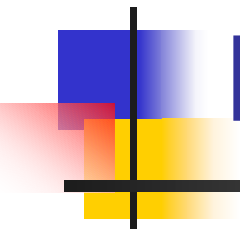


Paper as Input Mechanism

Isaac Mativo & Cassie Thomas

CMSC 828G

Structure-Taxonomy

- User Orientation
  - -Social Purposes
  - -Specific Application driven
- Technological Orientation
  - -Kind of paper used
  - -input devices
  - -portability

User Orientation – Social Purposes

- Mining Community from the print stream
  (Antonietta Grasso)
  - Gather information from printed material then
    do analysis based on the content
- Linking multimedia meeting documents by image matching(Patrick Chiu, Jonathan Foote, et. Al)
- - Capturing meeting proceedings to create
    a multimedia record of the meeting
- paper as glue(Mike Fraser, Danaë Stanton)- using.....coherent visiting experiences
- Palette(Les Nelson, Satoshi Ichimura, et al): A paper interface for giving presentations
  -using index cards to give/manipulate a
  presentation

Mining community from the print stream

- Uses observation of print activity to provide recommendations and notifications of other relevant activities in the same community
- Hypothesis:
  - Printed material have a level of importance
  - Could be important to other members in the group
  - Important to know and have opinions of others printing the same document

Mining community from the print stream (cont)

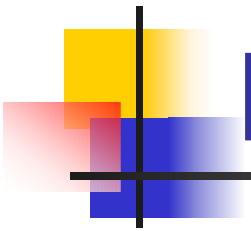
Uses a SmartPrinter that can

- Can be enabled or disabled
- Keeps a PDF version of documents in the users' personal print memory

Benefits

- Indexing to provide full text search and retrieval
- Sharing within a workgroup
- Retrieval of related documents (friends)
- Recognition of multiple versions of same document (twins), hence versioning, hence alert to owners of previous versions.
- Monitor shifts in individual and group interests

Mining community from the print stream (cont)



Mining the print steam:

- Compute document to document distance (document similarity)
- Provide twins and friends together with the printed copy on the SmartCover

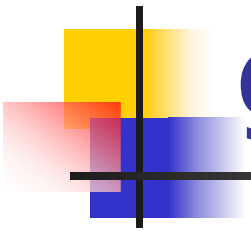
Cons:

- Output media only
- Privacy concerns

Linking multimedia meeting documents by image matching

- Problem: Browsing and review meeting recordings
- Solution: Making a hypermedia meeting record from multimedia meeting documents by image matching
- Hypermedia meeting record consists of
  - Table of contents page
  - Links to the set of handouts given in a meeting
- Multipath links may be used for revisited slides.
- Problems:
  - Does not use paper interface for playing back the video recording (could use Xerox Glyph technology)
  - Involves scanning paper to an electronic form

Palette: A paper interface for giving presentations



- Presenters use this to control electronic media
- Eliminates the need for the manipulation of slides on a pc.
- Index cards are used
- Code reader reads the cards

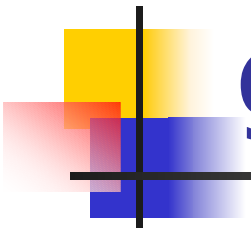
Palette (cont)

- Slides are created using a presentation application i.e. Powerpoint
- The index cards are then created from the presentation
- These cards contain a thumbnail view of the slide, notes, and a code(I.e. dataglyph or barcode)

Palette (cont)

- The index cards contains the file and slide information.
- The presenter can slide the index card under the code reader
- This allows for the reader to have the cards in hand or spread them out.
- Presentation can be organized ‘on the fly’ if necessary

Palette: addresses how people give presentations



- Slide initialization
- Slide manipulation and overview
- Slide re-ordering
- Presenter mobility
- Audience vs presenter views of the material
- Use of hands
- Sharing material

Critique-Paper Palette

- Pros-
  -Spatial representation
  -adhoc presenting

- Cons
  -Preparing the cards (use of Palette converter, card scanner)
  -can not directly annotate
  -no reuse

User Orientation- Specific applications

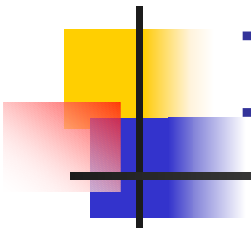
- Video mosaic(Wendy Mackay)
- Insight lab(Beth M. Lange, Mark A. Jones, James L. Meyers)
- Physical paper as a user interface for architectural design(Dzmitry Aliakseyeu, Jean-Bernard Martens)
- Missing Link (A-book)(Wendy Mackay)

