A Programmable Mobile Platform for UbiComp Research

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Motivation

Ubiquitous computing applications are complex. They often involve

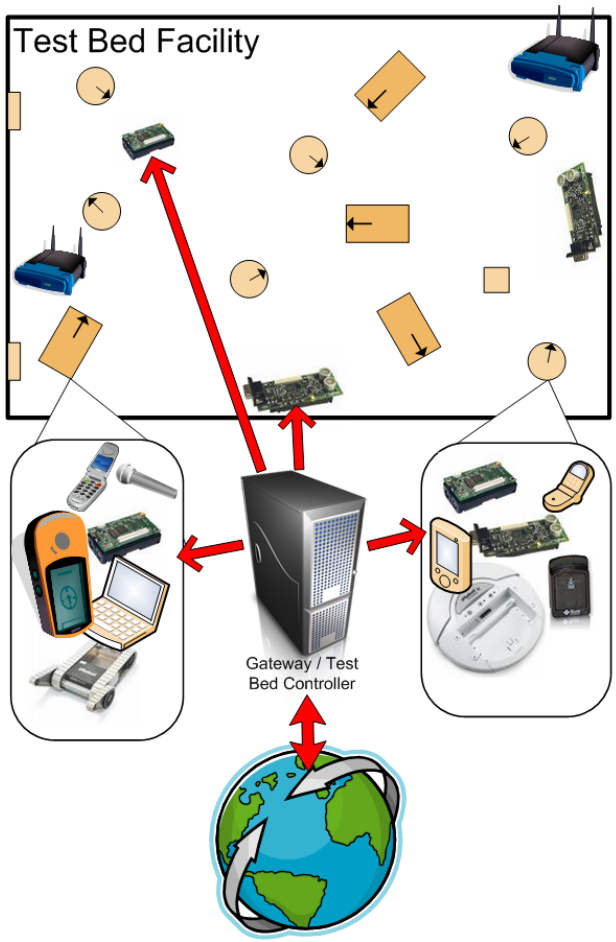
- multiple mobile users
- integration of many heterogeneous hardware and software systems
- interpretation of context information
- ...

But, we still need to prototype and test them!

The Vision

A ubiquitous computing testbed that

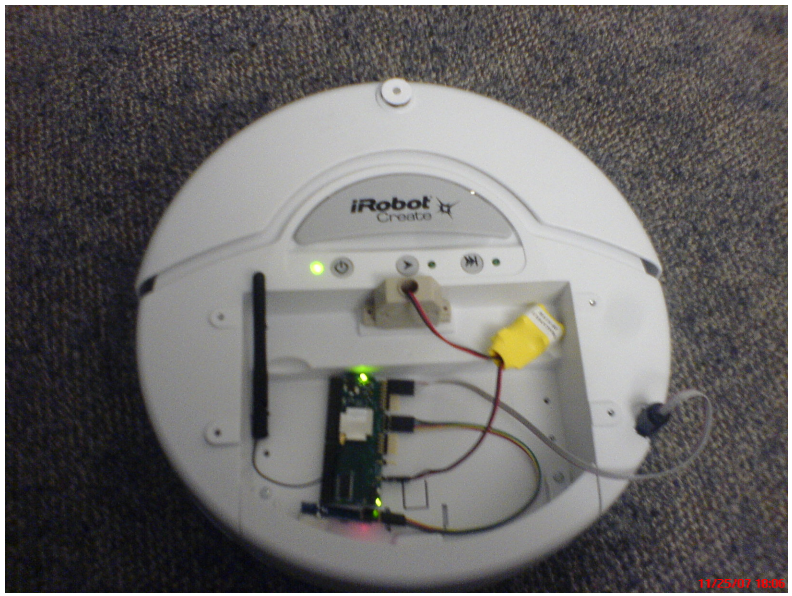
- supports many mobile nodes
- allows for easy deployment of heterogeneous software and hardware
- is usable locally and remotely under limited supervision



An Initial Step

A programmable mobile platform for nodes in such a testbed based on the iRobot Create

- Supports mobility
- Supports heterogeneous hardware/software
- Is controllable locally and remotely
- Is robotic, thus can perform under limited supervison



