Design and Implementation of a Smart Mobile Sensor Node

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Introduction

- Wireless sensor networks may consist of
  - Static sensor node v.s. Mobile sensor node
- Applications with mobile sensor nodes
  - Node replacement
  - Location assignment
  - Hole and partition recovery
  - Autonomous deployment
  - Dynamic sensing

Introduction

- We designed and implemented a smart mobile node which can be used to solve the above Applications

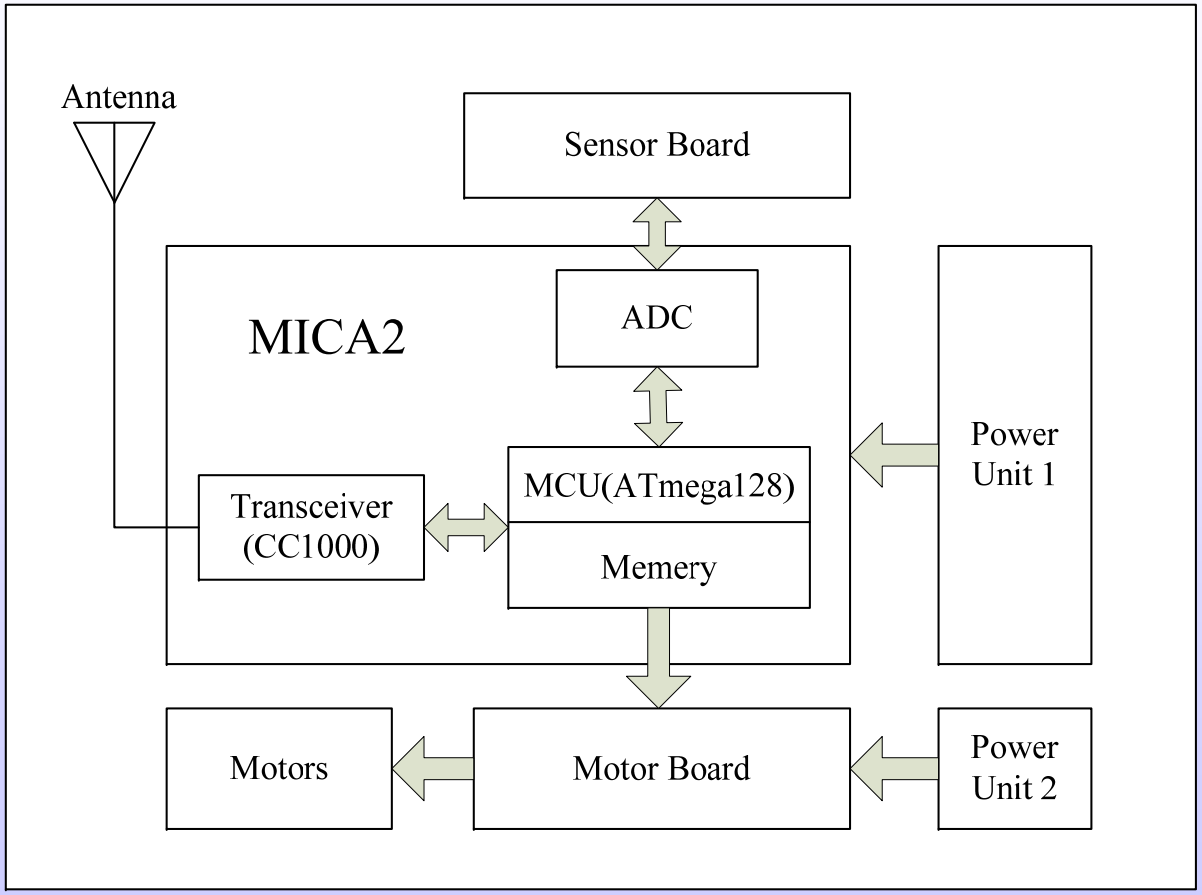
Architecture of Mobile Sensor Node

- Software
  - TinyOS
    - Operating System
  - nesC
    - Programming Language

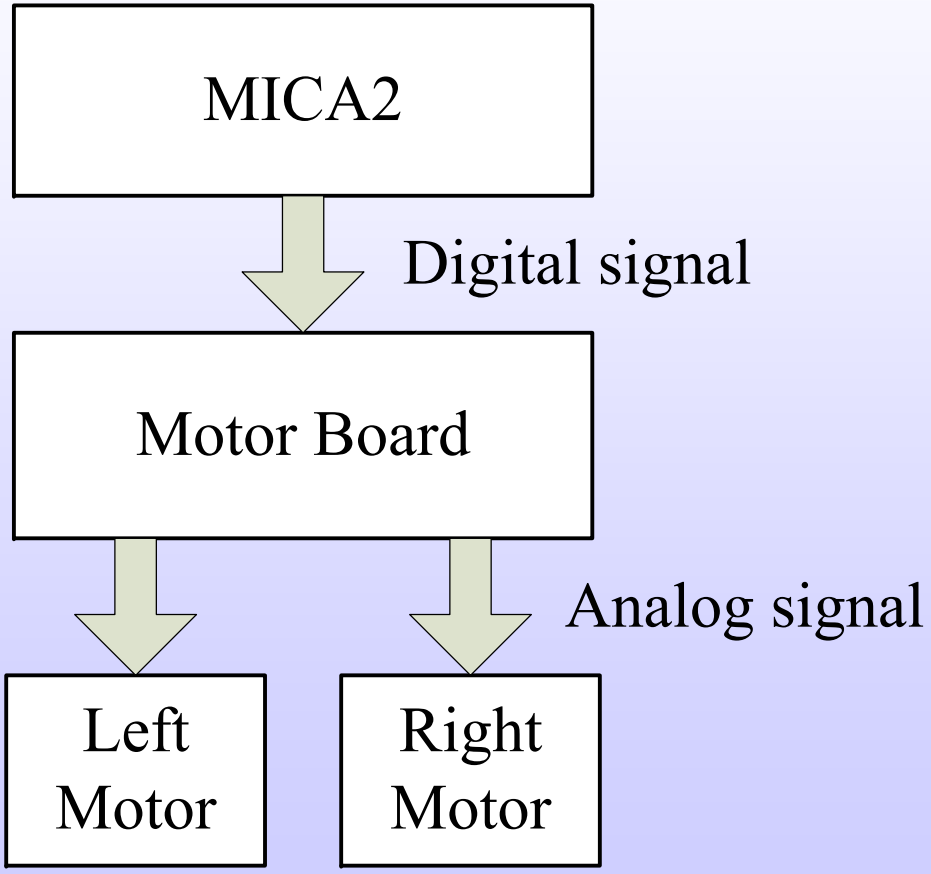
Architecture of Mobile Sensor Node

- Hardware:
  - MICA2
    - Computing, Communication, and Sensing
  - Motor Board
    - Drive DC motors
  - Platform of Mobile Sensor Node
    - Aluminum base, Battery pack, Motors, Gear Box, and Tracks

