Research Project: ***SP209B4M***
Date: ***November, 2013***

RESEARCH SUMMARY

AUTOMATED LOW-COST AND REAL-TIME TRUCK PARKING INFORMATION SYSTEM

Problem

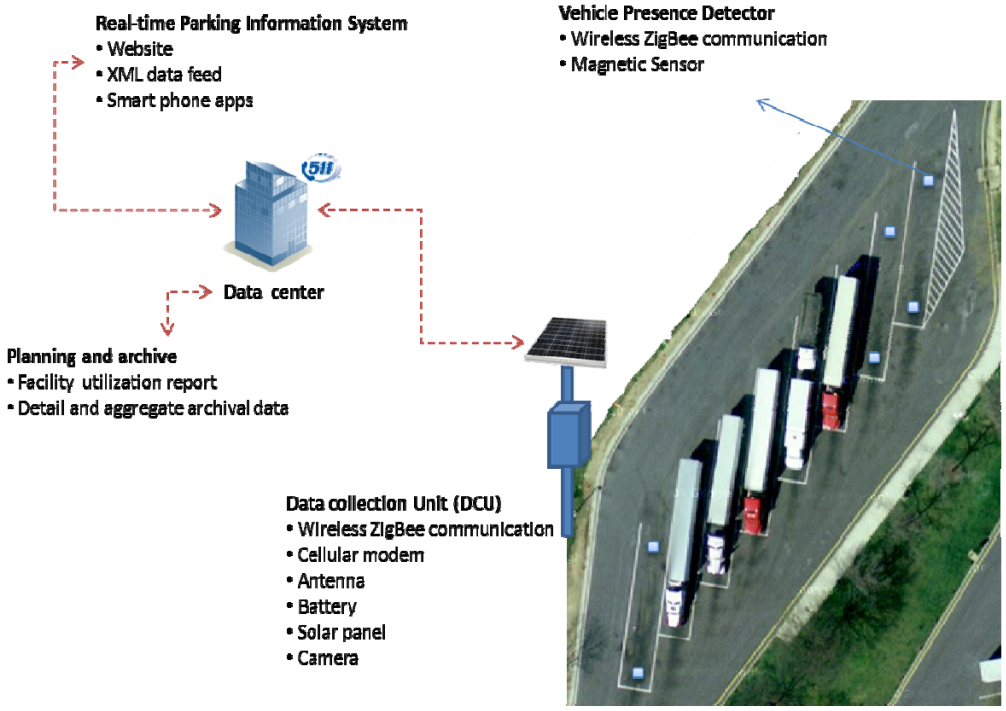
Overnight truck parking is a significant safety problem nationwide. Commercial drivers seeking to comply with the Federal Motor Carrier Safety Administration's Hours of Service regulations often park illegally on freeway shoulders and ramps when parking in a truck parking facility is either not available, or the availability is not easily known. The Maryland State Highway has an interactive emergency truck parking map which is helpful, but real-time parking availability information is not yet provided.

Objective

The main goal of this project was to develop an inexpensive and scalable wireless sensor network prototype, which encompasses a cost-effective and reliable architecture for detection of trucks and other vehicles in truck parking facilities. The development of such a system could lead to real-time information about commercial vehicle parking in Maryland.

Description

The vehicle detection solution developed in this project consists of four main components: sensing, collecting, processing and user interface (UI).



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The sensing component refers to networks of magnetic sensors that measure the magnetic field at different spots. Magnetic sensors are enabled by a microcontroller to use IEEE 802.15.4 protocol and wirelessly communicate with the collectors. Sensing components uses a patch or monopole RF antenna for transmission and is powered up with two 1.5 volts triple-A batteries.

The collecting component uses the same microcontroller as the sensing component to collect the data measured by the sensors. A camera can optionally be utilized to capture ground truth images from empty and occupied spots. A cellular broadband component is also used to forward the collected data to remote servers. The collecting component is powered up with solar panels and lithium acid batteries as backup. In case of using a camera, an AC/DC converter can also be utilized to power up the system with AC electricity distribution network.

The processing component consists of a central database located at remote stations. A TCP/IP data logger application is designed for receiving the incoming packets from local stations and saving data in the database. An application for processing the data and also processing the ground truth data was designed. The processing application connects to the database and after processing the data, updates status of each spot in real time.
The UI component consists of developed software to remotely connect to the servers and check the status of the spots in real-time along with other necessary information for administrators to control the performance of the system. The UI can be customized for any kind of internet enabled device on any OS platform.

Results

The system was deployed and tested at the I-95 North Welcome Center from January 2013 to May 2013. Several experiments were conducted and ground truth information was also provided to measure the performance of the system. The overall error rate of the system during the experiment was 3.75% on average. However the error rate can potentially be lowered by using more sensors at each spot and using repeaters to avoid signal blockings.

Report Information

Link to the final report: http://www.roads.maryland.gov/OPR_Research/MD-13-SP209B4M_TRUCK-PARKING_Report.pdf. For more information about the study please contact:

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