WIRELESS SENSOR NETWORKS FOR TRAFFIC MONITORING

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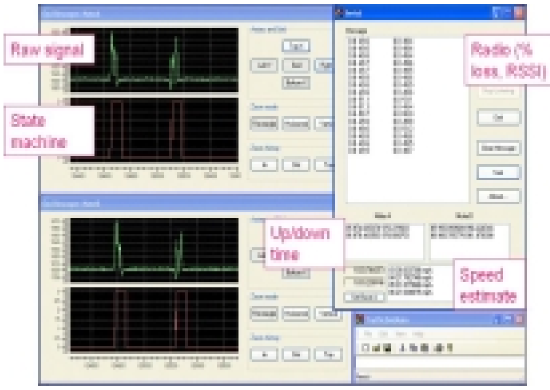
Wireless magnetic sensor networks offer a very attractive, low-cost alternative to current technologies such as inductive loops, video cameras and radar for traffic measurement in freeways, urban street intersections and presence detection in parking lots. The actual network comprises 5" diameter sensor nodes or "dots" glued on the pavement where vehicles are to be detected. The sensor nodes send their data via radio to the "access point" or AP on the side of the road. The AP forwards sensor data to the Traffic Management Center via GPRS or to the roadside controller.

The demo is very similar to the actual network. There will be 2 or more sensor nodes that are placed on the floor and an AP that forwards the data of the nodes to a laptop.

The sensor node has a built-in magneto-resistive sensor that measures changes in the Earth's magnetic field caused by the presence or passage of a vehicle in the proximity of the node. A low-power radio relays the detection data to the AP at user-selectable periodic reporting intervals or on an event driven basis. By placing two nodes a few feet apart in the direction of traffic, accurate individual vehicle speeds can be measured and reported.

The AP collects detection data from all sensor nodes assigned to it and relays the data to the laptop.



Laptop has a user interface that shows the actual sensor readings together with the *detection results* and *speed estimates* of the nodes, and the *link quality* measures such as received signal strength and successful packet reception probability of the nodes.

Collaborative signal processing and low power communication are the main components of research in this application. The signal processing is performed to correctly report the vehicle presence, count, speed and occupancy information to the AP. We have successfully processed the data based on the communication of all data from the sensor nodes to the AP. Currently; we are working on a collaborative signal processing algorithm. The algorithm allows the communication of the data only between the neighboring nodes. The nodes detect the faulty behavior and direction of the vehicle movement based on the correlation, and estimate the parameters that the AP is interested in. Based on the partial information transmitted from the sensor nodes, the AP improves the estimation as the number of sensor nodes increases.

The system uses TDMA (Time Division Multiple Access) to send the data from the sensor nodes to the AP. We have developed PEDAMACS (Power Efficient and Delay Aware Medium Access Protocol for Sensor Networks) to extend the common single hop TDMA to a multi-hop sensor network, using a high-powered access point to synchronize the nodes and to schedule their transmissions and receptions. Based on the simulations in TOSSIM, for the traffic application we consider, the PEDAMACS network provides a lifetime of several years compared to several months and days based on random access schemes with and without sleep cycles respectively.