Electronics Overview of Physical Computing

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Preparation

Learning Objectives
Two Worlds
Getting information between worlds
Comparing worlds
Review

Do you have a smartphone or tablet? If so, in what ways can it get information from the user or the environment? In what ways can it provide information to the user or the environment?

Do you have an electronic device that you wear? If so, in what ways does it interact with you?
Preparation

- Do you have a smartphone or tablet?
Preparation

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If so, in what ways can it get information \textit{from} the user or the environment?
Preparation

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In what ways can it provide information \textit{to} the user or the environment?
Preparation

- Do you have a smartphone or tablet?
  If so, in what ways can it get information *from* the user or the environment?
  In what ways can it provide information *to* the user or the environment?
- Do you have an electronic device that you wear?
Preparation

- **Do you have a smartphone or tablet?**
  - If so, in what ways can it get information *from* the user or the environment?
  - In what ways can it provide information *to* the user or the environment?
- **Do you have an electronic device that you wear?**
  - If so, in what ways does it interact with you?
Learning Objectives

By the end of this lesson, you should be able to:

- identify what sets physical computing apart from ordinary computing
- state properties of analog and digital quantities
- define the terms sensor and actuator
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- *state properties of* **analog** and **digital** quantities
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- *define* the terms **sensor** and **actuator**
Two types of questions
Two types of questions

What is the third letter of the alphabet?
Two types of questions

What is the third letter of the alphabet?  Should I wear a coat today?
Two types of questions

What is the third letter of the alphabet?
What is the square root of 16?
Should I wear a coat today?
Two types of questions

What is the third letter of the alphabet?

What is the square root of 16?

Should I wear a coat today?

Do I need to get gasoline in my car on my way home?
Two types of questions

What is the third letter of the alphabet?
What is the square root of 16?
What is the area of a rectangle 4 inches by 3 inches?

Should I wear a coat today?
Do I need to get gasoline in my car on my way home?
Two types of questions

- What is the third letter of the alphabet?
- What is the square root of 16?
- What is the area of a rectangle 4 inches by 3 inches?
- Should I wear a coat today?
- Do I need to get gasoline in my car on my way home?
- Which direction is north?
Physical computing
Physical computing

*Physical* computing involves interaction with the world outside the computer.
Further examples
Physical computing systems are all around us. Many we are not even aware of.
Further examples
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Further examples

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Further examples
Getting information between worlds
Getting information between worlds

- Sensors
Getting information between worlds

- Sensors
  
  get information *from* the user or the environment
Getting information between worlds

- **Sensors**
  get information *from* the user or the environment
- **Actuators**
Getting information between worlds

- **Sensors**
  get information *from* the user or the environment

- **Actuators**
  provide information *to* the user or produce action in the environment
Getting information between worlds

- Sensors
  get information \textit{from} the user or the environment
- Actuators
  provide information \textit{to} the user or produce action in the environment

\textit{Inside the computer, electrical signals represent all of the real world quantities.}
Comparing worlds

The world outside the computer is primarily analog.
The world inside the computer is primarily digital.
Comparing worlds

The world *outside* the computer is primarily *analog*. 
Comparing worlds

The world *outside* the computer is primarily *analog*. The world *inside* the computer is primarily *digital*. 
Analog versus digital worlds
Analog versus digital worlds

Analog
Analog versus digital worlds

Analog

Digital
Analog versus digital worlds

Analog
continuous

Digital
Analog versus digital worlds

<table>
<thead>
<tr>
<th>Analog</th>
<th>Digital</th>
</tr>
</thead>
<tbody>
<tr>
<td>continuous</td>
<td>discrete</td>
</tr>
</tbody>
</table>
Analog versus digital worlds

Analog
continuous
many different
quantities (sound, light, temperature, etc.)

Digital
discrete
Analog versus digital worlds

Analog
- continuous
- many different quantities (sound, light, temperature, etc.)

Digital
- discrete
- numbers, represented by electrical signals
Review

What sets physical computing apart from ordinary computing?

What is different about the analog and digital worlds?

What is a sensor?

What is an actuator?
Review

What sets physical computing apart from ordinary computing?
Review

- What sets *physical computing* apart from ordinary computing?
- What is different about the *analog* and *digital* worlds?
Review

- What sets *physical computing* apart from ordinary computing?
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- What is a *sensor*?
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- What sets *physical computing* apart from ordinary computing?
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- What is a *sensor*?
- What is an *actuator*?
Review

- What sets *physical computing* apart from ordinary computing?
- What is different about the *analog* and *digital* worlds?
- What is a *sensor*?
- What is an *actuator*?