

# Relative Positioning

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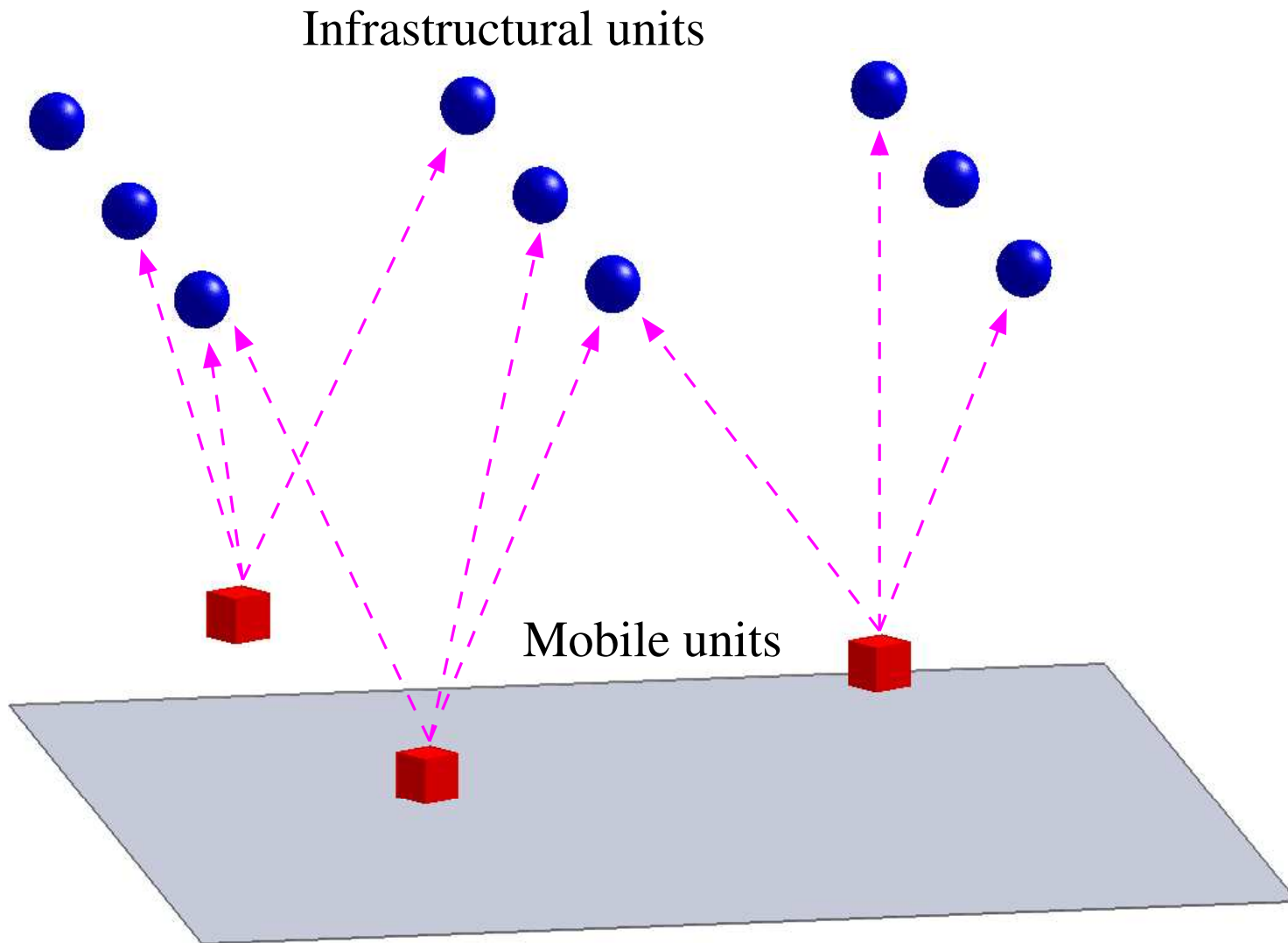
# Introduction

- Background
- Motivation
- Considerations
- The Relate Project
- Current implementations

# Location, Location, Location

- important component of context
- various methods exist
- all rely on infrastructure

