Digital Shopping Assistance

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22.11.2007
Introduction

- How do we normally buy products?
- Are there any kind of disadvantages in the buying process?
- How to make Shopping more convenient & efficient?
- Is there anything in the buying-process, which could be enhanced with Digital Information Systems?
Digital Shopping Assistance

- Four examples how digital systems can help the customer in the buying process
  - *IntelliShopper*: Shopping Assistant for E-Commerce.
  - *MyGROCER*: Shopping Assistant considering different human-living environment.
  - *PromoPad*: Tablet PC + Camera for Augmented Reality.
IntelliShopper

- **Personal Assistant for buying products on the Internet (E-Commerce)**
  - Agent based system
  - *Personal*: Observes the user while shopping ⇒ Learns from users behaviour
  - *Proactive*: Remembers the user’s requests and autonomously monitors vendor sites for new items
  - *Privacy*: Protects user by pseudo-identities
IntelliShopper: Architecture

- The user contacts privacy agent on the anonymizing server
- The privacy agent creates a *Shopping Persona*, which is the “public user”
  - Hides user information (e.g. name, IP-address)
- All user requests are forwarded by the persona to a learning agent on the IntelliShopper server
The learning agent
- takes the requests
- saves the requests on the database
- forwards them to the vendor modules
- retrieves the resulting hits from the local database
- displays the results back to the user
- observes the user’s behaviour
Learning Example

Before user click

<table>
<thead>
<tr>
<th>Feature</th>
<th>low</th>
<th>avg</th>
<th>high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>3.25</td>
<td>1.25</td>
<td>2.75</td>
</tr>
<tr>
<td>Bids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

After user click

<table>
<thead>
<tr>
<th>Feature</th>
<th>low</th>
<th>avg</th>
<th>high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>3.25</td>
<td>1.00</td>
<td>3.00</td>
</tr>
<tr>
<td>Bids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lavazza Oro 500g vacuum-packed $9.05 4 bids 2 days
Illy Caffe' - imported from Italy $19.95 9 bids 5 min
Folgers American Coffee $6.50 6 bids 8 hrs
The vendor modules are responsible for the interaction with the vendors Web sites

- 1 vendor module is assigned to 1 vendor
- Submitting queries
- Parsing results

The monitor agent makes this architectural approach proactive

- Background process, which periodically queries the database for requests not expired or removed
**Digital Shopping Assistants**

**Key Differences**

- IntelliShopper
- MyGROCER
- Mobile ShopAssist
- PromoPad

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**IntelliShopper GUI**

![IntelliShopper GUI](image)

**Figure: 1. Query-Interface**

**Figure: 2. Results of search**

<table>
<thead>
<tr>
<th>Description</th>
<th>No of Bids</th>
<th>Price</th>
<th>Time remaining</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simpsons Season 1 Collector Edition - DVD 3 Discs</td>
<td>0</td>
<td>$84.95</td>
<td>2 days, 15:08:19</td>
<td>Buy</td>
</tr>
<tr>
<td>SIMPSONS COMPLETE 1ST SEASON DVD (3 Disks)</td>
<td>-</td>
<td>$9.99</td>
<td>10 days 1 hr</td>
<td>Buy</td>
</tr>
<tr>
<td>The Simpsons Season 1 DVD Brand New Sealed</td>
<td>14</td>
<td>$27.00</td>
<td>2 days 21 hrs</td>
<td>Buy</td>
</tr>
<tr>
<td>The Simpsons Season One DVD Set</td>
<td>1</td>
<td>$25.00</td>
<td>6 days</td>
<td>Buy</td>
</tr>
<tr>
<td>NEW THE SIMPSONS SEASON 1 ONE DVD 3 DISC SET</td>
<td>6</td>
<td>$15.50</td>
<td>Oct-27 23:45</td>
<td>Buy</td>
</tr>
<tr>
<td>The Simpsons Season One Box Set – DVD</td>
<td>8</td>
<td>$19.50</td>
<td>Oct-29 12:16</td>
<td>Buy</td>
</tr>
<tr>
<td>SIMPSONS COMPLETE 1ST SEASON DVD new&amp;sealed</td>
<td>10</td>
<td>$21.00</td>
<td>Oct-29 08:38</td>
<td>Buy</td>
</tr>
<tr>
<td>THE SIMPSONS 1st Season 3 DVD SET NEW!</td>
<td>9</td>
<td>$20.50</td>
<td>Oct-27 18:12</td>
<td>Buy</td>
</tr>
<tr>
<td>SIMPSONS EPISODES ON VCD/DVD!! WOOHOOO!!!</td>
<td>8</td>
<td>$15.50</td>
<td>Oct-27 13:36</td>
<td>Buy</td>
</tr>
<tr>
<td>Simpsons Season 1 on DVD Very Nice, Sealed</td>
<td>2</td>
<td>$11.00</td>
<td>Nov-02 20:59</td>
<td>Buy</td>
</tr>
<tr>
<td>&quot;NEW DVD&quot;-Simpsons 1st Season &quot;Free Shipping&quot;</td>
<td>2</td>
<td>$20.50</td>
<td>Oct-26 10:59</td>
<td>Buy</td>
</tr>
<tr>
<td>Simpsons Season 1 Coll. Ed. DVD 3 Disks</td>
<td>0</td>
<td>$84.95</td>
<td>07:50:55</td>
<td>Buy</td>
</tr>
<tr>
<td>Simpsons Season 12 Complete DVD 21 episodes</td>
<td>8</td>
<td>$30.00</td>
<td>Oct-30 15:15</td>
<td>Buy</td>
</tr>
<tr>
<td>THE SIMPSONS Complete First Season 3 DVD SET</td>
<td>-</td>
<td>$25.99</td>
<td>Oct-31 12:12</td>
<td>Buy</td>
</tr>
</tbody>
</table>
Existing Challenges

