The Tablet PC overview

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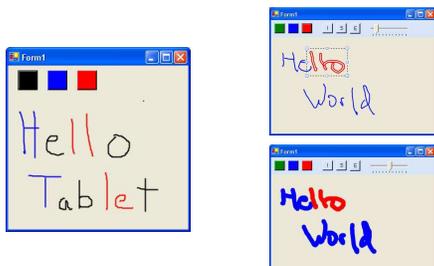

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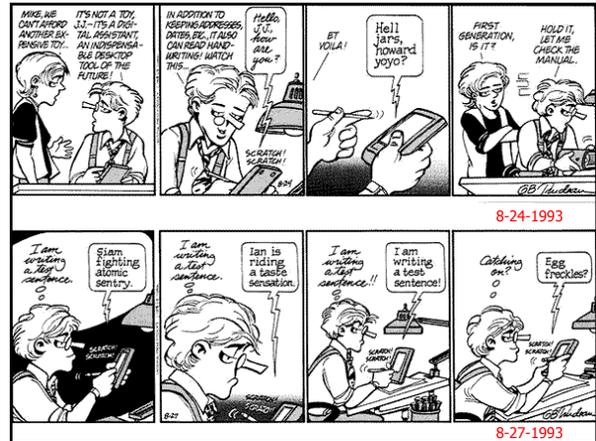
Topics

- Tablet PC introduction
  - What and why
- Usability issues
  - Hardware requirements
  - Display

Homework Assignments

- Due 1/11, 1/18, 1/25, 2/1
- HW1, HW2, HW3, and HW4 are available

- We will provide some sample code for HW3 for reading in .JNT files

Hello World!

Project Teams

- Meet with team members to start thinking about project
- Project ideas, team structure
- Start to figure out software environment
- Craig and Richard will schedule meetings with teams
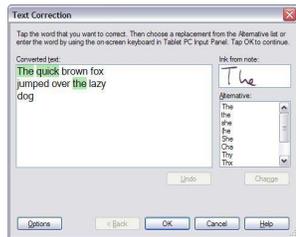- Vision presentation, January 23

Handwriting test

- Write the following phrase in journal:

  The quick brown fox jumped over the lazy dog
- Convert to text
  - Edit -> Select All
  - Actions -> Convert Handwriting to Text...
- For each word, record status
  - correct, correct?, incorrect?, incorrect

Text Entry
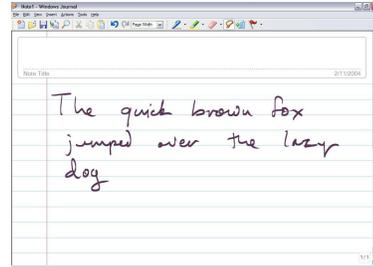
Reco

What is a Tablet PC?

- Pen-driven computer with various form-factors
  - Pure slate
  - Convertible
- It's a full PC
  - Fast processor, lots of memory, hard-drive, high-resolution graphics
  - Runs Windows applications
  - "Laptop with a pen"

Why Tablet PC?

- Desktop and laptop computing doesn't fit well with certain common situations
  - Meetings: laptops can be annoying and/or remove user from discussion
  - Relaxing (e.g. leaning back in chair, lying on couch): laptops must be on a flat surface
  - On-the-go (walking, standing waiting): laptops must remain statically positioned for use

Why Tablet PC?

- Desktop and laptop computing can feel unnatural
  - Entering information can be awkward (e.g. ASCII text into a word-processor)
  - Using the mouse – hard to master, and disconnected from the task at hand
  - Must be sitting upright when operating a computer

Why Tablet PC?

- Using a pen is natural
  - Task adapted to human physiology rather than the other way around
    - Evolved over thousands of years
  - Easy
    - Most people can do it
    - Direct interaction/input
    - "Always on"

Why Tablet PC?

- Ink is a great data type
  - Expressive
    - Text, graphics, diagrams, etc.
  - Personal
    - ASCII text is "cold" :-)
  - Free-form input
    - Write anywhere

Why Tablet PC?