Hardware architecture of Mobile Sensor Node



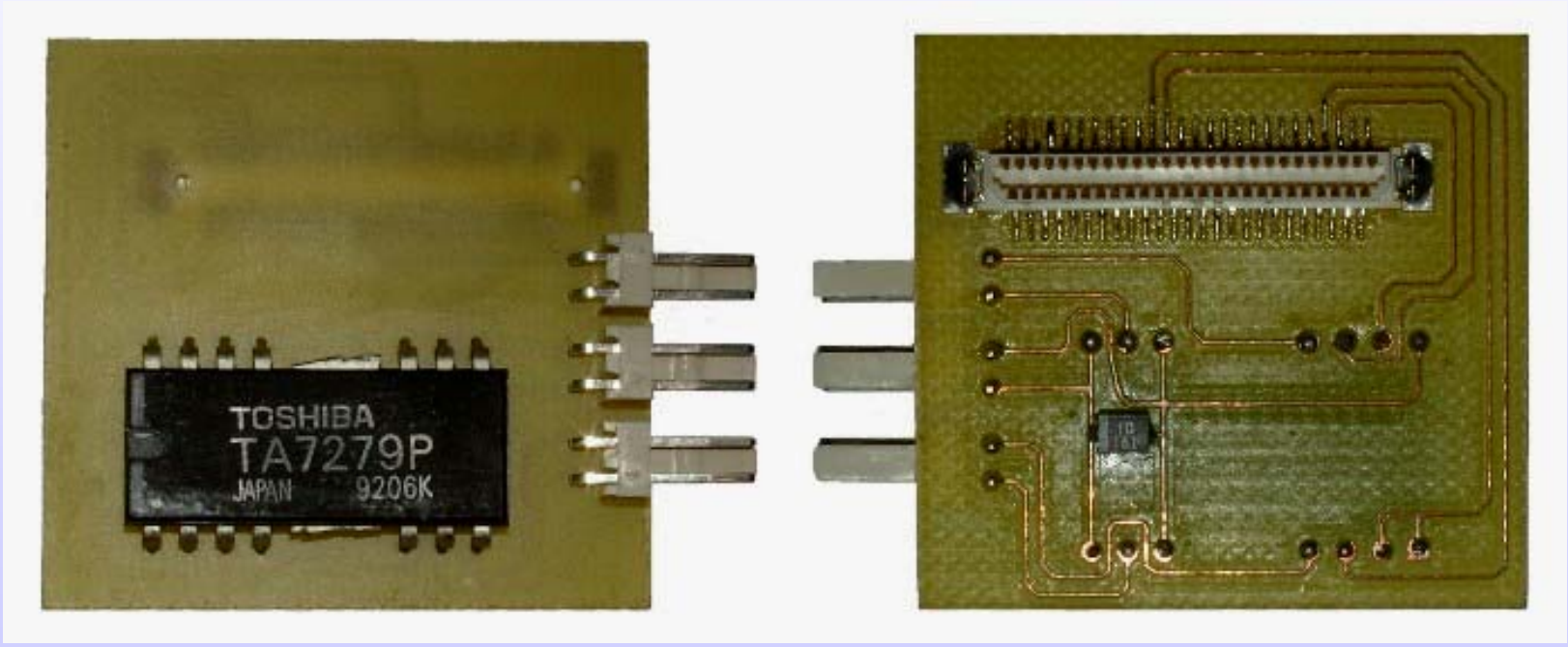
Motor Board


MICA2
Digital signal
Motor Board
Analog signal
Left Motor
Right Motor

