**Wireless Sensor Networks (WSNs)**

Number of related papers topic encompasses: 3 papers.

A Wireless Sensor Network or WSN is a network that have sensors as nodes (wherein nodes can have multiple sensors), upon which information is taken from and sent to a main location or hub for data processing. The primary goal of a WSN is to collect and retrieve data about the environment or location the sensors are within. The data is to be used for studies, research, and other data-requiring processes, mostly for real-time inference pertaining to studied location.

Since the current generation has produced a new technology that is the smart phone built with multiple sensors, two of the three following papers have decided to use smart phones as their sensor nodes.

The first two papers specifically tackle mobile crowdsensing, and both use an engine called the Context-Aware Real-Time Open Mobile Miner (CAROMM) in ther implementations, which is an engine the proponents of the paper have also implemented in previous years. Specifically, CAROMM is an engine that has on-board mobile data stream mining algorithms that reduce the amount of data transmission while maintaining accurate levels of Information sent, thus, it can be said that CAROMM itself has provided the solution towards possible network delays and other similar problems.

1. **Here-n-Now: A Framework for Context-Aware Mobile Crowdsensing**

The goal of the researchers of this particular paper is to create a framework for context-aware mobile crowdsensing that other developers can choose to use for their specific data-gathering purposes. The framework aims to provide real-time reasoning for the users regarding user-selected locations.

This framework’s noteable features are as follows:

i) Its processes are aimed to be energy-efficient (particularly for the mobile devices), and it was designed to be highly scalable, meaning it can be made to handle large and growing amounts of data.

ii) It not only allows the reading of sensory data (taken from phone camera, etc.), but it also allows the reading of motion data (accelerometer-based, GPS-based). The framework makes use of the Google Places API to return places of interest.

iii) It allows for the utilization of sensory data and user activity data. User activity data pertains to apps used and movement in a certain location. These data are gathered for further contextual processing.

iv) The framework includes a cloud-based context-reasoning engine for data processing. (The Context-Aware Data Processing Module is deployed in the Amazon Elastic Compute Cloud or the EC2.) A resource-aware clustering technique is also used to identify significant changes in a particular situation.

v) The framework correlates mobile sensory info to info taken from social media (e.g. Twitter, Facebook), meaning, the framework also taps into social media for location context.

vi) The framework is extremely flexible; it allows integration of a number of mobile activity recognition models (though the default is a Neural-Network-based activity recognition model for walking, running, sitting, and driving—accelerometer sensory data) for the mobile phone and context reasoning engines. The framework also enables an easy de-coupling of the mobile client, data management component, and context reasoning from each other, so if a developer would want to use only one of these components, then he/she may feel free to do so.

The researchers have also modelled situations based on 4 parameters (for experimenting):

i) noise level (audio input)

ii) activity level (number of users in an area that are “active”)

iii) light intensity (image input)

iv) crowd intensity (number of users in an area)

Based on these parameters, it can be inferred if a location is either lively, busy, or quiet.

In conclusion, it can be said that this particular framework can be used for a lot of possible applications pertaining to data-mining, data-gathering, and mobile crowdsensing. The input ranges from multimedia (images and video), twitter/social media streams, text, activities, location, temperature, time, device orientation, speed, device movement, and more, thus, a lot of information and context about a particular location can be extracted. A lot of aspects of living can be applied to this technology, and, in turn, a lot of specific problems can be addressed.

The paper itself (consisting of only 4 pages, single-column) did not discuss much of the specifics involved such as the algorithms and mathematics used for the creation of this framework.

The following paper presents related information in a more detailed manner.

1. **Using On-the-move Mining for Mobile Crowdsensing**

This particular paper is an improvement of the first paper. It also presents more detailed explanations of the algorithms and the mathematical approaches involved in the construction of the framework and data model. This paper includes cost models for bandwidth, energy, and accuracy, proving that its system is efficient in all these fields. This version also addresses the energy-consumption issue more thoroughly by having the device stop sending input during times when it isn’t needed, e.g. when there is low light, the camera won’t be used, etc. Data also won’t be sent from each mobile device when there aren’t any changes detected in the environment.

1. **Target Tracking and Mobile Sensor Navigation in Wireless Sensor Networks**

In contrast to the previous two papers, whose focus is more on mobile crowdsensing, this particular paper focuses on tracking a targeted signal using WSNs. As the paper suggests, the WSN should consist of many stationary sensory nodes, and one mobile (or constantly moving) sensory node for maximum accuracy. This paper addresses the problem of tracking the mobile sensory node and the mobile target. This paper also addresses the problem of moving and navigating the mobile node remotely.

The paper is very math-heavy, providing algorithms for the tracking and navigating to be highly accurate, and, at the same time, resource-efficient. It uses a cubic navigation function, a non-linear time varying algorithm for estimating target positions AND for navigating the mobile sensor, and a time of arrival [TOA] model for signal-detection, as suggested by the proponents’ review of related literature. Their unique proposal, however, is a min-max approximation approach that can be solved by semidefinite programming (SDP) relaxation. Another proposal of theirs is a weighted tracking algorithm to be able to use measurement info more efficiently.