Grundzüge der Wirtschaftsinformatik

Introduction to Business Information Systems

Unit 4

Prof. Dr. Martin Hepp
http://www.heppnetz.de
mhepp@computer.org
http://www.heppnetz.de/teaching/gwi/

Logistics

• Lecture
  – Tuesdays, 13:15 - 14:45, Auditorium Maximum (Building 33)

• Tutorial and Exercises
  – Wednesdays, 11:30 – 13:00, Building 33 Room 2401 (in German)
  – Thursdays, 09:45 - 11:15, Building 43 Room 4/126 (in German)
  – Thursdays, 15:00 - 16:30, Building 33 Room 2116 (in German)
  – Thursdays, 16:45 - 18:15, Building 33 Room 2116 (in German)

• Exam
  – At the end of the Winter trimester, in conjunction with the exam in „Accounting“ (by recommendation of the Dean of Studies)

Structure of the Lecture

Unit 1: Introduction
Unit 2: Central Processing Units
Unit 3: Storage and Data Structures
Unit 4: Input and Output Devices
Unit 5: Software
Unit 6: Networks, Data Interchange, and the Internet
Unit 7: Design, Development, Deployment, and Operations of Information Systems
Unit 8: Office Applications
Unit 9: Enterprise Applications
Unit 10: Supply Chain Applications and E-Business
Unit 11: Management Support Systems
Unit 12: Exam Review

Link to the Previous Unit

• Last Unit:
  – How can binary data be stored persistently, so that it remains available even if the power supply is interrupted?
  – How can we translate
    • numerical values,
    • text, and
    • complex data items
    into a sequence of binary numbers?
  – What techniques can help us retrieve a needed data item from a large data collection quickly?

• Today:
  – How can we collect information from reality and get it into a computer system?
  – How can we display or print out computer data?
  – What types of equipment exists and how do they work?

Assignment from last week

• WI2: pp. 93-211, 387-515
• Review the slides

WI1 = Hansen/Neumann: Wirtschaftsinformatik 1; WI2 = Hansen/Neumann: Wirtschaftsinformatik 2; IBIS = Wigand et al: Introduction to Business Information Systems.

Overview: Collecting Input

Entering Text
Dear Sir:
Please ...

Speech
Hello!

Images

Video

Position Data

Voltages

Temperatures

Capture
1. Capture
2. Convert into binary representation
Remember: Computers can process digital data only!

Address Bus:
Which memory cell is to be used?

Control Bus:
What should the memory chip do?
When is the CPU ready to take the results?

Data Bus:
For exchanging values between memory and the CPU

CPU

128 + 64 + 0 * 32 + 0 * 16 + 8 + 4 + 2 + 1 = 207

Input and Output Devices

Input Device

CPU (Processor + Main Memory)

Transfer via media

Output Device

cf. Hansen/Neumann p. 216

Transmission: Types of Media

Wire

Fibre cable

Radio Frequency

Infrared

Input Device

Output Device

Types of Transmission: Serial vs. Parallel

• When transmitting a byte (8 bits), one can either send
  – a full byte via eight wires (parallel transmission) or
  – one bit at a time via a single wire (serial transmission).

Classification of Input Devices

• By modality (i.e., the type of the input)
  – Manual
  – Optical
  – Audio
• By type of content and purpose
• Discrete vs. continuous

Input Devices for Texts and Numbers

• Keyboards
• Handwriting Recognition
• Simplified Handwriting
• Speech Recognition
Keyboards
- Array of small switches
- Keyboard controller checks for status of switches
- If a key is pressed down, a number reflecting the position of the key is sent to the CPU
- CPU uses a table to translate from the position of that key to the correct character

Handwriting Recognition
- Optical
  - Reconstructing the characters from an image of the handwriting
- On dedicated writing pad
  - Can take into account the speed of individual movements and strokes into account

Simplified Handwriting
- Reduce the complexity of recognition by defining a simplified and standardized way of writing per each character
- Example: Palm Graffiti and Graffiti 2

Speech Recognition
- Spoken language is captured via a microphone and converted into a sequence of values.
- Those values reflect the volume at a given moment in time.
- Then, the sequence of values is compared to the patterns of known words.

Pointing Devices
- Computer Mouse
  - Mechanical
  - Optical
- Trackball
- Touchpad
- Joystick
  - Digital
  - Analog
- Lightpen
- Touchscreen
- Data Glove
Optical Computer Mouse

Takes multiple pictures per second and reconstructs mouse movement from the position of characteristics patterns in the picture.

Repetitive Strain Injury (RSI)

- Continuous usage of computer input devices can cause serious injuries and chronic pain.
- This is known as Repetitive Strain Injury.
- Watch out and see a doctor if using a keyboard or computer mouse causes pain!

Joystick: Digital

A digital joystick has four or more buttons (switches) to capture the position of the stick and the "fire" button.

Joystick: Analog

An analog joystick uses two potentiometers (variable resistors) to capture the direction and position of the stick. This returns not only the mere direction but also the intensity.