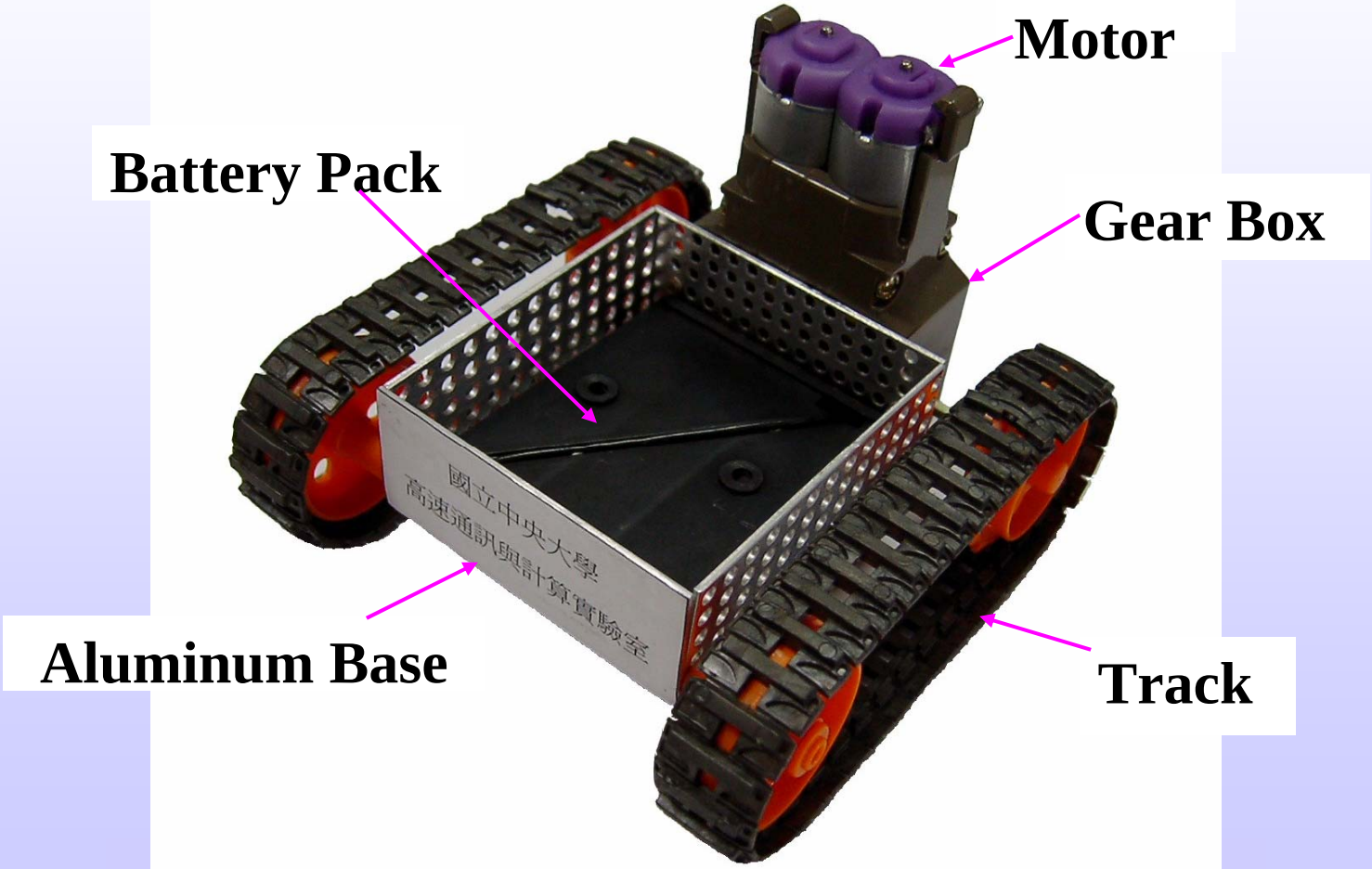
Motor Board

- Front Side

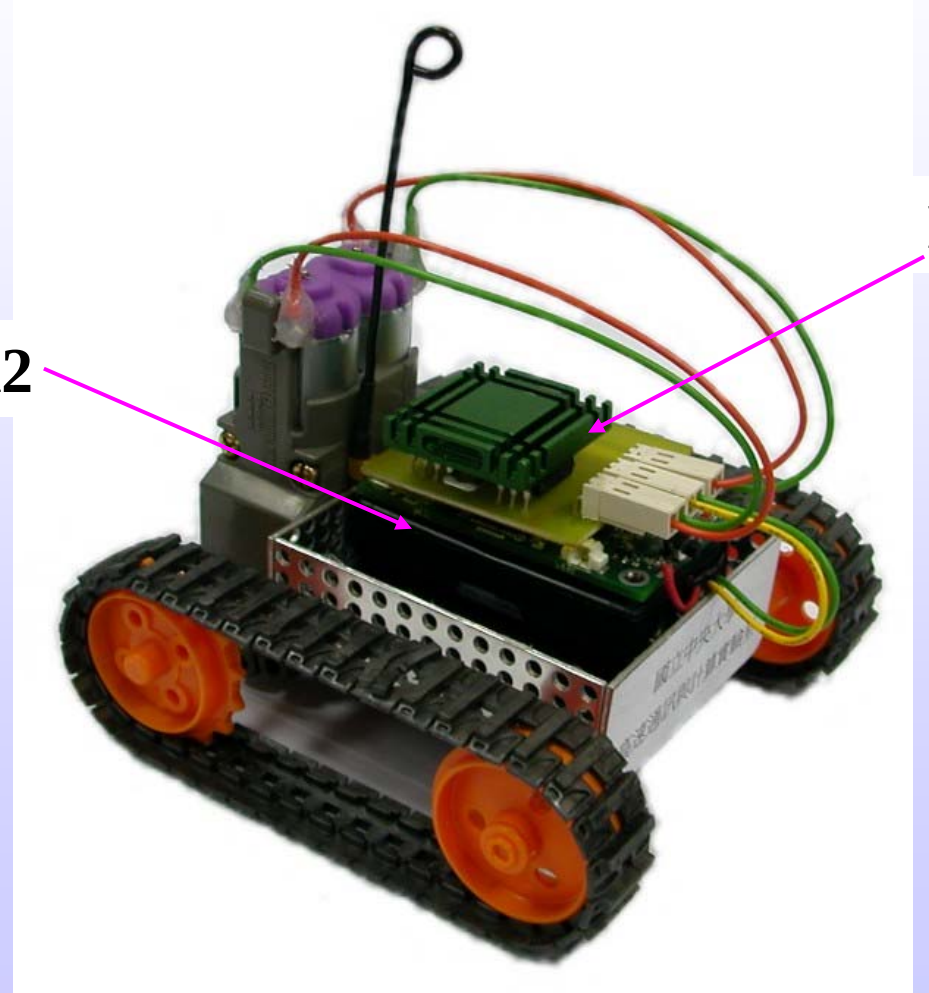
Back Side



Platform of Mobile Sensor Node



Mobile Sensor Node



Experiment 1 (One-to-One)

