

307CR

# Aspects of Pervasive Computing

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# Pervasive Computing

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# Summary

- What is required for a system to be "Pervasive"
- Key Areas
- Aspects of pervasive technology

# Pervasive Systems

- Almost all pervasive systems monitor some phenomena
  - Require some way of **detecting** this phenomena
  - Need a way to **process** and **communicate** data
  - Many pervasive systems allow user interaction.

# Characteristics of Pervasive system

- Many are Battery Powered
  - Need to consider network lifetime
    - Sensing
    - Processing
    - Communications

# Monitoring a Phenomena

- By this we mean something, often physical in nature that can be monitored.
- We also need to know WHY we are monitoring this
- The physical characteristics are also important
  - Is it physical, can it be seen / heard.

# Example: Building Monitoring System

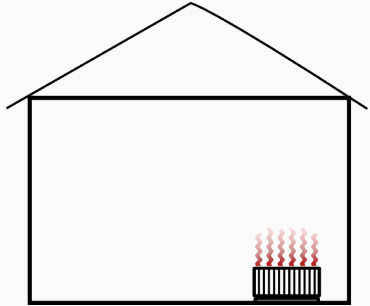
- What are we wanting to measure?
- Why do we measure it?
- What are its characteristics?

# Example: Building Monitoring System

- What are we wanting to measure?
  - Temperature (Room / External), Heating System Status
- Why do we measure it?
  - To help make decisions on heating / cooling
- What are its characteristics?
  - Physical (Temperature), Gas Use (Heating)



Example:



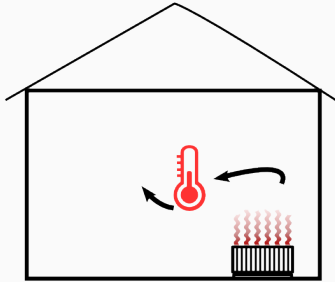
# Method of Detecting / Sensing

- There are a wide range of sensors that can be incorporated into a pervasive system
  - (To be covered in another lecture)
- Think about the data you are collecting and select the most appropriate device
- Where in the system does this go? How does it work?

# Example Building Monitoring System

- In our above example we can use a temperature sensor
  - Thermistor (changes resistance based on temp)
  - MEMS based sensor

Example:



- We shouldn't be collecting data for the hell of it.
- Pervasive systems help us to make decisions based on the data.
  - Transform from Data to User Relevant Information

# Processing Data

- Can be Done In-Network
  - On the sensing devices themselves
- At the Sink
  - Data collected from all devices in a central place

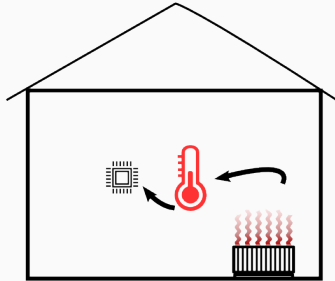
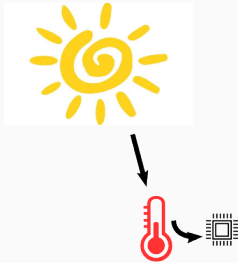
- In network processing tends to make use of Microprocessors
  - Low energy consumption
  - Becoming increasingly powerful whilst shrinking in size
  - Similar to a desktop style processor, only smaller
  - Many types of microprocessor available.

# Question

- What are the advantages and disadvantages of in-network processing?
- What limitations may you experience when using a microprocessor, rather than a desktop processor.



## Example:

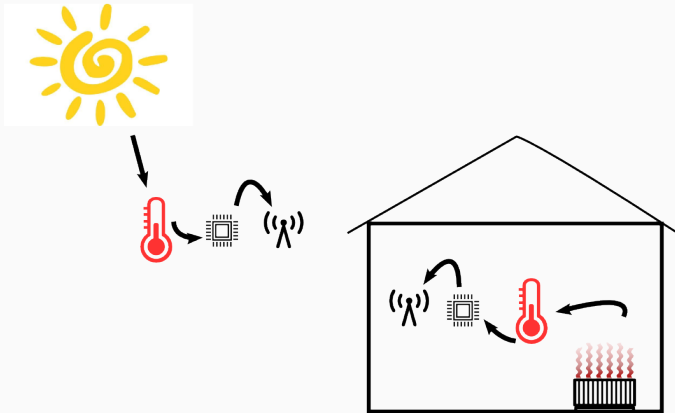


- Often the purpose of the pervasive system will be to monitor and send details back to a user
- There are numerous methods of communication available:
  - Bluetooth
  - WiFi
  - Sneakernet
- The microprocessor will interact with the comms hardware and send relevant data to the user

# Communications Trade offs

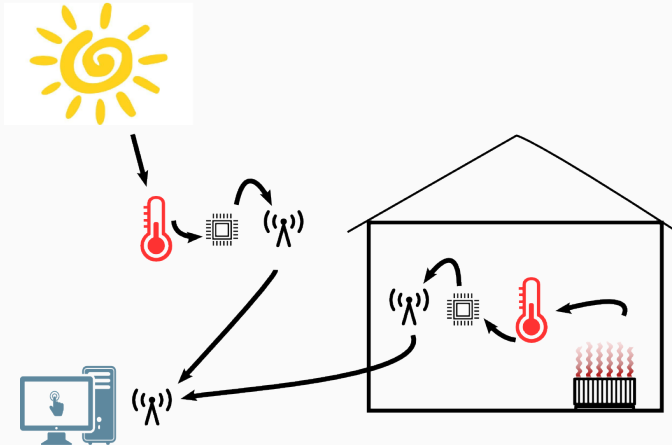
- Sending data is usually the most expensive part of sensor network operation
- Trade off between Range, Bandwidth and Network Lifetime

# Example



- Finally Data is usually sent to a sink
  - Central Repository for the data
  - More processing can take place
  - User interface to display data

# Example



# Key Areas of Pervasive Computing

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The majority of pervasive systems fall into one of the following categories.

- Wearable Computing
- Wireless Sensor Networks
- Context Aware Systems
- Augmented Reality.



# Wearable Computing

- A computer powered device that can be worn by the user
- Includes Clothes, accessories, bags etc.
- Wearable systems are often referred to as "smart" (IE Smart Watch, Smart Shoes)
- A Popular theme at the moment

- What are the potential limitations of wearable systems?

# Wireless Sensor Networks

- Based on distributed sensors feeding information back to a user
- Refers to the topology of a system, and can be used in conjunction with other systems (for example context aware, wearable)
- May include **thousands** of individual sensors
- Effective for collecting large amounts of data.

We want to create a WSN based system to map the current strength and temperature data of water on the great barrier reef. How is this possible?

# Context Aware Systems

- Refers to a system that is monitoring pre-defined parameters for change
- Can be create to alert a user of change, of activate pre selected systems to adjust to the phenomena
- Can be used in conjunction with wearable systems or WSN
- Effective for monitoring and maintaining certain environmental parameters.

How can a context aware system be applied to the growth of strawberries in order to ensure a higher quality product can be produced for more months of the year?

# Augmented Reality

- Personally I always get iffy over this being a pervasive system, or a use of a pervasive system
- Focus on blending the real world with the digital world
- Require some way of displaying information in the real world (projector, glasses)
- Pretty awesome way of showing the data from a sensor network.

How do augmented reality systems differ from Virtual Reality systems (such as the Rift)