Physics from Madras University & after Obtaining his DMIT in Electronics and Telecommunications Engg from Madras Institute of Technology in 1967, worked on design & development of Avionic packages for IAF, at Aeronautical Development Establishment of DRDO, for two& half years, before joining ISRO in 1970 at Thumba Equatorial Rocket Launching Station (TERLS, now a part of Vikram Sarabhai Space Centre), as a Radar Engineer. He was responsible for the Design & Development of Tracking Radar Systems for Satellite Launch Vehicle Missions from India's Space Port viz Sri Harikota (SHAR). He later on initiated the development of PCMC radar system as a joint development project between ISRO & BEL to support PSLV Mission. Thereafter, he was the Project Director for the Establishment of the MST radar at Gadanki near Tirupati as a major Scientific Facility for Atmospheric Research in India. Indian MST radar system happens to be the Second largest such facilities in the world. He was also Co Investigator for the Ground validation of the Tropical Rain fall Measuring Mission (TRMM), especially for the Space borne Precipitation Radar (PR), along with the Japanese Space Aerospace Agency. Later he was responsible for the design development and commissioning of the state of art Doppler Weather Radar system for IMD as an inter agency project between DOS & DST. Based on Technology transfer from ISRO to BEL the DWR system is now in production to meet national requirements. As the Director of ISRO Radar Development Unit (ISRAD), headed a team of Radar system professionals in realizing Tracking & Weather radar systems for national development, including the next generation tracking radars for GSLV Mk-III through technology support to L&T. He is a Fellow of IETE & a Member of a number of professional societies in India & abroad including IEEE. He has published more than 25 Technical & Scientific papers in National & International journals. After super superannuation from ISRO in 2007, he is currently the Adjunct Professor at Aryabhatta Research Institute for Observational Sciences, Nainital, where ST Radar is being established by DST. He is also a Member of the Committee on Technology Vision for Ministry of Earth Sciences and Chairman of the Sub committee on Atmospheric Technology. He was awarded the IETE – IRSI award for excellence in Radar systems in 1992. With his leader ship, ISRAD received the first team award instituted by Astronautical Society of India, for the development of Doppler Weather Radar System. He was felicitated by IAF & Met Society in Feb 2008 for his outstanding contributions in Space & Aviation Meteorology. He has recently (on Aug25,2009) received the ISRO Merit award from the Hon.Prime Minister of India Dr Man Mohan Singh for his contributions towards Atmospheric and Weather Radars.