Atividades no Projeto SIIAM

Grupo de Computação Pervasiva e GRID
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  - Rede de Sensores
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  - Gerenciamento de Rede de Sensores
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- Sumário

Atividades no Projeto SIIAM

Projeto SIIAM – Fase I

- Apoio na especificação arquitetural da rede de sensores com base na(s) aplicações escolhidas
- Apoio na especificação arquitetural do nó sensor
  - Hardware de processamento
  - Hardware de comunicação
  - Sistema operacional
  - Protocolos de comunicação “power-aware”
- Apoio na especificação do sistema de gerenciamento da rede de sensores e interface com a aplicação

Projeto SIIAM – Fase II

- Desenvolvimento do subsistema de comunicação, gerenciamento e interface com a aplicação
- Utilização de gerenciamento baseado no padrão OSI-CMIP

Sistema de Comunicação

- Tipos de Meio
  - Óptico através de Laser e LED (fibra óptica, visada direta através do ar)
  - Infravermelho
  - Rádio
  - Fio (par trançado, coaxial etc.)
- Selecionável através de um módulo "mezanino"
- Profundo impacto no Software (S.O, firmware e aplicação de gerenciamento)

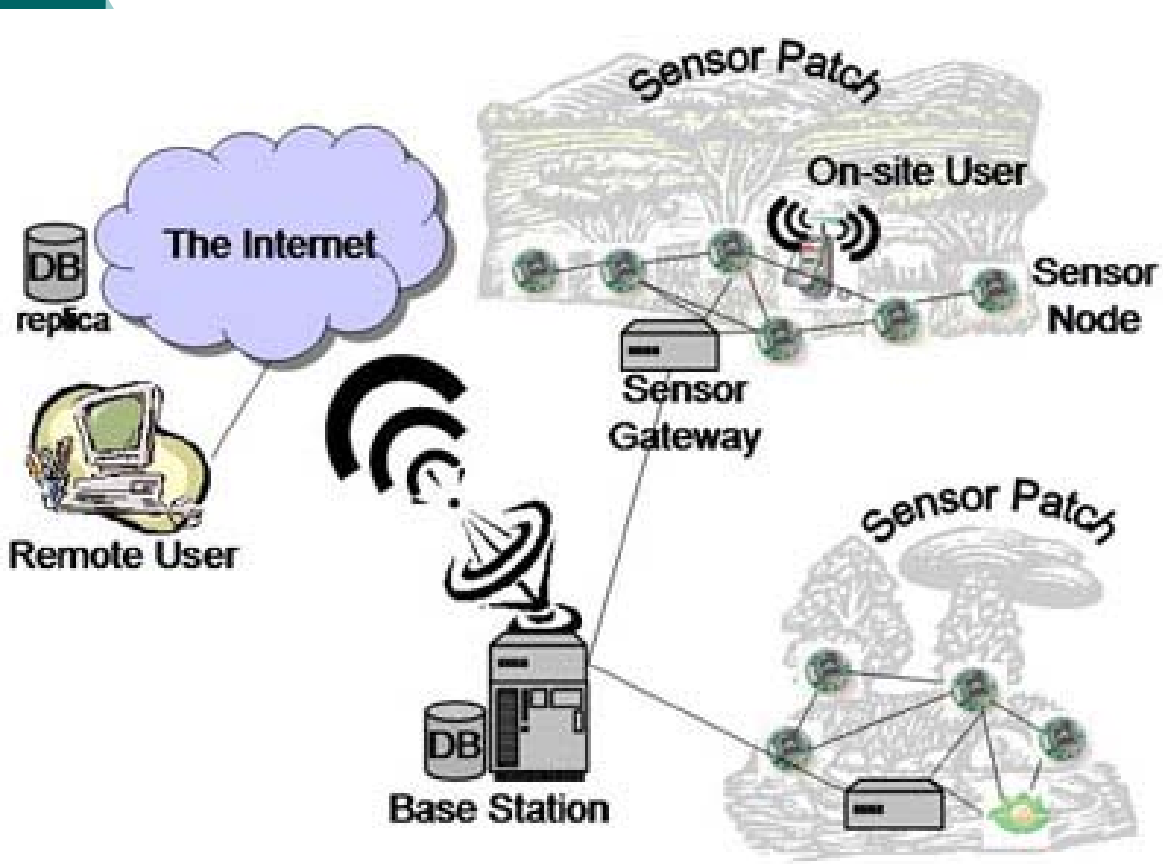
Outras Atividades

Rede de Sensores

Rede de Sensores

- Arquitetura de rede de sensores
  - Survivable networks
  - Active networks
- Arquitetura de nós sensores
- Hardware de comunicação sem fio
- Protocolos de Comunicação
  - Segurança (criptografia, autenticação, autorização)
  - Roteamento multihop
  - Comunicação ponto-a-ponto, multicast, broadcast “power-aware”
  - Operações coletivas (gather, scatter, reduce, control messages etc.)

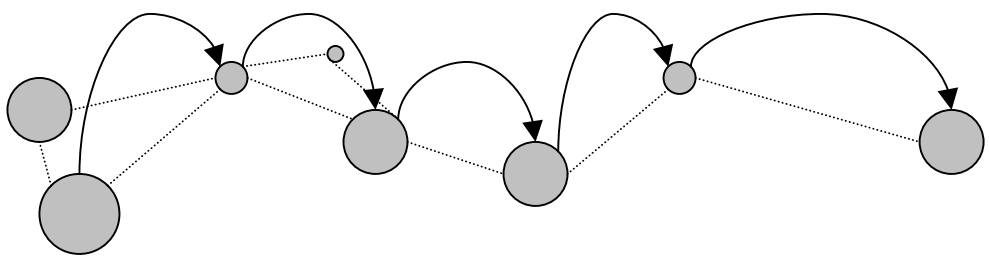
Sensoriamento Ambiental



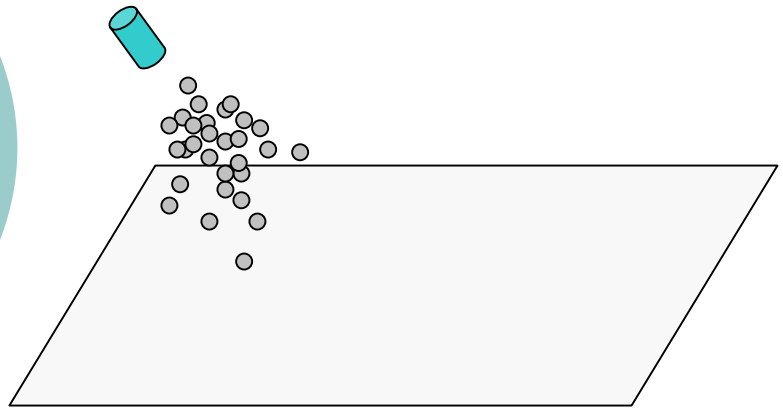
- Great Duck Island Project
  - Remote investigation of microhabitats. David Culler, Alan Mainwaring, Intel Berkeley Laboratories

Roteamento

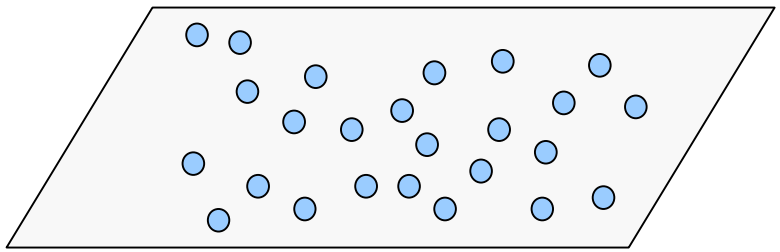
- Multi-Hop Routing
  - Limited Transmission Range
- Routing Issues:
  - Irregular Topologies – Data Transport Aware
  - Power Aware – Fault Tolerant