Video Mosaic

- It is an attempt to combine the power of paper video storyboards with the full capabilities of video editing software
- Connects paper-based storyboard elements, digital elements and video clips through the use of cameras, scanners and barcodes (or Glyphs)
- Elements of a paper video storyboard are used as input to an online video editing system to take advantage of the best aspects of each (electronic and paper forms)

Insight Lab: Linking Paper Displays and Data

- Objective: To facilitate the data analysis process through seamless interaction for computer-based technologies with objects in the environment.
- Useful for teams that create design requirement documents with numerous considerations to make
- The lab consists of numerous display devices and writing surfaces, and the use of barcodes to link paper, displays and data.
- Interaction with paper is enabled by a barcode reader, a custom designed barcode command slate, and barcode enabled paper forms



Insight Lab: Problems

- Used only by people who designed it
- Uses many input and output devices
- Must have computers to see results
- Need to have barcode scanners, etc

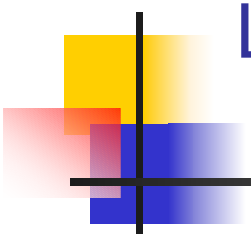
Physical Paper: Interface for an architectural design

- Involves use of camera to track infrared reflecting tags on paper
- Physical paper placed on digital drawing board
- Virtual paper projected to the drawing board with relevant data from a data base
- Electronic paper used to do sketching
  - Sketches traced into computer then projected to the paper

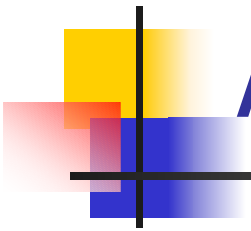
Physical Paper: Problems

- No editing function implemented
- Not portable
- Pen does not leave trace on the physical paper
- Need camera

A-Book -The Missing Link: Augmenting Biology Laboratory Notebooks



- Provide missing link between physical and on-line information.
- Setting: Research biologists lab
- Must solve these problems:
  - Capturing user information e.g. hand-writing
  - Displaying information in response to command
  - Managing the link between physical and on-line data



A-Book

- Uses a graphics tablet connected to the host computer to capture handwriting
- A-book consists of
  - An inking pen (for writing on paper)
  - Non-inking pen (interacting with the interaction lens)
  - 4-D lens for tracking the position of the interaction lens
- Introduces a physical interaction lens that lets users
  - Highlight, link and annotate information
  - Track physical objects, such as tagged animals or lab specimens

Technological Orientation-Kind of paper used

- Ordinary paper-

  Paper PDA (Jeremy Heiner)

  XAX(Walter Johnson)

- Special Paper

  *anoto, intelligent paper(Marc Dymetman)

  *paper as glue(tagged paper)

Paper as Glue

- Paper clues can support people in making different connections between displays, locations, and historical events.
- Combines visual and electronic record on single paper
- Uses electronically tagged paper to
  1. Keep history record of visiting experience
  2. Provide information, e.g. maps, clues, etc.
- Can write on paper too
- Problems
  - Special kind of paper, displays needed

Paper PDA

- Conventional paper notebook which has electronic capabilities
- Users can carry around a notebook and write on it with an ordinary pen
- The marks made in the notebook, can then used in the digital world.

Paper PDA-how does it work?

- Paper in the notebook has two registration marks
- Uniquely identifiable
- Page identifiers can be machine readable or textual
- OCR recovers the textual

How does it work (cont)

- Operates in disconnected fashion
- Once marks are made, periodic synching is done
- Synchs with a networked computer

Paper PDA - Capability

- Location and decoding of registration marks
- Paper widget specification and processing –a printed affordance to the user where info can be entered or edited

Figure 2. Example Registration Marks and Corresponding Radial Profiles

Paper PDA- Critique

- Pros
  - -ordinary paper specially tagged
  - -uses office supplies to (synch)
  - -use of a notebook (pages moved around)
- Cons
  - -rely on hardware (time)
  - -rearrangment is manual

Intelligent Paper

- Standard paper covered with marks
- Visible to the pointer but not to human
- Marks contain certain information

