A Study of Mountain Environment Monitoring Based Sensor Web in Wireless Sensor Networks

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Abstract. As the number of sensors increases and their size becomes smaller, there can be more interaction between everyday objects of our life. New generations of these devices that are smaller, it is possible to put a wireless interface on almost all everyday objects: vehicles, clothes, foodstuffs, etc. Interaction with thousands of sensors leads to a continuous and massive flow of events which are generated spontaneously. In this paper we present architecture of mountain environmental monitoring based sensor web in wireless sensor networks. This architecture provides various real-time sensing data such as mountain environment using temperature sensor, air pressure sensor, illumination sensor, humidity sensor, snowfall sensor, rainfall sensor, wind speed sensor, etc. Information of this architecture supports to develop Sensor web for effective monitoring in mountain environment.

Keywords: Sensor web, Mountain environment, Sensor networks

1 Introduction

The wireless sensor networks describe as consisting of spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental conditions at different locations. Typically, sensor networks emphasize technology to support robust power and communications technology, based on its heritage from military applications, notably battlefield operations. Small, autonomous wireless motes are deployed to monitor the environment and transmit data. Wireless communication protocols, network topologies, distributed and collaborative signal processing, microcontrollers, energy issues, miniaturization, low replication costs, and similar themes dominate the technology drivers for sensor networks. Related themes of intelligent sensors, target recognition, sensor fusion, situational awareness, and machine learning, among others, demonstrate that sensor networks concepts are rapidly evolving.

The sensor web concept is at least one generation beyond the popular sensor
network, which is a relatively straightforward interconnection of sensors that route measurement to a central data collection point. The sensors are envisioned to interact in an environment that leverages information from many sources. Leveraging and expanding on Internet web technologies, sensor web systems coordinate and interoperate to adaptively respond to events and create customized data products on demand.

The sensor web is a coordinated observation infrastructure composed of distributed resources that can behave as a single, autonomous, task-able, reconfigurable observing system that provides observed and derived data along with the associated metadata by using a set of standards-based service oriented interfaces. Key sensor web features include the ability to obtain targeted observations through dynamic tasking requests, the ability to incorporate feedback to adapt via autonomous operations and dynamic reconfiguration, and improved ease of access to data.

The approach of this paper is to employ new architecture and systems for sensing that are responsive to environmental mountain events for both safety application and scientific purposes. The rest of this paper is organized as follows: In Section 2, related works are introduced. In Section 3, we describe proposed architecture of mountain environmental monitoring based sensor web in wireless sensor networks. Finally, we make a conclusion in Section 4.

2 Related Works

The sensor web concept builds on this foundation to emphasize the heterogeneous nature of space and ground sensors. The vision addresses space-based sensors, each unique and complex, collaborating with in situ sensors, including sensor networks (networks), which can dynamically collaborate with data processing systems or forecast systems to dynamically respond to science or hazard monitoring goals. Sensor webs can achieve science objectives beyond the abilities of a single platform by reducing response time and increasing the scientific value, quantity, or quality of the observation by enabling collaboration among sensing and analysis assets.

Scientific projects have in the past been very isolated, data has seldom been reused within departments, opportunities for data sharing within institutions are missed and collaboration across institutions has generally only taken place when the expertise did not exist in-house. E-science is changing this and Swiss-Experiment is one such e-science project. The Swiss Experiment collaboration will encourage data sharing and preservation of knowledge across projects and institutions through the use of a common, state-of-the-art database and data processing infrastructure.

SensorMap further enables scientists to explore the spatiotemporal distributions and correlations of the shared sensor data. SensorMap allows a user to directly specify the area of interest based on a map, by drawing polygons or typing. Sensors within the specified geographical region are automatically aggregated at an appropriate granularity based on the zoom level of the map. SensorMap directly depicts the sensors on maps as image icons with different color schemes indicating the real-time readings. Besides the real-time view, a user can explore sensor data streams in historic or spatial views. Via SensorMap, they can select a list of sensors of interest and

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visualize their temporal distributions in a single comparison chart or in multiple side-by-side time series charts. A third feature of SensorMap is to generate map/image-overlaid contours of selected sensors in view, which can be zoomed or panned together with the underlying map/image.

SwissEx is a collaboration of environmental science and technology research projects. These projects cover a range of environmental hazards from sustainable land use, to earthquakes and avalanches. In the details of these projects, there is however a large range of overlap where they may benefit from sharing data, particularly if experiments can be arranged to take place on common sites. Measurements such as meteorological parameters, soil temperature/conductivity/humidity and hydrological parameters are common across many projects and some projects even have synergies on much larger scales.

The OGC Sensor Web Enablement Standards are discovery of data sets from registers, the heterogeneity of descriptions and the lack of semantics or reasoning. SWE services based infrastructures lack semantically rich discovery mechanisms. Search algorithms facilitating semantically enhanced queries from users would be retrieving useful information out of sensor web registers and services. Also, related concepts, subgroups of sensor types and integration of domain ontology, semantic queries and semantic transformations in sensor web infrastructure have to be addressed. Ontology of sensors has the potential to be a key component of semantic sensor webs.

Fig. 1. Sensor web configuration in OGC

The OGC enablement of such sensor webs and networks is being pursued through the establishment of several encodings for describing sensors and sensor observations, and through several standard interface definitions for web services. Sensor web enablement standards that have been built and prototyped by members of the OGC include the following pending OpenGIS® Specifications. Fig. 1 shows Sensor web configuration in OGC.

Currently, the framework defines catalog services for discovering sensors and sensor data, collection services for accessing real-time or achieved observation data, planning services for tasking sensors, and notification services for providing users the results of task requests or for alerting users of other services observed.
3 Proposed Architecture Based Sensor Web for Mountain Environment Monitoring

Proposed architecture monitors environmental mountain based sensor web for climbing safety and ecological adaptation. This architecture support to display map and context information on GIS. Client accesses Sensor web site for search real-time weather information using HTTP protocol.

The architecture based on Sensor web is can be divided three layers, a physical, service, application. The physical layer has sensor hardware and sensor operating systems that porting in the hardware. These sensors collect phenomenon data for temperature, air pressure, illumination, humidity, snowfall, rainfall, wind speed, etc. In this layer, the sensing data is occurred and this data is sent to the middleware in service layer. The sensing data is registered through the sensor collection service and it uses a manager and map information, sensor information based on the database. In the application layer database and data sending suitable to the service is processed through the data base access interface. The sensor web application is composed of GIS based sensor information component and sensor data statistic component, and real time sensor data list component, sensor data searching component. And through the smooth data sending and independent function distribution, it chases the service stability. Fig. 2 shows proposed architecture based on Sensor web to monitor mountain.

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