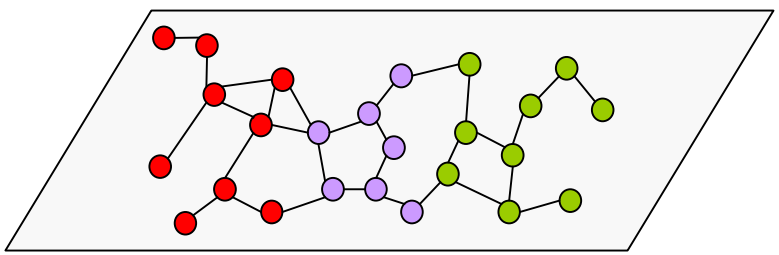
Fases: Implantação/organização/operação



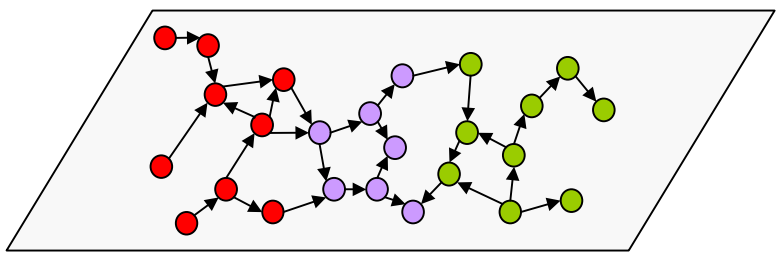
Deploy



Wake/Diagnosis



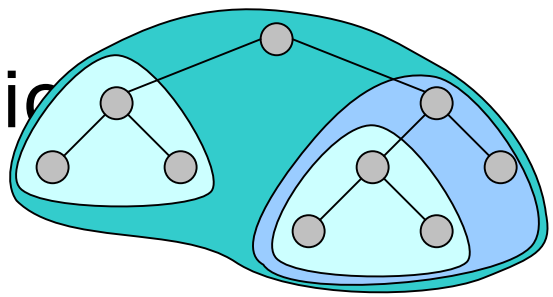
Organize into Clusters



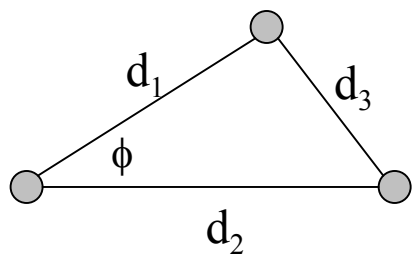
Route

Outros aspectos

- Multiple Data Points: Time and Position
- Temporal Synchronizatio
  - Hierarchical Schemes



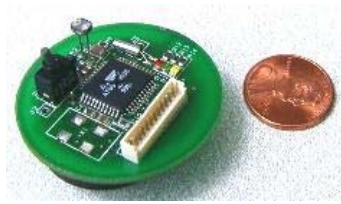
- Position Estimation
  - Digital Ranging
  - Offline Triangulation

