Using Local and Global Knowledge in Wireless Sensor Networks

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Abstract

Wireless Sensor Networks (WSNs) produce large quantities of raw data from multiple sources, such as cameras, temperature or humidity sensors. We propose a network that uses the knowledge of domain experts that use the network, as well as previously sensed data, to classify incoming sensed data in near real-time. Using a field centre in Malaysia as a testbed, we are currently implementing a prototype network to classify images of animals that trigger wildlife cameras. Initial experiments to test the individual components of the network have yielded positive results and a prototype is planned for deployment in July of 2012.

Categories and Subject Descriptors

C.2.1 [**Network Architecture and Design**]: Network topology; C.2.1 [**Network Architecture and Design**]: Wireless communication

Keywords

sensor network, wireless, in-network processing

1. SCENARIO

Danau Girang is a field centre in the Kinabatangan Wildlife Reserve, Malaysia. It is operated by Cardiff University's School of Biosciences and owned by the Sabah Wildlife Department. Twenty-two wildlife cameras have been deployed to detect the movement of carnivores between parts of the rainforest, connected through corridors. Currently, research students are charged with the task of maintaining the cameras and manually processing the resulting images. Every two weeks, students must collect the SD cards and change the batteries of each camera. The images are then loaded onto a netbook and each picture is classified.

Using Danau Girang as a testbed, we aim to implement a prototype WSN that uses the knowledge of domain experts and the deployed environment of the WSN to classify sensed data before it reaches the user.

2. PROPOSED SOLUTION

There are existing systems that have been designed to merge Context Aware Systems (CAS) with WSNs to apply high level semantics to sensed data [3]. We aim to use a WSN to automate image retrieval that can, through the use of *local knowledge*, process sensed images within the network, thus providing users with classified images at the Field Centre in near real-time. We define local knowledge as knowledge of an area, that has been gained through experience or experimentation [2].

We have developed a WSN that consists of three tiers that aims to automate image retrieval and processing. The lower tier is the Data Collection (DC) nodes, attached to the wildlife cameras, that take images when motion is detected and route sensed data to the middle tier. The middle tier comprises Data Processing (DP) nodes tasked with serving a subset of Data Collection nodes and processing received data, classifying it via of image processing and a knowledge base of previous classifications. The upper tier comprises Data Aggregation (DA) nodes that stores all sensed data and acts as a gateway to the network itself. DA nodes mirror sensed data to online services, such as Flickr, when internet access is available. Data Aggregation nodes run GSN, a sensor middleware that integrates heterogeneous sensors through the use of virtual sensors [1].

3. EVALUATION AND IMPLEMENTATION

A visit to Danau Girang was made in 2011 to test individual components of the network, such as wireless range and impact of humidity on the hardware. A second visit is planned for 2012 to test the interoperability of each tier and implement a small-scale prototype network.

4. REFERENCES

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