

Library and the Internet of Things (IOT)

UNC Charlotte

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Libraries are charged with meeting a variety of patron information needs on a daily basis. Given the advent of the Internet of Things (IoT), the Technologies and Digital Strategies Team at UNC Charlotte began thinking about how IoT devices might be leveraged to meet known accessibility needs. We were quickly able to adapt the idea to custom in-house applications but wondered how this technology could be applied to a broader set of tools used by libraries, museums, and archives. Searching through an online index of content held for patron use can be daunting for patrons unable to use the keyboard, mouse, and monitor. Through the LYRASIS Catalyst Fund, we were able to focus on IoT devices and their capability to integrate with the Ex Libris Primo interface for known item searching. The goals of the project were outlined as follows:

- Develop integration using API's
- Test integration in a lab setting.
- Deploy IoT devices within the Library building.
- Perform a usability study to determine if this deployment is satisfactory to users (e.g., can it recognize multiple voice patterns, is it easy to use, do patrons get the output they need, etc.).
Adjust the integration to improve usability.
- Make available any software products created with Catalyst Funds on a royalty-free basis according to the terms of an open source license and in an open source repository, such as GitHub.
- Share results with community via Coalition for Networked Information Presentation

ACCOMPLISHMENTS

- Tested multiple IoT device platforms and the maturity of their development interface(s).
- Concluded the Amazon Alexa interface provided most flexibility and was improving at a faster rate including visual development (requires less coding experience and will be more accessible to organizations).
- Tested off the shelf and custom built IoT solutions to leverage selected vendor platform.
Note: some applications will require custom built solutions to leverage organizational authentication and authorization systems (e.g. Blackboard contactless card interface).
- Successfully created voice-enabled action (Amazon Echo) to perform known-item searching within the library online catalog (Ex Libris Primo) and allow for the item to be reserved (pulled for the patron and available at the circulation desk).
- Modified code created to work on video enabled device (Amazon Echo Show) to provide a universal access interface benefitting all patrons (including those with accessibility needs). One benefit is the ability to return the cover image and bibliographic details on the same device.

PROCESS

1. Explored multiple IoT platforms including Apple HomePod, Google Home, and Amazon Echo Dot, Echo, and Echo Show. As a part of the evaluation, we evaluated the hardware, development platform, ease of integration, and the evolution of the product platform.
2. After evaluating products in a lab environment, the decision was made that the Amazon Alexa platform offered the most options and was evolving at a significantly faster pace.
3. We quickly developed a proto-type connecting to a non-proprietary system that allowed for the quick development of Amazon Alexa actions to test within the library environment.
4. Upon deploying the prototype and conducting usability, we learned several key pieces of information that directed the remainder of our development efforts:
 - The sound from the device(s) can be distracting to other areas/patrons within the library.
 - Patrons will need training or a visual cue card by the device(s) to guide initial interaction via voice.
 - The Alexa returned responses need to be precise to avoid confusion and allow for smooth interactions/transactions.
5. The issue of sound was mitigated by installation of the devices in specific spaces or by using a Holosonic speaker to direct sound to a precise spot.
6. Creation of a transcript provided not only the action word for Alexa but also an example of how a patron can interact with the known-item search action (**Atkins Search**). The transcript of a typical interaction follows:
 - User: Alexa, use **Atkins Search**

- Alexa: "What book are you looking for within the J. Murrey Atkins Library? For example:
Say: Search for Harry Potter."
 - User: "Search for Harry Potter"
 - Alexa: "I found Harry Potter. It is located on the Second Floor. Would you like to place it on hold?" (OR if unavailable: "I found Harry Potter. It is normally located on the Second Floor, but it is currently unavailable.")
 - User: "Yes"
 - Alexa: What is your campus ID number? You can find this on the bottom right of your ID card. Please say your ID digit by digit. For example, 8 0 0 1 2 3 4 5 6
 - User: 8 0 0 1 2 3 4 5 6
 - Alexa: Your hold has been placed. You will receive an email when your item is available for pickup on the hold shelf. Thank you for using Atkins Library.
7. The evolution of the Amazon devices allowed for additional work to be completed during the grant period. We were able to move from thinking about accessibility to universal access. The Amazon Show allows for the device to interact with patrons that may be limited to voice interaction but also provides additional value to sighted patrons. The same interaction occurs as above but the device also returns a cover image and bibliographic data on screen.
8. User authentication and authorization will vary depending upon organization or institution. We have started integration with our Blackboard Transact system to utilize card taps for user authentication when interacting with future iterations of IoT applications/devices.

Note: Changes in vendor provided API's and hardware changes can require re-creating actions.

FUTURE DEVELOPMENTS

The work that we have completed thus far has built a solid base of knowledge. We are developing several IoT applications to deploy across the library for multiple innovative uses. We are currently working on developing additional actions to leverage the Amazon Alexa platform:

- Search the library catalog for materials held by libraries worldwide and potentially enable ILL requests.
- Email returned results to patron device(s).
- Virtual Research Assistance to enable identification of database sources 24x7.
- Integration with room scheduling system allowing voice booking and check-in.
- Integration with library project center to allow voice interaction (tasks, projects, incidents, add notes)

We hope to demonstrate some of these actions and share a full usability study at the Coalition for Networked Information Fall Meeting 2018.



The Amazon Alex action that was developed to interface with the Ex Libris Primo interface can be found here: https://github.com/unc-charlotte-libraries/alex_atkins_search

To find out more about current development and opportunities to partner with the team at UNC Charlotte feel free to contact us:

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