

Demo Abstract: Agile Cargo Tracking Using Mobile Agents

Gregory Hackmann, Chien-Liang Fok,
Gruia-Catalin Roman, Chenyang Lu
Dept. of Computer Science and Engineering
Washington University in Saint Louis
Saint Louis, MO, 63105, USA
{gwh2, liang, roman, lu}@cse.wustl.edu

Christopher Zuver, Kent English,
John Meier
Boeing Corporation
Saint Louis, MO, 63105, USA
{christopher.k.zuver, kent.l.english,
john.l.meier}@boeing.com

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Cargo tracking is vital for national security and useful for shippers and their customers. All of these users have different and evolving requirements, placing higher flexibility requirements than existing infrastructure can provide. This flexibility can be provided by equipping each shipping container with a wireless mote, which will form a wireless mesh network and monitor the containers' contents. Each user can then deploy custom mobile agents to query the contents of the containers. Also, for security purposes, these motes can be equipped with sensors to detect and record anomalous events.

We developed *AgiTrack*, a cargo tracking system using mobile agents in wireless sensor networks. *AgiTrack* is implemented on *Agilla* [1] and *TinyOS*, using *Agilla* mobile agents to track cargo. Mobile agents are suitable for this application since they allow for flexible and reliable application development and deployment. These agents are small enough for efficient, on-demand deployment. *Agilla* provides developers with mechanisms for spreading their agents throughout the sensor network. *Agilla* also provides a tuple space for facilitating inter-agent interactions.

This demo presents *AgiTrack*. It uses 12 MICA2 motes, each attached to one container arranged in a 4x3 stack. These motes sense motion and light using attached MTS310 sensor boards. Two base stations, one on a "ship", another on a "dock", serve as aggregation points. The user issues queries from a laptop or PDA, which connects to the aggregation points using 802.11b and *Limone* [2], a lightweight communication middleware for ad hoc networks. When a

query is issued, the aggregation points inject a mobile agent into the sensor network, collect the incoming data, and send the data back to the user. The aggregation points can optionally connect to a central event-correlation engine [3], which correlates low-level events (e.g., only two out of three associated items found) into higher-level alerts (e.g., a container may have been tampered with).

Each mote stores a manifest in its local tuple space reflecting the contents of the mote's container. These manifests are generated based on RFID tags on each item in the container. However, to save time, in this demo, we manually load the manifests.

This demo presents several types of services. In order to monitor potential intrusions, the user can "arm" a box by deploying a watchdog agent onto a mote. This agent collects acceleration or light data from its sensor board. Any unusual changes in this data will cause the mote to sound its alarm, send an alert message to the nearest base station, and record the event in the mote's local tuple space. This allows the user to later deploy another mobile agent which searches for these events and reports back any recorded intrusions.

Likewise, users can deploy mobile agents which count the containers, or inspect the manifests to locate a specific item. These queries can either be localized to a specific sensor network, or issued globally to all the base stations' sensor networks.

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1. REFERENCES

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