# Infrastructure-based Systems



# Infrastructure Requirements

- deployment of devices/markers
- topological survey

# Restricted Applications

Unaugmented environments can be common for

- mobile computing
- computer-supported cooperative work
- interfaces

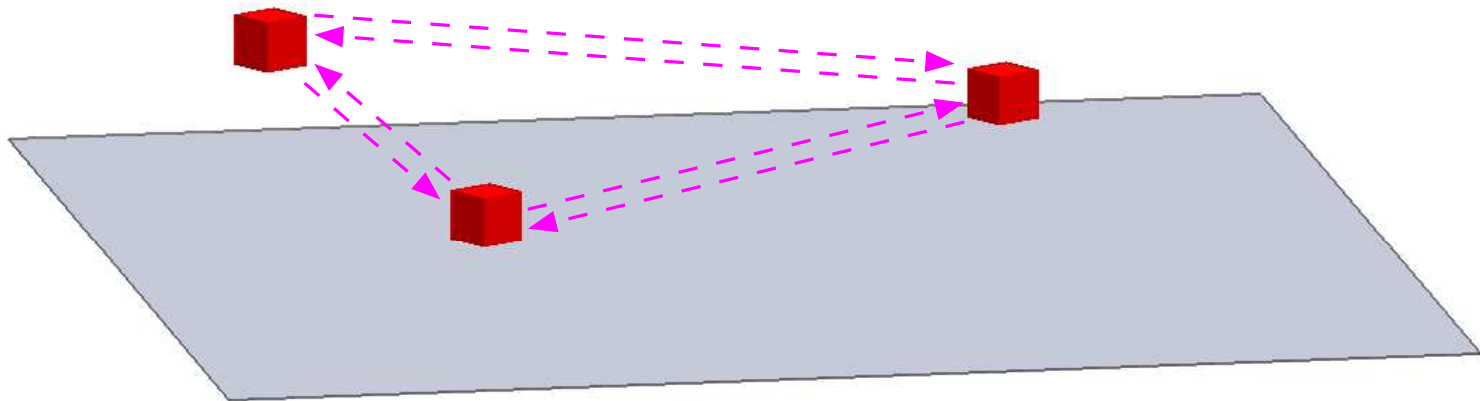
# Motivation

devices in these settings must provide

- location
- orientation

→ relative positioning

# Infrastructureless Systems



# New Approaches for Infrastructureless Systems

1. sensor technologies
2. wireless distributed systems
3. location algorithms

parallel: ad hoc sensor networks

# Location Algorithms

- single-object measurement
- triangulation/trilateration
- multilateration
- collaborative multilateration  
(Savvides et al.)

# The Relate Project

- EC one-year assessment project
- Lancaster University and University of Karlsruhe
- Aim: *assess methods and technology options for relative positioning on surfaces*

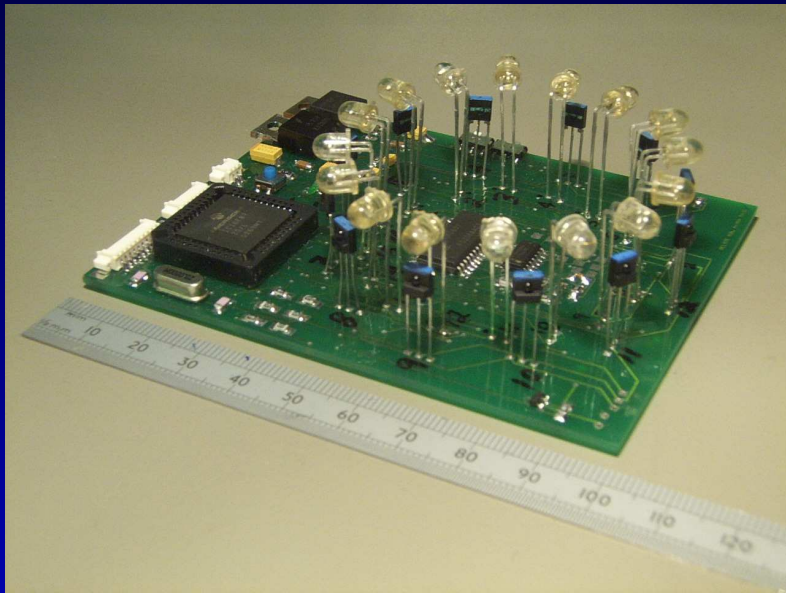
# Why 2D?

- immediately relevant
- one year study
- informative for 3D

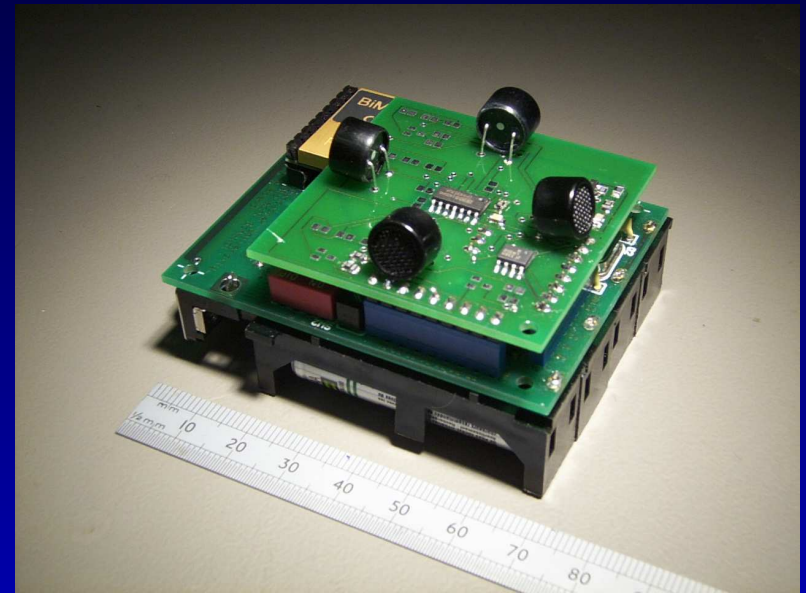
# Prototyping Strategy

- sensor board
- Smart-Its

# Prototype Implementations



Infrared



Ultrasound

# Performance

## Infrared

- intensity-based (fine-grained)
- distance: 9 cm (95%)
- orientation:  $\pm 15$  degrees
- reflection, direct sunlight
- calibration

# Performance

## Ultrasound (preliminary)

- time-of-flight–based
- $<5$  cm
- temperature measurement
- environmental noise

# Conclusions

- infrastructureless relative positioning
- technologies/methods for surfaces
- Relate prototypes address these needs
- uncontrolled environments