Touchpad

- A small device that detects the position and movement of your finger tip
- Works on the bases of changes in the capacity, caused by the presence of a finger

Touchscreen

- A transparent layer mounted on top of a screen that can also determine whether someone touches the screen, and if so, where.
- Various principles
  - Resistive
  - Capacitive
  - Surface Acoustic Wave (SAW): ultrasonic technology

Input Devices for Visual Information

- Scanners
- Digital Camera
- Webcam
- Digital Video Camera

Scanners

- Used to create a pattern of bits that reflects a given image
  - bw
  - greyscale
  - color
- Most scanners use a CCD (Charge-coupled Device) for capturing the amount of light reflected per pixel
- Color-CCDs mostly use a grid of filters

Scanners (2)

Digital Camera and Digital Video Camera

- Also use CCD technology for capturing still and moving images.
- Think of business potential in integrated computer applications:
  - Car rental: Documenting damages
  - Recording meetings

Other Input Devices

- Barcode Reader
- RFID
- OCR
- Analog/Digital Converters

Barcodes and Barcode Readers

- A small light source and a photo-sensitive transistor can easily convert such a pattern on paper into a sequence of high / low signals.
Barcodes and Barcode Readers

• Rather simple but highly efficient technology for capturing data from paper and other surfaces
• A barcode contains digits or characters. Each binary number is encoded as a sequence of narrow and wide bars.

```
Narrow-Wide-Narrow-Wide-Narrow-Wide-Narrow
010010100
(Code 39 Start/Stop character)
```

Barcodes

Why can a barcode reader deal with varying reading speeds?
And why must one try to move the reader at a constant speed?

Barcodes Applications

```
10% Off
Lowes
```

RFID

• Very small, inexpensive devices that can send a short message to near receivers
• Self-powered or powered by induction

Optical Character Recognition

• Reconstructing the characters from text
  – Regular fonts
  – Specially designed OCR fonts

```
1234, Hepp
```

Data Collection from Paper Documents

• Corporations can include barcodes and checkboxes in paper documents, which can be used for processing the documents automatically.
• Example: Contract number
Analog/Digital Converters

- Special equipment for converting a voltage into a binary value

Output Devices

- Screen Output
  - Displays
    - Cathode Ray Tubes (CRT)
    - TFT / Flatscreens
    - Liquid Crystal Displays
    - Projectors
  - Graphics Cards
- Printers
  - Impact
  - Non-impact
- Plotters
- Sound Card

Screen Output: Principle

Video Memory

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 0000 0000</td>
<td></td>
</tr>
<tr>
<td>0111 1111 1110</td>
<td></td>
</tr>
<tr>
<td>0100 0000 0010</td>
<td></td>
</tr>
<tr>
<td>0111 1111 1110</td>
<td></td>
</tr>
<tr>
<td>0000 0000 0000</td>
<td></td>
</tr>
</tbody>
</table>

Monitor

Fonts: Binary patterns that represent characters, numbers, and symbols

Each Character is represented by a combination of dots.
Those dot patterns are stores as binary numbers.

Types of Displays

- Cathode Ray Tubes (CRT)
- Liquid Crystal Displays
- TFT / Flatscreens
- Projectors

Printers

- Impact
- Non-impact
  - Xerographic (“Laser”)
  - Thermal
  - Inkjet
Laser Printer

A laser beam or LED is used to paint an electrostatic image of the page to print. Then, the printer coats the drum with a fine black powder (the toner). Toner particles remain only at electrically charged points.

http://computer.howstuffworks.com/laser-printer.htm/printable

Ink-jet Printer

Total Cost of Ownership (TCO)

- Purchase Price
- Installation, Training
- Supplies
- Maintenance

\[ \text{TCO} = \text{determined by the chosen brand} + \text{usage and brand} \]

Problem: Partial Consumption of Consumables

- Paper: 10 $/500 sheets $ 0.02/page
- Toner: 50 $/2,000 pages $ 0.025/page
- Drum unit: 200 $/10,000 $ 0.02/page

When one prints 12,000 pages over the whole life span of the printer, you have to pay for 2 drum units, not 1.2!
Example

<table>
<thead>
<tr>
<th></th>
<th>Approach 1</th>
<th></th>
<th>Approach 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase Price</td>
<td>$ 300</td>
<td>Purchase Price</td>
<td>$ 300</td>
<td></td>
</tr>
<tr>
<td>Supplies</td>
<td>$ 975</td>
<td>30 Boxes of Paper</td>
<td>$ 300</td>
<td></td>
</tr>
<tr>
<td>15,000 * 0.065</td>
<td>$ 1275</td>
<td>30 * $ 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCO</td>
<td>$ 1275</td>
<td>8 Toner Kits</td>
<td>$ 400</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 * $ 50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Drum Kits</td>
<td></td>
<td>$ 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCO</td>
<td></td>
<td>TCO</td>
<td>$ 1400</td>
<td></td>
</tr>
</tbody>
</table>

Assignment for Next Week

- WI2, pp. 301-385; IBIS, pp. 20-31
- Review the slides

WI1 = Hansen/Neumann: Wirtschaftsinformatik 1; WI2 = Hansen/Neumann: Wirtschaftsinformatik 2; IBIS = Wigand et al: Introduction to Business Information Systems.

Thank you!

The slides and additional materials will be available at
http://www.heppnetz.de/teaching/gwi/