- Parsing of results is not easy
  - Vendor modules are written by hand
- Purchasing not taken into account
  - A transaction service could be used (e.g. PayPal)
MyGROKER

- Using a mobile/PDA for shopping
- Interaction takes place in three different scenarios
  - In-Store
  - Smart-Home
  - On-the-Move
MyGROCER: In-Store

- Logging in MyGROCER with PDA via Bluetooth (shopping cart device)
- System identifies the user and displays shopping list.
- The RF-Reader on the cart recognise when products with RFID-Tags are placed in.
- Promotion based on previous buying behaviour or cross-selling.
- Direct electronic payment possible
- Shopping list information is stored in the system for future shopping activities.
MyGROCER: General In-Store Infrastructure
**MyGROCER: Smart-Home**

- RF-Id readers are placed at key-storing location (e.g. larder)
  - Register each individual product and update inventory in regular intervals.
  - If products are removed and not reinstated, MyGROCER will be informed over the Internet (shopping list will be automatically updated).
    - PC or set-top-box is needed
MyGROCER: Smart-Home Infrastructure

Diagram showing the connection between RF-Readers, a Hub, Home PC or Set-Top Box, Internet, and a Retailer's Server.
MyGROCIER: On-the-Move

- Consumers have access to shopping list through internet capable devices (Mobile, PDA).
  - Shopping list can be changed by user
  - Information how much products on shopping list will cost
- Home delivery is possible
- Product recommendation based on:
  - User profile (e.g. user is vegetarian or diabetic)
  - past buying behaviour
Can anyone free me ?!?
Mobile ShopAssist

- Comparable with the In-Store environment in MyGROCER
- Emphasize on interaction with the (shopping) environment in three different ways (or modalities)
  - Verbal communication
  - Interaction by handwriting (on the PDA/mobiles)
  - Interaction through Gestures (e.g. in real world or on PDA/mobiles)
- Better adapted to human communication capabilities
Mobile ShopAssist: In Use

1. Customer walks up to a shelf
2. Synchronizes PDA with shelf
3. Asks a product about its properties

(1) O: "Hi, there. I'm the new camera from Canon with 7 mega pixels."
(2) U: "What is your price?"
(3) O: "My price is €599."
Mobile ShopAssist: Infrastructure

- Infrared beacon for synchronisation
- Each container has a RFID antenna & reader
- Optical markers on products
- Projector and loudspeaker are used for (verbal- & external gesture-) output
- Trolley-Display shows contained products
  - Cross-Selling is used
- PDA is used for handwriting & internal
Mobile ShopAssist: Distributed Architecture

- Ambient Intelligence Server (AIS) maintains product database
- AIS handles external gesture events (shelf)
- PDA handles all modalities (maintains its own list of events)
- Trolley receive product-information (for cross-selling)
## Mobile ShopAssist: Symmetric Multimodality

<table>
<thead>
<tr>
<th>User Input</th>
<th>System Output</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Speech:</strong></td>
<td>What is your price?</td>
</tr>
<tr>
<td><strong>Handwriting:</strong></td>
<td>PowerShot S1 IS Optical Zoom</td>
</tr>
<tr>
<td><strong>Intra Gesture:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Extra Gesture:</strong></td>
<td>pick_up, and put_down</td>
</tr>
</tbody>
</table>
Mobile ShopAssist: Symmetric Multimodality

- The modalities can be unimodal or multimodal.
- During input and output respectively, the modalities can overlap.
- Symmetric: All modalities for input can be also used for output.
- Overlapping modalities make the system more robust.

