CSE118: APPLICATIONS IN UBICOMP
HANDS ON DIGITAL PEN AND PAPER

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The Myth of the Paperless Office...

> For decades, people predicted the office of the future as a paperless office

“I don't know how much hard copy printed paper I'll want in this world.”
George E. Pake, heads of Xerox PARC, 1975

“The use of paper should be declining by 1980.”
Vincent E. Giuliano of Arthur D. Little, 1975

Dick Brass, vice-president of Technology Development at Microsoft Research, 2001
Integrate Paper and Digital Technologies

"Rather than pursue the ideal of the paperless office, we should work toward a future in which paper and electronic document tools work in concert and organizational processes make optimal use of both."

Digital Pen and Paper

- Developed by Anoto
- Different pen manufacturers
  - Logitech, Maxel, Nokia,
    Adapx, Livescribe ...
- Pattern space
  - 60 million km²
Anoto Pattern

![Anoto Pattern Diagram](image)
4.1 Architecture Overview

We show an overview of the PADD infrastructure’s design in Figure 3 and Figure 4. When a user prints a document, the ProofRite application contacts a printer server to determine the unique Anoto page IDs for each piece of paper on which the document will be printed. Using these IDs, ProofRite queries the PADD directory service to retrieve the PADD database managing that page ID range. Once the database managing the page ID range has been found, ProofRite establishes a link between the digital document and the printed paper by uploading a copy of the document to the file repository. After the file has been uploaded, the printout proceeds and the user may begin annotating the printout using their digital pen. Once the user synchronizes their pen with a computer, the stroke collectors will use the PADD directory services to upload the annotations made by the user to the PADD database. A client-side service then downloads a copy of the document from the PADD database and imports annotations from the PADD server, allowing the user to continue the writing process. We now present each component of the architecture in more details.

4.2 PADD Directory Service

The directory service establishes the correspondence between a printout on a given

Figure 4 The communication between PADD client and infrastructure. The client (1) contacts the local directory server to determine the appropriate PADD Database, (2) contacts the PADD Database server, and (3) uploads or downloads files from the File Repository.


http://www.cs.cornell.edu/~francois/
Paper Augmented Digital Documents

- Digital World
  - The brown fox jumps over the lazy dog.

- Paper Augmentation System
  - Printer
  - Database
  - Strokes Collector

- Paper World
  - Digital Pen
  - The brown fox jumps over the lazy dog.

Diagram showing the interaction between the digital and paper worlds through a paper augmentation system.
PaperToolkit

Paper Toolkit UI
Interactive Paper

Active Components

- Button
- Slider
- Slider2D
- DateSelector
- Browser
- MapSelector
- Rating
- Capture
- CaptureAndSpeak
- Image
- Sound
- Movie
- SQLClient
- XCMRequest
- ClientCtrlRequest
- PaperPointControl
- PaperPointAnnot
- ...
Active Components ...

```xml
<?xml version="1.0" encoding="UTF-8" ?>
<iserver>
  <activeComponent id="s1a" creator="beat">
    <name>Show slide 1</name>
    <properties>
      <parameter>
        <key>org.ximtec.iserver.ac:command</key>
        <value>showSlide</value>
      </parameter>
      <parameter>
        <key>org.ximtec.iserver.ac:slide</key>
        <value>1</value>
      </parameter>
    </properties>
  </activeComponent>
</iserver>
```

<table>
<thead>
<tr>
<th>PAPERPOINT_CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Show slide 1</td>
</tr>
<tr>
<td>command</td>
</tr>
<tr>
<td>slide</td>
</tr>
</tbody>
</table>

...
Authoring Tool
Paper-Digital Structural Mapping

- Dual document representation in digital and physical document spaces
Publishing Infrastructure
iPaper Framework

iPUBLISH

<table>
<thead>
<tr>
<th>APIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOffice</td>
</tr>
<tr>
<td>Internet Explorer 7</td>
</tr>
<tr>
<td>Firefox</td>
</tr>
<tr>
<td>Adobe PostScript 3</td>
</tr>
<tr>
<td>Structure Highlighters</td>
</tr>
</tbody>
</table>

iDOC

- Document Mapper
- Content Analysers
- publish structure and content
- Document DB
- Printing DB
- publish print data
- Printer Driver

iSERVER

- Active Content
- iPaper Plug-in
- Link DB
- (x,y) coordinates

iPAPER

- iPaper Client

Display

Print

publishing

--- interacting ---
APPLICATIONS
PaperPoint Presentation Tool

- Mobile presentation tool
- Non-linear presentations
- Paper-based real-time annotations
- Digital whiteboard
- Multi-pen support
  - brainstorming

PaperPoint Architecture

PaperPoint: A Paper-Based Presentation and Interactive Paper Prototyping Tool

Beat Signer and Moira C. Norrie
Institute for Information Systems, ETH Zurich
8092 Zurich, Switzerland

Interactive Document

iPaper Client

iSERVER
cross-media
link server

Link DB

Java/COM bridge

Active Components
PaperProof

Interactive Paper

Digital pen technologies bridge the paper-digital divide by enabling user actions on paper to be tracked. Handwritten notes and sketches can be digitally captured. Active areas on paper can be defined that link to digital content and services by simply touching them with the pen. Possibilities abound for publishing new forms of interactive documents and providing paper-based interfaces to applications.