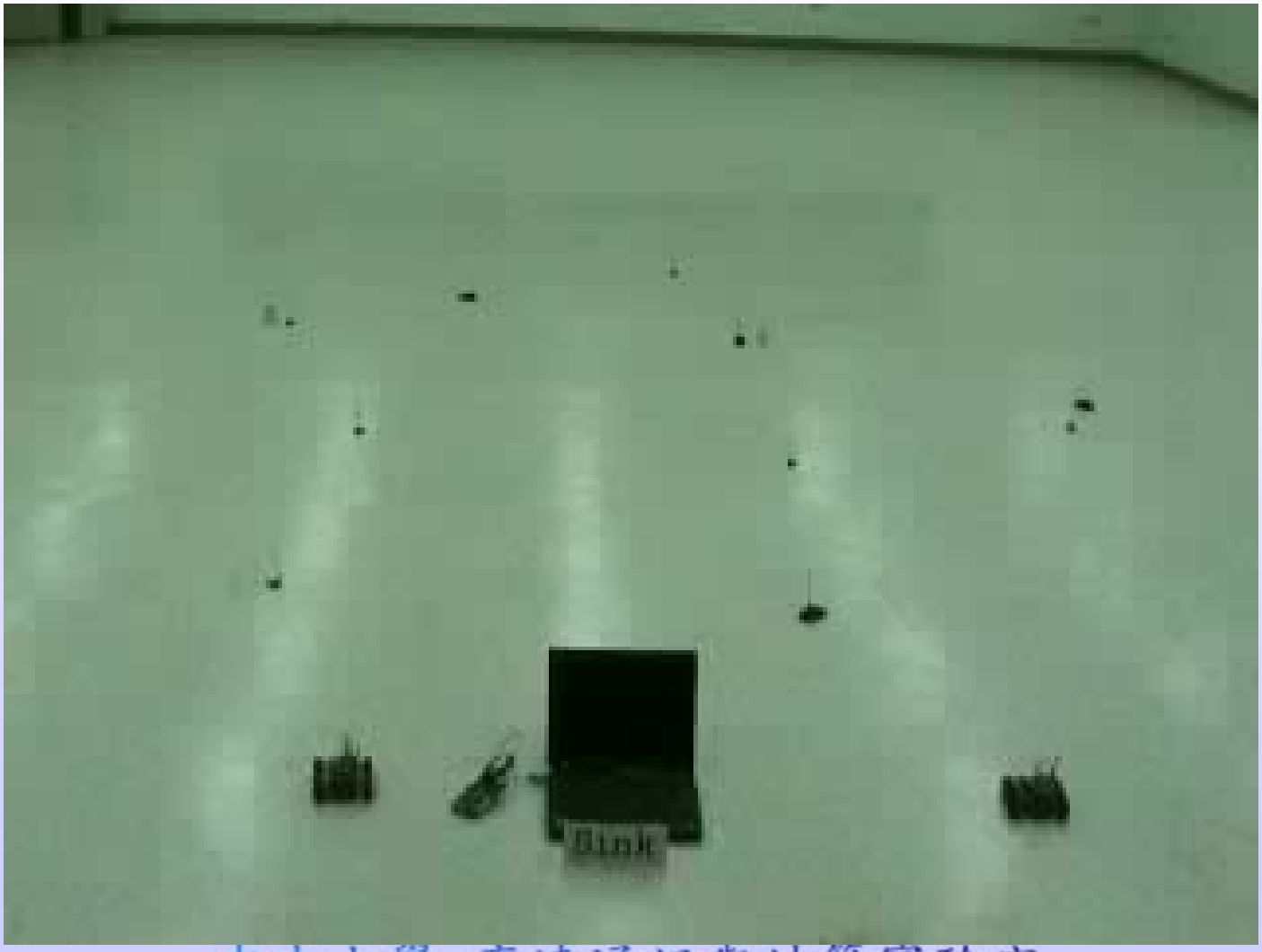
- Scenario
  - Number of mobile sensor node: 1 node
  - Number of target node: 1 node
  - Distance between target and sink: 3 hops
  - Distance between two node: 1 meter & 2 meters
  - Random deployment
- Experimental results of 10 experiments
  - Distance accuracy
    - 1 m: 7.2 centimeters
    - 2 m: 7.5 centimeters
  - Navigation time
    - 1 m: 28.3 seconds
    - 2 m: 70.5 seconds

Demonstration 1

Experiment 2 (Many-to-Many)

- Scenario
  - Number of mobile sensor node: 3 nodes
  - Number of target node: 3 nodes
  - Distance between target and sink: 3 hops
  - Distance between two node: 1 meter
  - Random deployment
- Experimental results of 10 experiments
  - Distance accuracy
    - 7.4 centimeters
  - Navigation time
    - 36.5 seconds

Demonstration 2



Experiment 3 (One-to-Many)

- Scenario
  - Number of mobile sensor node: 1 node
  - Number of target node: 3 nodes
  - Distance between target and sink: 3 hops
  - Distance between two node: 1 meter
  - Random deployment
- Experimental results of 10 experiments
  - Number of moving hop: 6 hops
  - Distance accuracy
    - 7.8 centimeters
  - Navigation time
    - 30.1 seconds

Demonstration 3