**use-case dialog**

Question: “Compare this camera `<intra_gesture_input>` with this one `<intra_gesture_input>`”.

Answer: “This camera `<intra_gesture_output>` has a more Mega-Pixel than this one `<intra_gesture_output>`”. 
PromoPad: **Augmented Reality**
PromoPad: *Augmented Reality*

- Augmented Reality: Enriching the *real* world with contextual information
  - 2D- or 3D-information fit in real scenes taken by camera
  - Military very much interested in it

- PromoPad is a physical shopping assistant
  - hand-held prototype device

- Enhances human perception by giving information about products encountered in real store
  - Context sensitive
PromoPad: General Architecture

- Front-End Client: Tablet PC with Camera attached to its back
  - Aware of position and orientation of Shopper
  - Provides see-through view of the shelves & related additional information
  - WLAN enabled

- Back-End Server: One or more Server containing
  - Inventory databases
  - Customer profiles
  - Sends Information to PromoPad, if needed.
No RFID is used!

Instead "fiducial-markers" in the environment are used.

- Fiducial-markers give information about position & orientation of customer/camera.
- Needed for higher accuracy of recognising objects.
- (No detailed description of object-recognition in research-paper)
PromoPad: Foreground & Background Information

- 2D- or 3D-information can be placed in fore- or background.
- Foreground:
  - Information is put on screen without considering many spatial coordinates of the real world.
  - Only position of the centered product is taken into account.
  - Information may be positioned around that product.
- Background: Spatial coordinates of the real world are taken into account.
  - Information or virtual 3D-objects are put spatially correct on the displayed image.
  - Real Objects can be occluded by virtual Objects (& vice versa).
- Displaying information in the background is more difficult.
PromoPad considers three different types of Shoppers.

**Planned Shoppers**
- Know what they want to buy
- PromoPad can optimise their shopping routes (buying products quickly)

**Bargain Shoppers**
- Want to buy discount products
- PromoPad can lead them to these products

**Recreational Shoppers**
- Have no clue what exactly they want to buy
- They browse in the shop around
- PromoPad can give them
  - additional Information not written on the packaging
  - make promotion for related products (Cross-Selling)
Context-Awareness & Information

- Context-aware computing provides context-information relative to space & time.
- Relation of location, user & product is taken into account.
- Location-context: *Where* in the store & looking at *what*
- User-context:
  - Consumer-profile: buying history, demographics etc.
  - PromoPad learns consumer’s shopping pattern & brand/product preference
  - Provides information based on profile
- Product-context:
  - Functional complementary products: Related products for specific operation
  - Sociocultural complementary products: Products related through sociocultural context
### Table 1 Product complementarity examples

<table>
<thead>
<tr>
<th>Focal Products</th>
<th>Functional Complementarity</th>
<th>Sociocultural Complementarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital camera</td>
<td>Photo papers, memory card, printer for digital camera, picture-editing software</td>
<td>Vacation package, plane ticket, ball park tickets</td>
</tr>
<tr>
<td>PDA</td>
<td>PDA keyboard, PDA software, Wireless Internet access, memory</td>
<td>Tie, pen, cell phone, laser pointer pen</td>
</tr>
<tr>
<td>Perfume</td>
<td>Body wash, deodorant, antiperspirant</td>
<td>Jewelry, candles</td>
</tr>
<tr>
<td>Pen</td>
<td>Notebook, highlighter, pencil jar</td>
<td>Hair tie</td>
</tr>
<tr>
<td>Candy bar</td>
<td>Soda, popcorns, ice cream</td>
<td>Ball park tickets, Big ‘n’ Tall clothes or shoes</td>
</tr>
<tr>
<td>Wine</td>
<td>Wine stand, cork screw, glasses</td>
<td>Crystal container, romantic dinner, travel package to winery</td>
</tr>
<tr>
<td>Detergent</td>
<td>Fabric softener, stain remover</td>
<td>Glass cleanser, floor cleaner</td>
</tr>
</tbody>
</table>
**Key Differences**

**IntelliShopper:** Only assistant taking privacy into account

**MyGROCER:** Can be used “almost“ everywhere

**Mobile ShopAssist:** Most sophisticated HCI

**PromoPad:** Makes use of human-vision
  - Greatest part of brain responsible for visual computation.
THE END

Thank you for your attention!