We have developed a platform and range of tools to support the rapid prototyping and production testing of all kinds of interactive paper applications.

iPaper

Paper is a framework that supports the rapid development and deployment of interactive applications. Active areas can be defined on paper and linked to various services. By providing an extensive library of active components, users can create a wide range of applications without having to do any programming. iPaper was built on top of Jav视图, a general cross-media server, which means that active areas can be linked to a wide range of physical and digital media including web pages, images, video, databases and RFID tags as well as application programs.

iGesture

iGesture is a general and extensible framework to support the development of gesture recognition algorithms. The API makes it simple for application developers to create their own gesture-based interfaces. It is device independent and can be used with any kind of touch input device, including digital pens.

# PaperProof Gestures-based Operations

<table>
<thead>
<tr>
<th>Operation</th>
<th>Gesture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delete</td>
<td><img src="image" alt="Delete Gesture" /> or <img src="image" alt="Delete Gesture" /></td>
</tr>
<tr>
<td>Replace</td>
<td><img src="image" alt="Delete Gesture" /> or <img src="image" alt="Delete Gesture" /> + ICR</td>
</tr>
<tr>
<td>Insert</td>
<td><img src="image" alt="Insert Gesture" /> or <img src="image" alt="Insert Gesture" /> + ICR</td>
</tr>
<tr>
<td>Move</td>
<td><img src="image" alt="Move Gesture" /> + <img src="image" alt="Move Gesture" /> + <img src="image" alt="Move Gesture" /></td>
</tr>
<tr>
<td>Range Annotation</td>
<td><img src="image" alt="Range Annotation Gesture" /> + <img src="image" alt="Range Annotation Gesture" /> + ICR</td>
</tr>
<tr>
<td>Side Annotation</td>
<td><img src="image" alt="Side Annotation Gesture" /> or <img src="image" alt="Side Annotation Gesture" /> + ICR</td>
</tr>
</tbody>
</table>

ICR = Intelligent Character Recognition
PaperProof: Video
Recent advancements in word processing programs have helped make the writing process less error prone. Word processing applications such as Microsoft Word, Open Office, and AbiWord, allow users to create and change content very easily. With the aid of “print preview” users are able to see what their documents will look like when printed while they are working. The improvements in computer technology, many word processing applications provide users with a natural interface for one of the most important steps in proofreading.

EdFest Project

EdFest Documents

comedy
A NIGHT AT THE PICTURES - STEVE DAY
Rating

GSOH Comedy
Café Royal Fringe Theatre, 17 West Register Street, 0131 556 2549
Grid Ref: D5

Are you tired of comedians and their cliched routines about Rembrandt? Caravaggio? When will they do something different? It’s just another deaf comedian talking about art! ‘...revelatory...very funny’ Guardian.

www.istronground.com
Aug 15, 17, 18, 19, 20, 21, 22, 24, 25, 26, 27, 28: 20.00 (60mins) £5.00 (£4.00)

OMID DJAMILI - NO AGENDA

What’s on at...?
Where am I?

Map

What’s on at...?

EdFest 2005
Preferences
☐ comedy
☐ dance & physical theatre
☐ music
☐ theatre

Booking
☐ Start reservation
Number of tickets
1 2 3 4 5 6 7 8 9 10 11 12 13 14
☐ reserve

Suggest show...
I like ☐ best ☐ any
...from category...
dance & physical theatre
comedy ☐ music
theatre ☐ any
...starting...
today ☐ tomorrow
August 2005
1 2 3 4 5 6 7 8 9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24 25 26 27 28
29 30 31

...at...

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EdFest Architecture Overview

- **iPaper Client**
- **Client Controller**
- **Context Engine**
- **Context DB**
- **XCM content publishing platform**
- **Metadata DB**
- **Appln DB**
- **Link DB**

**Active Components**

- **Text-to-Speech Engine**
- **ICR Software handwriting recognition**

**Additional Components**

- **iServer/iPaper cross-media link server**
EdFest Demo

POOL OF LIFE

Big Value Comedy

Café Royal Fringe Theatre, 17 West Register Street, 0131 556 2549
Grid Ref: D5

Following his critically successful show of 2003, Keith Carter returns as alter-ego 'Nige'. With new characters, a show celebrating Liverpool's capital of culture. 'Nige thinks he's a superhero. In comedy terms he already is **** Evening News.

Aug 15, 17, 18, 19, 20, 21, 22, 24, 25, 26, 27, 28: 21.20 (60mins) £7.00 (£6.00)
EdFest Demo
HIPerPaper

• 31.8 foot by 7.5 foot tall wall display
• 70 tiled 30" Dell LCD displays
• 35,840 x 8,000 pixels (286,720,000 pixels total)
• 18 Dell XPS 710/720 (Intel quad-core CPUs + dual nVIDIA FX5600 GPUs)
• 1 head node and 6 streaming nodes
• A total of 100 processor cores and 38 GPUs

N. Weibel, AM Piper and JD. Hollan, HIPerPaper: Introducing Pen and Paper Interfaces for UltraScale Wall Displays, Proceedings of UIST 2010
HIPerFace: Multi-channel Multimodal interactions
HIPerPaper Video

HIPerPaper
Pen and Paper Interactions
with Ultra-scale Wall Displays

Nadir Weibel
Anne Marie Piper
James D. Hollan
HIPerPaper Demo
N. Weibel, LG. Cowan, LR. Pina, WG. Griswold and JD. Hollan, Enabling Social Interactions through Real-Time Sketch-Based Communication, Proceedings of UIST 2010
UbiSketch: Video

UbiSketch

A ubiquitous real-time sketch-based communication system

Nadir Weibel, Lisa G. Cowan, Laura R. Pina, James D. Hollan, William G. Griswold
UbiSketch Demo