Laboratory for Communications Engineering

Department of Engineering

UNIVERSITY OF CAMBRIDGE

The Sentient Car

Context-Aware Automotive telematics

P. Vidales and F. Stajano {pav25, fms27}@cam.ac.uk

OVERVIEW

We consider the implementation of a vehicle-based sentient space that enables on-board context-aware systems to cooperate and adapt to changing conditions and events. This poster also describes the Sentient Car as a testbed, and the Adaptive Pollution Map as the first application that uses this platform.

From left to right: The Sentient Car, Sensing Equipment, Computing Equipment, Dashboard, ECU interface, Exterior photo.

SENTIENT CAR

Sensing. We measure various air pollutants with sophisticated sensing equipment. We also have a tap into the Electronic Control Unit of the vehicle to extract velocity, acceleration, temperature, steering wheel position etc. A GPS receiver gives the geographical position of the car to 10 m accuracy.

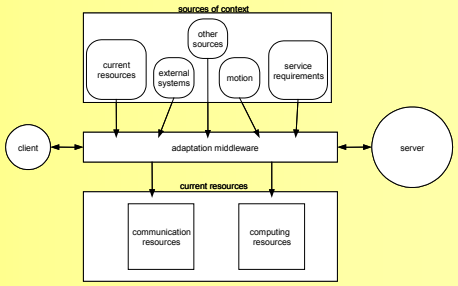
Computing. On the software front we also sense the availability of the computing and communication resources: network connectivity, communication cost, communication bandwidth etc. A full-size tower PC in the back of the van has interfaces to all the sensing and communicating devices, as well as ample storage and computing capacity.

Communication. A GSM cellular phone and modem respectively provide voice and low-speed data connection with almost universal coverage. An 802.11b network card provides a much higher speed data link but with limited coverage.

CONCEPTUAL MODEL

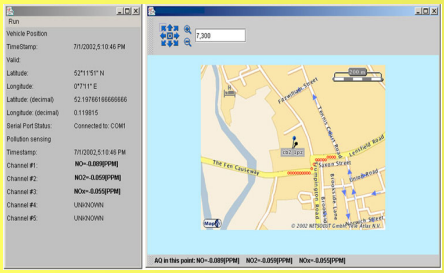
We have equipped a vehicle with several sensing, computing and communicating subsystems, all interconnected to form an integrated sentient car system, and we are building a framework to allow each of these subsystems to act as a supplier or a consumer of contextual information about the car, the driver and the environment.

The conceptual model of the sentient car system considers each of the sensors and subsystems as an input (location, velocity, vehicle status, etc.) to an *adaptation middleware,* which delivers context information to the on-board systems.The activity that is generated between the client and the server can best suit the situation according to the context information.

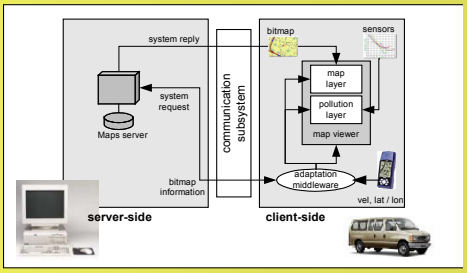


APPLICATION: ADAPTIVE POLLUTION MAP

One of the first applications we have developed on this platform senses the air quality around the car and overlays it on a map of the area that the car is visiting. The client-server application is split into a client-side map viewer, running in the car, and a server-side map repository running at the fixed base station. The delivery of maps is affected by context. Therefore, the client adapts itself in order to provide the best end performance to the user. We wish to explore the architectural issues that arise when content such as maps or real-time video footage of the highway traffic have to be delivered over a channel of varying capacity.



Adaptive Pollution Map



Application architecture

CONCLUSIONS

Sentient spaces are increasingly popular in building environments such as the office and home. The use of sentient spaces in cars will enhance the capacity of on-board systems dramatically, and will allow them to cooperate to provide and consume context information and adapt to frequently changing conditions. On-board systems must deal with more hostile heterogeneous conditions than apparent in sentient buildings, therefore knowing the context is even more important.

The Adaptive Pollution Map application shows the utility of sensing space around the vehicle in order to deliver service with different resources available.

ACKNOWLEDGEMENTS: Pablo Vidales has a scholarship from the Mexican government through the National Council of Science and Technology (CONACYT). The Sentient Car is funded by the Cambridge-MIT Institute (CMI).