  -page id

  -location

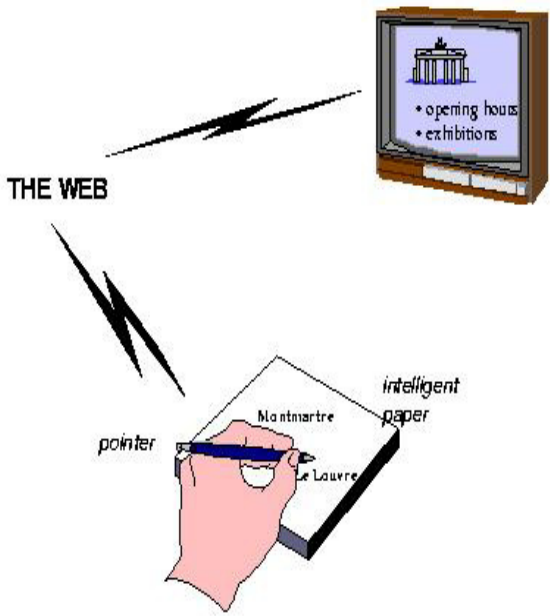
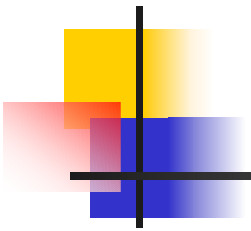


Fig. 1. Intelligent Paper.

Intelligent Paper made of 3 elements

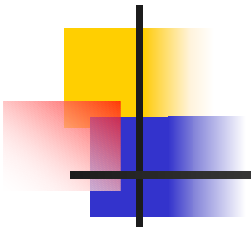


- Support- each sheet has a *page-id* which makes it unique
- Input Device- pointer (*page_loc*)
- Communication infrastructure – both *page-id & page_loc* are sent over the web

Actions that can be carried out

- Triggering output actions
- Using the pointer as a mouse
- Selecting content
- annotating

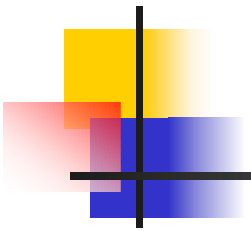
How is intelligent paper different?



- Screen-mouse relationship is emulated with the paper-pointer
- Physical page is tightly coupled to its digital page (unique page id)
- Absolute Device

Technology behind Intelligent Paper

- Two layers of ink are printed on the paper.
- The first layer is the code layer
- Second layer is typical ink which the user can see.
- Can have so ink is visible (code layer)



Page Identification

- Use of a router to do a mapping between page-id and the URL of the digital page.(first indirection)
- Then depending on where the users points and clicks(pointer-loc) will determine how the information will be outputted (second indirection)

Anoto

- Anoto paper has displaced grid structure, small dots with Anoto pattern.
- Anoto Pen-write on the paper with
- The pen creates a digital trace as you write
- Information is stored in the pen until appropriate checkbox is clicked

Anoto

- When the check box is clicked info goes to one of two places:
  - -PC
  - -bluetooth device

Critique –intelligent paper and Anoto

- Pros

  -visible ink vs. invisible ink(intelligent paper)

  -Both are absolute devices

  -Different applications- maps, encyclopedias, etc for intelligent and Anoto global communications(fax) , analog output, and e-services

  -Dataglyph vs. Anoto pattern

  -portable

- Cons

  -Have to use proprietary paper

  -special pen

  -has to be synched with computer

Technological Orientation- input devices

- Pens with camera attached or cameras e.g. video mosaic(Mackay) and paperlink(Toshifumi)
- Scanners/barcode readers – XAX(Johnson) and Paper Palette(Les Nelson)

Paperlink:A technique for hyperlinking from real paper to electronic content

- Two primary capabilities

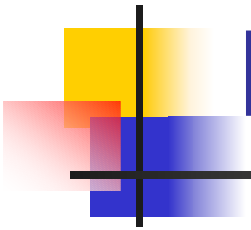
  -marks on paper are associated to electronic content or given meaning

  -words on paper can be used as input

Paperlink: the video Pen

- A retractable highlighter pen
- Miniature video camera and tip switch
- Properties of the marks can be recorded and associated with electronic content
- Which creates a hyperlink

Paperlink: hyperlinking



- The information that is associated can be retrieved and displayed
- Any data not recognized as a hyperlink is given to the OCR to pull out the text.
- It can be used as a parameter to a command or used as input

Paperlink: Interaction

- When the pen captures an image it is either input or it is a hyperlink
- The images are placed into a buffer
- When a command is encountered the contents in the buffer become the parameters to that command.

