



# CAR-WHERE

Locating parked cars using  
a multi-hop wireless network

## PROBLEM:

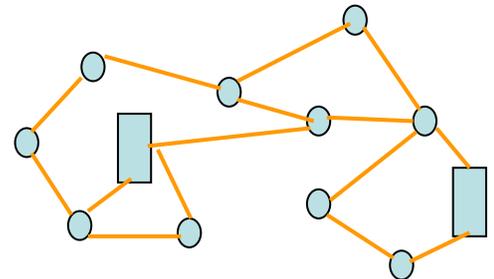
### Where did I park my car?

Busy commuters often forget where exactly they parked their car. Days of the week blend into one another and in their hurry they frequently fail to make note of the precise location of their vehicle. The problem occurs even for the infrequent traveler who parks in new and unfamiliar surroundings such as the parking garage attached to an airport or hospital. In addition to being new and strange such spaces are often repetitive in their architecture causing people to misremember where their car is. Locating a particular car in a vast sea of parked cars is a problem faced by car manufacturers and dealers.

## CAR-WHERE:

### Concept – Multi-hop wireless network

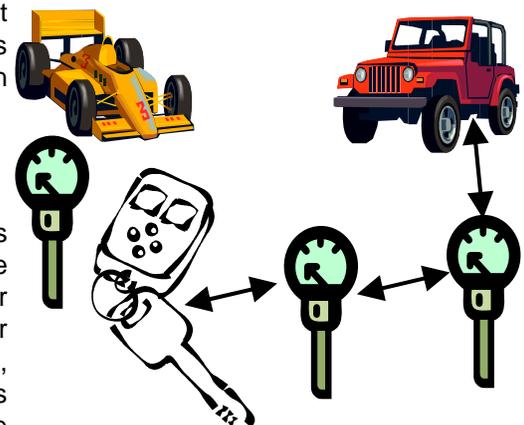
The basic idea is to have a self-organizing multi-hop wireless network of low-cost transceivers. For example these nodes could be attached to parking meters. When a car owner wishes to locate their car they simply walk to the nearest meter and emit a lock signal from their keyless fob toward the meter. The meter will trap the signal and send it out on the network, hop by hop. Each meter will play the signal at the car parked next to it and if it hears a beep (signaling the car is already locked) it will report back to the original meter which will then notify the owner of the location using a visual or audio display.



Wireless mesh network

### Implementation – MICAz motes

CAR-WHERE utilizes a self-organizing network of MICAz motes (Crossbow Technology, Inc) that communicate using 2.4GHz Zigbee technology and can be flashed with custom programs. In our prototype motes are programmed to be parking meters, cars, or car locaters, and are attached to parking meters, cars and the tablet PC, respectively. A query for a car generated at the car locator travels through the network by a process of controlled flooding with sequence tracking. RSSI (Received Signal Strength Indicator) and LQI (Link Quality Indicator) are combined to determine which parking meter is closest to the car and answer is returned back to the car locator. In a real world application the tablet PC and car locator mote would be substituted by the keyless fob.



Prototype

### Conclusion – it works!

The CAR-WHERE prototype serves as a proof of concept and demonstrates that such a system can be actually built, deployed and used. One can conceive of many other uses for such a setup – in addition to locating parked cars it can also be utilized for locating empty spaces, wirelessly paying for the space and automating meter maid functions such as ticketing and collections.



MICAz mote