Bridging the Digital Accessibility Gap through MAISON Services

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Need

• According to American Foundation for the Blind (AFB), the current rate of unemployment for people who are legally blind is around 70%.

• There is impending need to improve participation to education by teachers, librarians, and students who are blind.

Solution

We are developing MAISON (Middleware for Accessible Information Spaces on NSDL) to enhance the accessibility of
• NSDL’s internal and external resources,
• existing NSDL services (such as science literacy maps), and
• NSDL community tools (such as blogs, wiki, and RSS newsfeeds).
Accessibility Challenges

Most of the web interfaces are primarily designed for people with sight, with visually rich features that make effective use of these tools, but almost impossible for users who are blind or visually impaired to use these.
Example: Science Literacy Maps (StrandMaps)

• Concept maps and other graph structured information spaces are very effective in representing relationships and order dependencies among information units to individuals with sight.

• But for visually impaired users who cannot rely on graphical and mouse driven maps, these pose impossible challenges.
Our Contributions

• Providing accessibility to complex information spaces, where navigation towards a target requires constantly contemplating answers to questions of the form “which of the available links should I follow?” and “what is beyond this link?”

• Goal is to provide open services to enable accessible education tool design.
Presentation Outline

• MAISON CSIP-A services (and demo)
• User study results and feedback
• Personalization, and Navigation History (and demo)
• Resource link preview service (and demo)
How to Render StrandMaps Accessible
MAISON CSIP-Accessible Architecture (CSIP-A)

MAISON uses the existing CSIP API to query and access StrandMaps and adapt them based on user provided context and adaptation strategies.
CSIP-Accessible (CSIP-A) interface

• Our CSIP-Accessible (CSIP-A) interface takes various content adaptation options that are used for adapting the CSIP strand map results based on the user’s preferences.
  
  — **Grade/topics focus**: This tells the MAISON middleware whether the adaptation should be grade- (or row-) centric or topic- (or column-) centric.
  
  — **Clustering**: If this option is yes, related benchmark nodes of the strand map maybe clustered together to reduce the number of nodes to be presented and the links that has to be followed by the user who is blind.
  
  — **Link preview**: This link previews are annotations for helping the user who is blind to decide whether to follow a forward or backward link.
MAISON Link Previews

- **Content of the next node option** provides the text of the next benchmark;

- **Upcoming Key concepts option** identifies and annotates each edge on the resulting strand map with concepts that are dominant in upcoming (one or more) benchmarks

- **Summary of the upcoming nodes option** extracts a textual summary of the upcoming (one or more) benchmarks;

<table>
<thead>
<tr>
<th>Current grade level: grades K-2</th>
<th>View history</th>
<th>Go BACK to the search page</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Benchmark is on topics &quot;rates of change&quot; and its description is: Some changes are so slow or so fast that they are hard to see.</td>
<td>View Related External Resources</td>
<td></td>
</tr>
</tbody>
</table>
Example: Upcoming Concepts

- **SMS-BMK-0133**
  - moons, planets, artificial satellites, flat rings, geologic

- **SMS-BMK-0664**
  - motion, rest, object, respect, point

- **SMS-BMK-0129**
  - orbit, earth, moon, planets, sun

- **SMS-BMK-1908**
  - chunks, sun, orbit, rock, particles,
Leveraging Context

Two context-based preview adaptation techniques are introduced for more effective preview generation:

– In **benchmark-adjusted concept weighting**, each benchmark is associated with a context score and the concepts extracted from that benchmark are given more or less weight based on this context score.

– In **decay-adjusted concept weighting**, the decay factor itself is decided based on the contextual scores of the benchmark.
Complexity Reduction through Strand-based Benchmark Clustering
Complexity Reduction through Grade-based Benchmark Clustering

Grade-based Clustering

Summary for Benchmarks in Grade3

Summary for Benchmarks in Grade2

Summary for Benchmarks in Grade1
Personalization and Usage History

• Helping users find a benchmark is only half of the story.

• In order to help them leverage relevant pathways along the StrandMap, we need to provide quick reference to
  – past navigation and usage history,
  – bookmarked benchmarks,
  – bookmarked pathways or StrandMap fragments (or personalized StrandMaps)
Navigation History without Login
Navigation History with Login

One more window, which summarizes each series of navigation history and presents by order of date.

Same as anonymous history.
MAISON StrandMap Interface

• Available at
  – [http://maison.asu.edu](http://maison.asu.edu)
User Study Results

• User studies with both sighted users and users who are blind (approved and supervised by IRB at ASU)
• **Study 1:** user study with 10 users with sight
• **Study 2:** We report results only for those users without sight that completed all tasks and only relying on JAWS screen reader; there were 4 such users
• Tests were double randomized, both the order of tests and the order of results links.
## Study 1: Users with Sight

<table>
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<tr>
<th>LINK COUNT</th>
<th>SP</th>
<th>KUC</th>
<th>KU</th>
<th>TIME</th>
<th>SP</th>
<th>KUC</th>
<th>KU</th>
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<tbody>
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<td>63.8</td>
<td>65.9</td>
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</tbody>
</table>

SP – Simple preview (Content of the node)
KUC – Key Upcoming Concepts with context
KU - Key Upcoming Concepts
Link count – no. of links clicked to reach target page
Time – time taken to reach target page in seconds
## Study 2: Users who are blind

<table>
<thead>
<tr>
<th>Users</th>
<th>Time</th>
<th>KUC</th>
<th>KU</th>
<th>Keystroke</th>
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<th>KUC</th>
<th>KU</th>
<th>Link</th>
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<td><strong>5.5</strong></td>
<td><strong>13.25</strong></td>
<td><strong>5</strong></td>
<td></td>
</tr>
</tbody>
</table>

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KUC – Key Upcoming Concepts with context  
KU - Key Upcoming Concepts  
Link count – no. of links clicked to reach target page  
Time – time taken to reach target page in seconds  
Keystrokes – no. of keystrokes pressed
Sample User Comments

• “….faster to hear keywords then sentences”
• “..lot quicker than say amazon.com..”
• “… its easier, more description...”

• “ don’t give entire content on the link, because some users skip links and read the text..”
How About Other Internal and External Resources

• Link Previews
  – Annotates the (selected) links with preview keywords
  – Enables user to know what the education resource (webpage, PDF, powerpoints, blog) is about in a given context without accessing (clicking, reading, coming back to old page) the resource.
  – Firefox plugin prototype is ready, IE plugin is in development, backend services are in alpha.
Link Preview Annotation Backend (MAISON 2.0)

Request (URL) → Maison Web Service

Maison Web Service

Converter to parse text data

URL

Text

Text Summarization Module → Summary

Keyword Extraction Module → Keywords

Cache

Response (keywords)
Link Preview Annotation Demo

• Let’s give it a try

– http://www.ucar.edu/news/features/climatechange/faqs.jsp
Thank You!

• Questions, comments and feedback, you can email to:
  • Candan@asu.edu (MAISON Principal Investigator)
  • Toufeeq@asu.edu (me)