Ch 4: Context Aware Computing

Proactive

Context?

- System state in which our actions are taking place
- Who is using the system (User context)
  - can change language
  - background

G

Open Session ➔ Session ➔ don’t want to login

If detect a new user is in proximity again need proximity sensor.
2) detect the identity of the user
   - authentication (user name, passwd)
     - will require active participation by the user
     - avoid this how?
   - smart card?

![Diagram]

- Id and other information stored in Memory
- passive device doesn't need battery
- Can be used for electronic cash
- Biometric sensors
  - Iris scanner
  - Fingerprint

Embedded Computing

Smart Space

Smart Conf Room
Class

Region
In a smart space different people have different Roles. Based on roles the “environment” or smart space can give them different privileges (access rights). Students who are registered in the class which is currently being taught are the only students who are given participant role/privilege.
Things that need to be detected:
- time
- location / proximity
- id of the student

Contextual Information

Smart space

Extension of Role-Based Access Control:
- Roles assign users
- Define privileged for each role
- Constraints on the roles
Sensors?
- Detects some "signal"
  - Analog / digital
  - Continuous / discrete

\[
\begin{array}{c}
M \\ \rightarrow \text{Transducer} \\ \rightarrow M
\end{array}
\]

- Types
  - Hardware / Software
    - Numeric / String

- Properties
  - Continuous / discrete
  - Precision / Fidelity
  - Range
Wireless Sensor Network

1. Cabling not required
   - reduces cost dramatically
2. Can be deployed in remote areas
   - don't require infrastructure
3. Can be mobile
   - change the configuration easily
4. Causes less disturbance of the environment
   - less invasive
- don't have to bore dig hole in wells etc. can be deployed in historic places etc.

Disadv:
- some cases wireless may expensive
- need energy source
  - battery
  - RF power - cannot provide much power
  - self-power
    - solar
    - wind
  - Energy harvesting
    - seismic
    - heat
- Security

For stronger security, you need to spend more energy.

- Energy cost of transmission is enormous compared to computing cost.

- Reliability

- Environmental effect
Network?

- Each node has limited range of communication

  \[ O \text{ transmission power level} = P_t \]
  \[ \text{distance/range of } O = d \]
  \[ \text{reliable communication} \]

  \[ d \propto P_t \]

- Multihop communication may be cheaper in terms of energy consumption
\[ P_T(d) = k \cdot d^a \quad a \geq 2 \]

Let's assume \( a = 2 \) (propagation loss factor constant)

\[ P_T(d) = k \cdot d^2 \]

\[ P_T(2d) = 4k \cdot d^2 \]

\[ = 4 \cdot P_T(d) \]

\[ P_T(x \cdot d) = x^a \cdot P_T(d) \]

\[ d \quad o \quad d \quad o \quad d \]

\[ 0 \quad o \quad 0 \quad o \quad 0 \]

\[ 2d \]

\[ Kd^2 + Kd^2 \leq 4k \cdot d^2 \]
What are hidden costs of multi-hop routing?

- More nodes
- More complexity (system issues)
- Deployment problem

![Diagram of a network with a sink node labeled BS and compute routes labeled routing protocol]
Start Reading Ch. 8. in the Book.