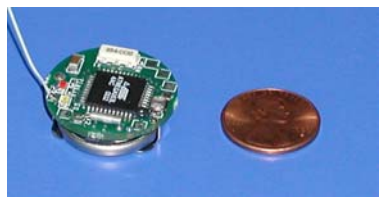


Outras Atividades

Arquitetura do Nó Sensor

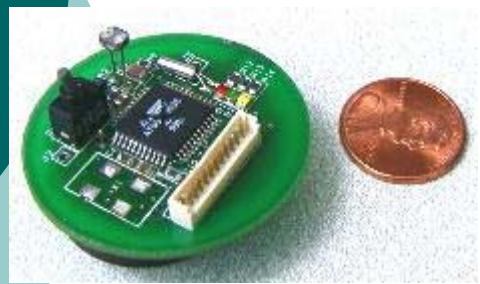
Algums Nós Sensores



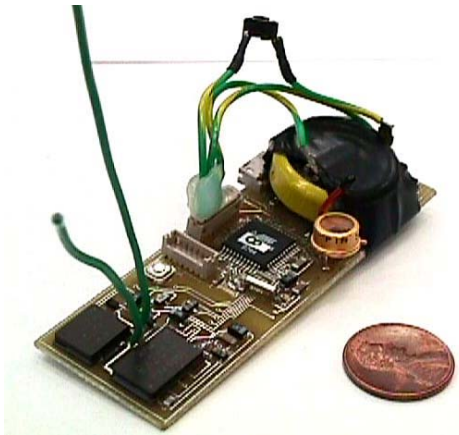


- Embedded processing, time synchronization mechanisms, real-time event handling, multihop network routing, application development tools and environments

Nós Sensores “famosos”



UC Berkeley: COTS Dust



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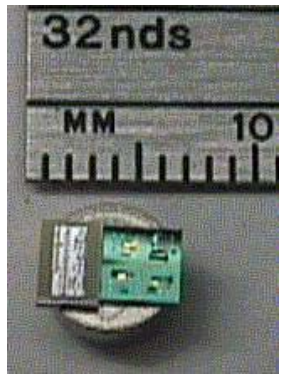