Paperlink-Critique

- Pro

  -can use ordinary paper, don’t have to buy special paper
- Can operate on actual contents of the paper

Paperlink-Critique

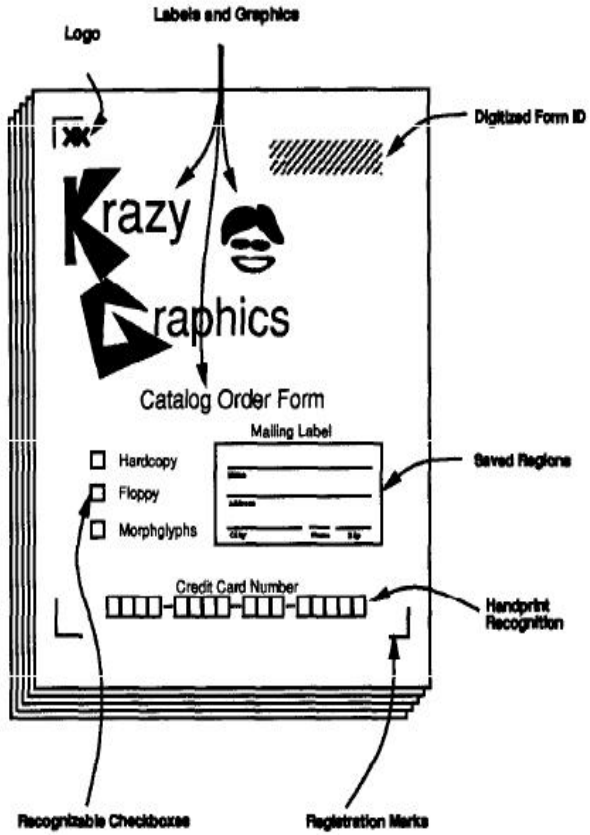
- Can’t make use of document context
- A relative device
- Need to use a special input device to get information from the paper.
- Hard to know what is happening in the larger area (desktop)

XAX-The Paper User Interface

- Retrives documents written or printed on a paper form and Faxed to/from a server.
- Conventional office equipment used in conjunction with pencil & paper.

XAX-Form

- Piece of paper with machine readable marks
- Markable areas for a human
- Human readable marks


Logo
Labels and Graphics
Digitized Form ID
Krazy
Graphics
Catalog Order Form
Mailing Label
Hardcopy
Floppy
Morphglyphs
Saved Regions
Credit Card Number
Handprint Recognition
Recognizable Checkboxes
Registration Marks

XAX- Server

- Documents arrive from scanner or fax
- XAX must interpret them
- Server looks for “glyph” information to determine identity, locates what actions need to be carried out, process the image, clipped regions, and checkboxes.
- Information is passed along

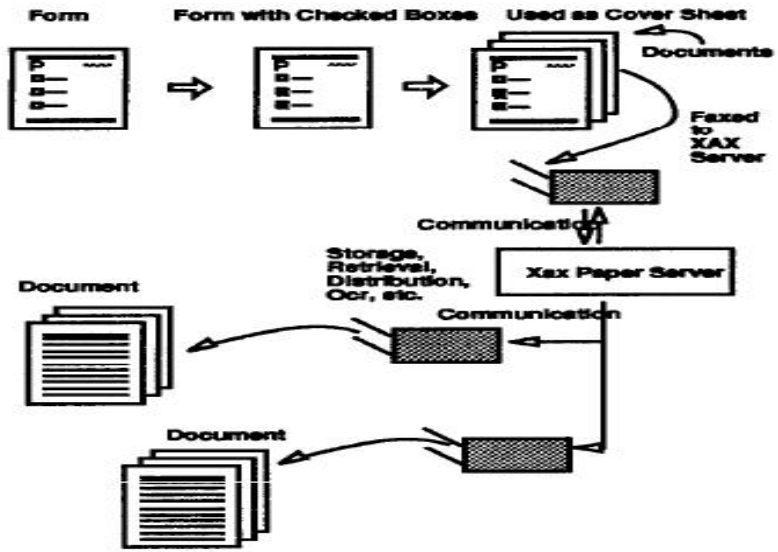


Figure 4: Using Cover Sheets.

Critique – XAX (paper interface)

- Pro

  -uses conventional office tools

  -ordinary pencil and paper

- Con

  -not interactive with the use of scanner/fax

Questions/Discussion

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