IrisNet: Internet-scale Resource-Intensive Sensor Services

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1. MOTIVATION

The proliferation and affordability of smart sensors such as webcams, microphones, *etc.*, has created opportunities for exciting new classes of distributed services. While such sensors are inexpensive and easy to deploy across a wide area, realizing useful services requires addressing a number of challenges, such as preventing transfer of large data feeds across the network, efficiently discovering relevant data among the distributed collection of sensors and delivering it to interested participants, and efficiently handling static meta-data information, live readings from sensor feeds, and historical data.

2. OVERVIEW OF IRISNET

We present IrisNet (*Internet-scale Resource-intensive Sensor Network Services*), a potentially global network of smart sensor nodes and organizing nodes, which provide the means to query recent and historical sensor-based data. IrisNet exploits the fact that high-volume sensor feeds are typically attached to devices with significant computing power and storage, and running a standard operating system. Aggressive filtering, smart query routing, and semantic caching are used to dramatically reduce network bandwidth utilization and improve query response times.

IrisNet has two main components (Figure 1) :

- **Sensing Agents (SAs):** SAs are devices that consist of a smart sensor (webcam, microphone, *etc.*) attached to a PDA or PC class device. SAs collect and process data from the attached sensors and pass them on to the organizing agents.

- **Organizing Agents (OAs):** OAs are PCs in the Internet that provide facilities for querying recent and historical sensor data.

Key features of IrisNet include :

- IrisNet provides simple APIs for orchestrating the SAs and OAs to collect, collaboratively process and archive sensor data while minimizing network data transfers.

Figure 1: IrisNet Architecture

- The user is presented with a logical view of the data as a single XML document, while physically the data is fragmented across any number of host nodes (*location transparency*).

- IrisNet supports (the unordered projection of) XPATH 1.0, a standard XML query language, for querying the data in the system.

- IrisNet handles issues of service discovery, query routing, semantic caching of responses and load balancing in a scalable manner for all services.

Please see `www.intel-iris.net` and [1] for further details of the system.

3. WHAT WILL BE DEMONSTRATED ?

We demonstrate a parking space finder service that utilizes webcams monitoring toy parking spaces to gather information about the availability of the parking spaces. The webcams are attached to laptops that act as sensing agents in this setup. The user interacts with the system in the form of a web frontend that allows the user to enter her destination as well as other constraints she might have. The web frontend then queries the IrisNet system, and presents the user with driving directions to the closest parking space that matches the constraints. We also demonstrate various aspects of our system such as semantic caching and routing of queries to data, using a log-and-replay mechanism that logs the messages exchanged during execution of a query, and replays them pictorially.

4. REFERENCES

[1] DESHPANDE, A., NATH, S., GIBBONS, P. B., AND SESHAN, S. Cache-and-query for wide area sensor databases. In *SIGMOD* (2003).