- Hardware finally makes it doable
  - Small enough: 8.5" x 11", under 3 lbs, less than 1" thick, good battery life
  - Cheap enough: shouldn't cost more than a nice laptop
  - Fast enough: real-time ink, handwriting recognition
- Software is good enough
  - Handwriting recognition doesn't suck
  - "Ink as ink"

History of Pen Computing

- Sketchpad (1963)
- GRiD GRiDPad (1989)
- GO Pen Point (1991)
- Microsoft Windows for Pen Computing (1992)
- Apple Newton (1993)

Why past efforts failed

- Hardware was cumbersome
  - Units were slow and heavy
  - Screens were black and white, low resolution
- Handwriting reco was bad, but the usage paradigm needed it to be great
  - Often, ink was instantly converted to text, making bad reco obvious
- Usage paradigm was unnatural
  - Conversion to text often required
  - Little use of free-form input
  - Ink "gestures"

Why past efforts failed

- No standard software development platform
  - Low market penetration, tough business justification for 3rd parties
  - Therefore no "killer apps"
- Portable computers were niche
  - Networking wasn't common for PCs
  - Tradeoffs were significant in comparison to today (e.g. screens, upgradability, speed)

Windows XP Tablet PC Edition

- Version 1.0 released November '02
- Superset of Windows XP Professional
  - Runs all apps XP Pro can
- Culmination of many years of work
  - Ink recognition software
  - End-user studies
  - Learning from the past
- Evolution rather than revolution

Windows XP Tablet PC Edition

- The goal: the simplicity of paper combined with the power of the PC
  - "Ink as ink" / "Ink as a first-class type"
    - Data lives life as ink
    - Editable, searchable, persistable
  - Natural feel
    - Ink flows out of the pen quickly and smoothly
    - Free-form input
    - Pages of paper instead of infinite canvas

Windows XP Tablet PC Edition

- The goal: the simplicity of paper combined with the power of the PC (cont'd)
  - Using existing ("legacy") apps with the pen
    - Mouse input
    - ASCII text input

About the digitizer

- Want accurate ink: looks more "real", and has better recognition results
  - Therefore need high sampling rate with high resolution
- Must be low power consumption
  - Narrows range of technologies that can be employed
  - Electromagnetic is popular choice, but not without tradeoffs

About the digitizer

- Pen hovering capability
  - Important to connect the user interface with the pen even when it's not touching the screen
- Capture other data from pen besides x,y position
  - Pressure, tilt, rotation, roll, etc.
  - Great ink and data manipulation

About the digitizer

- Tradeoffs: sensitive to interference
  - Hard drive, CPU, battery, and other components can alter where the digitizer thinks the pen actually is
  - Calibration system (i.e. software correction) helps tremendously, but still not perfect

About the digitizer

- Only one digitizer in common use
  - Wacom digitizer
  - Exception was the TC1000
    - Contributed to TC1000's demise
    - Battery powered pens
- Tablets can use pressure sensitive digitizers
  - Ultra-mobile Tablet PC (aka Origami)

Display hardware

- User can't write directly on the LCD surface
  - Psychedelic color blooming occurs because of squishing liquid crystals; very distracting
  - Bad for the display
- Solution: glass overlay
  - Doesn't allow any "give" across the display
  - Protects the LCD

Display hardware

- Tradeoffs:
  - No "give" means it feels unnatural
  - Glass is slippery to a hard plastic pen
    - Pen skids a little, making writing and targeting a bit more difficult
  - Parallax
    - Thickness of glass causes visual disconnect from ink/cursor/etc. when pen tip touches the display
  - These will get better

Pen/stylus design

- Very personal piece of hardware!
  - People play with it, chew on it, etc.
- Should be as close to a ballpoint in size and weight as possible
  - Pocket clip is a good thing too, even if people don't use it for their pocket
- Needs rugged design
  - Most people on the tablet team have broken a pen because the design was fragile

Pen/stylus design

- Pen tip
  - Some pens have their tip act as a momentary switch so the digitizer knows when the pen is touching vs. hovering – feels strange
- Pen button
  - Very useful trigger for non-ink functionality
    - Right-button click, erasing, selection, etc.
  - Some designs are very prone to accidental clicks by users
    - Causes undesirable behavior – very frustrating!

Portrait-mode display

- Support portrait mode; just like paper
  - Great for web surfing, reading eBooks and most other document types
  - Hot-switch to landscape and back is great for convertibles
- Tradeoff: Legacy apps suffer
  - All written assuming horizontal > vertical resolution
  - Toolbars, menus, etc. can be cut off

Digital ink realism

- Ink should look smooth
  - No "jaggies" -> antialiased
  - No straight lines -> curve-fitted
- Use pen pressure information
  - Vary stroke width (more pressure means wider stroke)
- Support pen tips
  - Round/ballpoint vs. rectangular/ highlighter

Digital ink performance

- Writing requires uninterrupted inking
  - Users have difficulty with delays in ink appearance
  - Users are frustrated with delays in inking
- Guideline
  - Ensure fast efficacy
  - Is it as fast as writing on paper?

Handwriting results

	The	quick	brown	fox	jumped
Correct					
Correct?					
Incorrect?					
Incorrect					

Handwriting results

	over	the	lazy	dog
Correct				
Correct?				
Incorrect?				
Incorrect?				