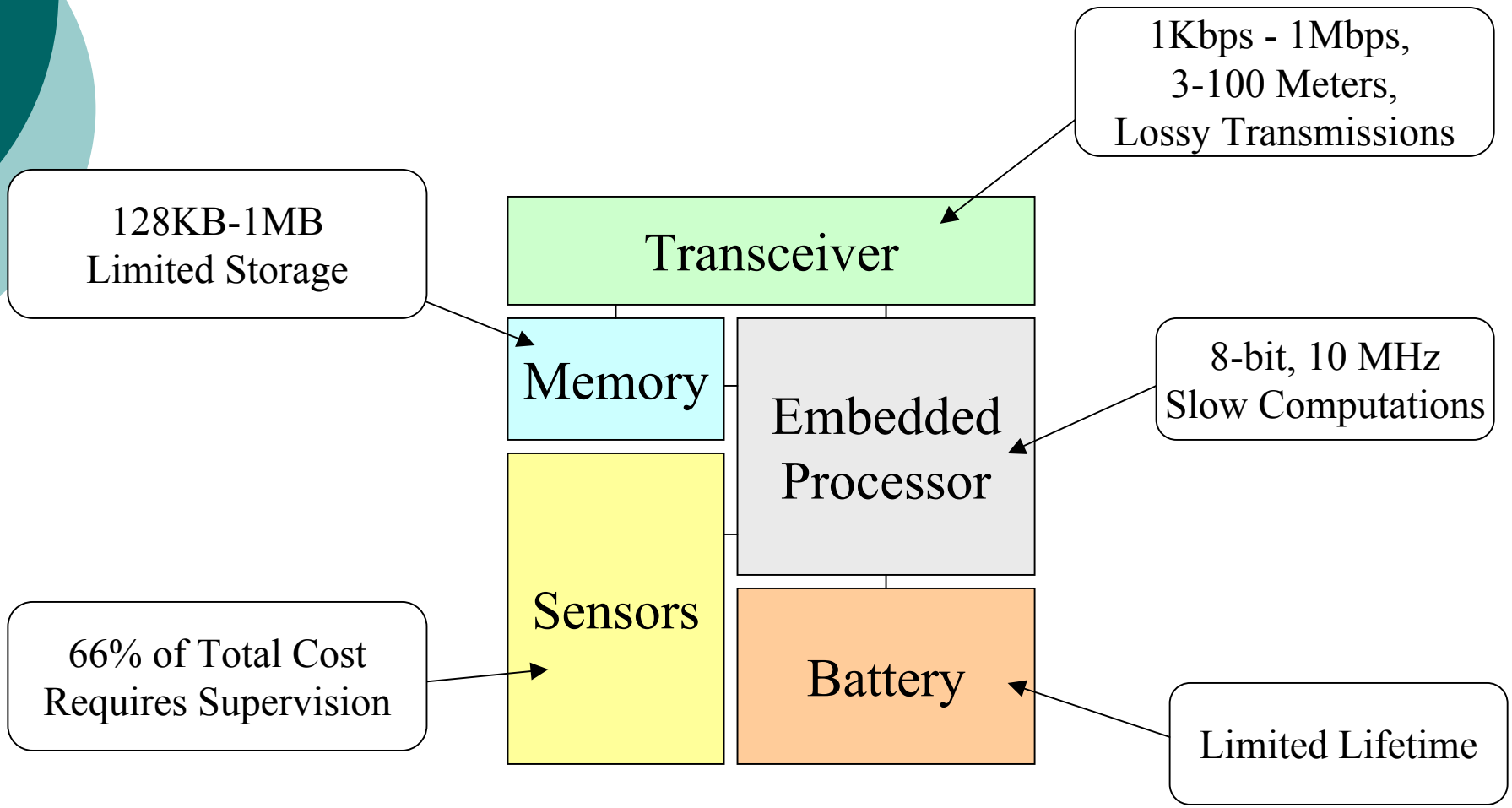
UC Berkeley: Smart Dust

UCLA: WINS

Rockwell: WINS

JPL: Sensor Webs

Hardware


1Kbps - 1Mbps,
3-100 Meters,
Lossy Transmissions
128KB-1MB
Limited Storage
Transceiver
Memory
Embedded
Processor
8-bit, 10 MHz
Slow Computations
Sensors
Battery
66% of Total Cost
Requires Supervision
Limited Lifetime

Exemplos Comerciais

CrossBow MOTE Development Kit

Mote Hardware Development

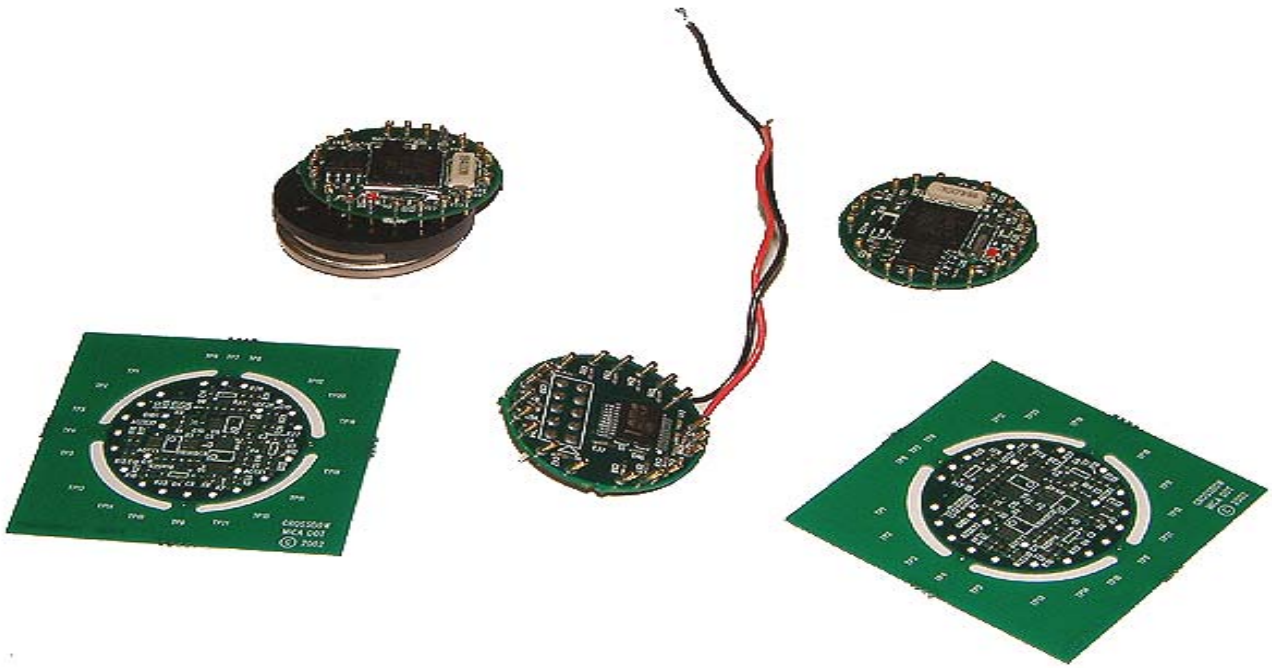
- Second Generation Mica Motes
  - Mica2 (2.25”x1.25”)
  - Mica2Dot (1” diameter)
  - New Programming board
- Sensor Boards
  - Weatherboard
  - General Interface Board (UCLA)
  - DOT Accelerometer sensor boards
  - DOT General Purpose sensor board
- Commercialization of Intel Stayton