The Hardware

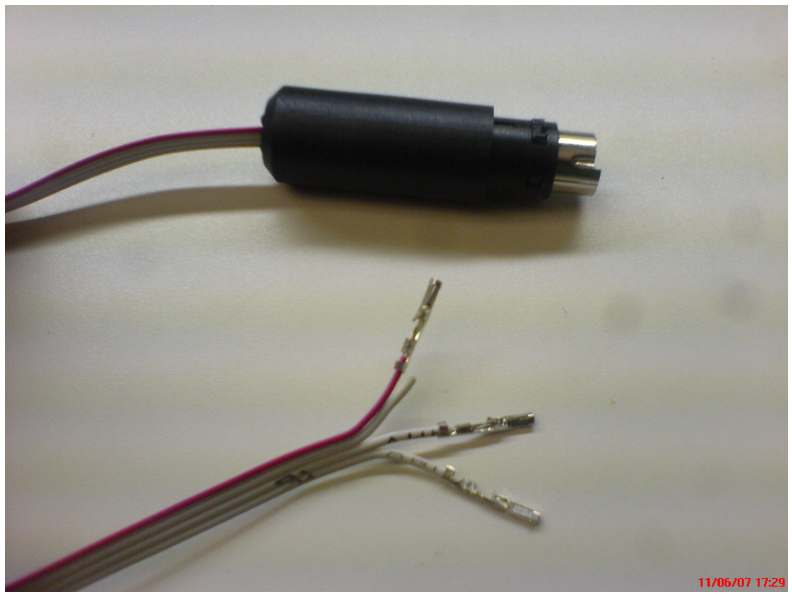
- The iRobot Create
  - Robot controllable over a serial interface
- The Gumstix Stack
  - The Gumstix embedded processor
    - ARM Core
    - 200 MHz, 16 MB RAM
    - Runs the control software
  - The Robostix microcontroller board
    - Allows the Gumstix to interface with sensors and the Create
  - The Wifistix 802.11 b/g board
    - Allows remote communication with the Gumstix

The Software

- The Player robotics software
  - Open source robotics software
    - Meant to be a Hardware Abstraction Layer (HAL)
  - Client/server architecture
    - Server runs on the robot
    - Client can run on the robot or on machine with a remote connection
    - Client APIs in several languages (C, C++, Python, Guile...)
- Das U-boot, Embedded Linux
  - Run on the Gumstix
- Buildroot
  - A set of makefiles and patches for generating a cross-compilation toolchain and root filesystem for a target Linux machine
  - Allows development on a powerful computer for the Gumstix

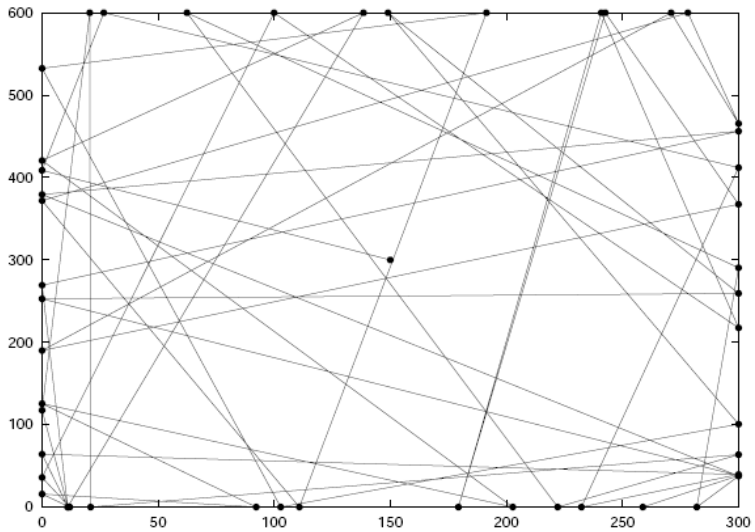
Difficulties

- Hardware integration
  - Lots of documentation on the individual hardware pieces, not as much on how to integrate them
  - Powering the Gumstix stack from the Create
- Unstable/immature software
  - No stable branch?
  - Incomplete documentation
  - Incomplete drivers



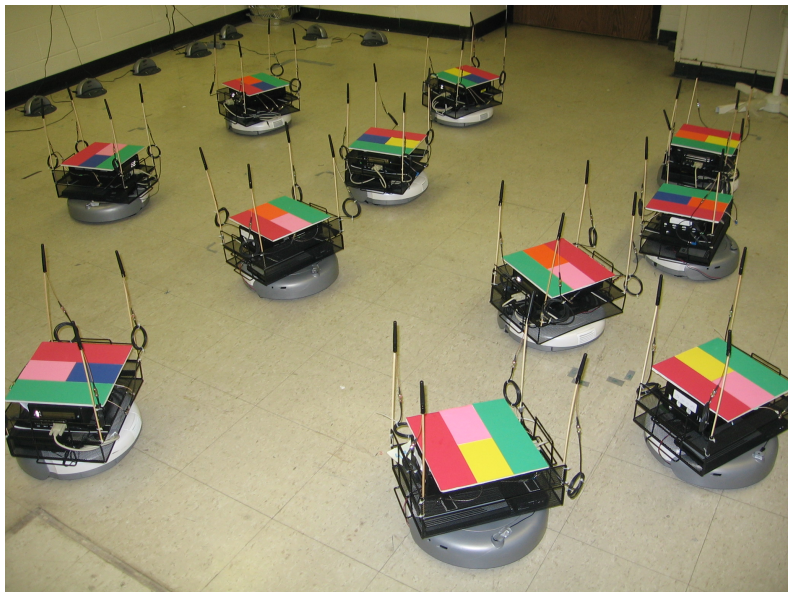
The Demo

- A prototype nodes performing the Random Direction mobility model
- Control software implemented as a Player client in Python



Related Work

- Related testbed projects
  - The MiNT Project
  - Emulab
- Roomba/Gumstix projects
  - The Robotics Primer Workbook
  - University of Alabama Distributed Autonomy Lab



Questions?