Mica2/Mica2Dot

New Radio (Chipcon 1000):

- Better noise immunity
- Better range
- FM modulated (vs Mica AM)
- Linear RSSI
- Digitally programmable output power (no pot)
- Built-in Manchester encoding
- Support 400Mhz and 900Mhz bands
- Software programmable frequency hopping within bands

Mica2Dot



Mica2/Mica2Dot

Other Changes/Additions/Improvements:

- No little guy coprocessor (has its own bootloader)
- 7.3728Mhz crystal to support higher UART baud rates (Mica2)
- Coax antenna connector for external antenna (Mica2)
- Low profile on/off switch
- No boost regulator, < 10uA sleep, active current reduced as well

New Programming Board

Changes/Additions:

- Programs both Mica2 and Mica2Dots
- Viewable Mote leds
- 51 pin sensor board connector on bottom (optional population)
- Mote processor reset switch

Sensors: Weather Monitoring

- IR Thermopile
- Humidity
- Barometric Pressure
- Ambient Light
- Optional ADXL202
- All sensor have internal ADCs.
  - will help with calibration

Sensors: General Purpose Interface

- Screw Terminal I/O Connections
- 8-Channel 12-bit ADC
  - Configurable 0-2.5V, 0-3, 0-5V
  - Configurable Divider for other ranges
- 8-Channel Digital I/O including 1 relay
- NiMH Charge Circuit (Prototype)

Sensors: Mica2Dot Bridge Conditioning

- Special Purpose
  - 3-axis interface for external accelerometers (bridge completion).
  - Programmable auto-balance
  - Programmable hi-pass/lo-pass filters
- General – Two Boards
  - ADXL202, 2-axis, sensor & battery board
  - Board with Holes

Intel Stayton (Lakshman, Roy Want)

- Embedded platform running Linux
- Intel 400Mhz Xscale processor
- 51 – pin Interface for MICA or MICA2
- Ethernet,USB, PCMCIA,Serial
- Future base station for GSK
- Shipping to start in Q2.

Software: NetProgramming Development

- No Little Guy
- Resident bootloader.
  - Resides at top of memory (4K)
  - Preloaded by Crossbow before shipping
- Remote Download ..
  - Loads code capsules to serial memory.
  - Retransmits lost capsules.
  - Verifies that battery voltage is OK before preceding.

Software: Chipcon Radio Stack (Mike G., Jason H, Phil B)

- Chipcon radio drivers for both 400 and 900Mhz bands
- Supports Chipcon Manchester encoding
- Supports Chipcon power-down modes

Software: High Speed ADC

- Supports streaming ADC data to 128 at max rate
- This rate is 20KHz at 10-bits
- Up to 50KHz at 8-bits