

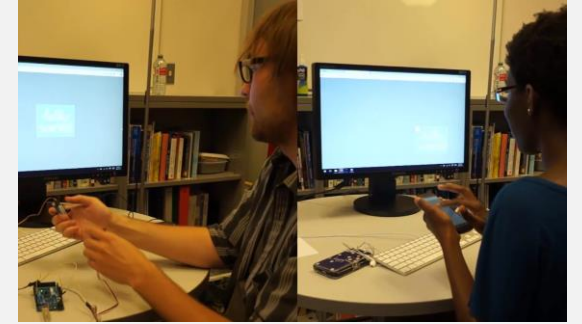
Case Study: Visual Authoring Tool for Designers

Research and Design by **Aneesh Tarun, PhD.**

Research Outline

Background

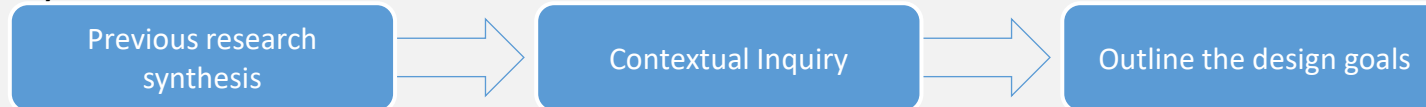
Designers and novice developers struggle to create interactive experiences using off-the-shelf sensors and sensor-equipped devices due to the complexity of setting up the technical medium. My goal was to conduct research and develop a toolkit that supports designers to easily prototype and simplify the process of creating interactive installations. In this project, I was the **Lead UX Researcher** and **Project Manager** working with a team of designers and developers. I partnered with researchers teaching a hands-on interaction design studio for designers at a local university. The designers worked with large displays, sensors, Arduinos and other microcontroller boards, and smartphones to create interactive installations and exhibits.



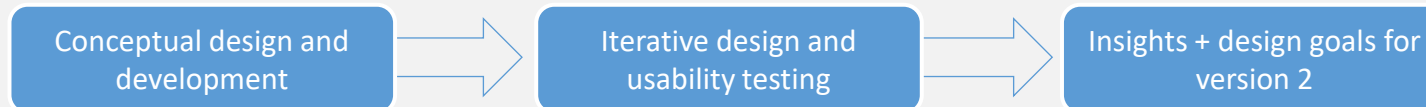
Approach

Here is an overview of the research and design process. Details will follow in the subsequent pages.

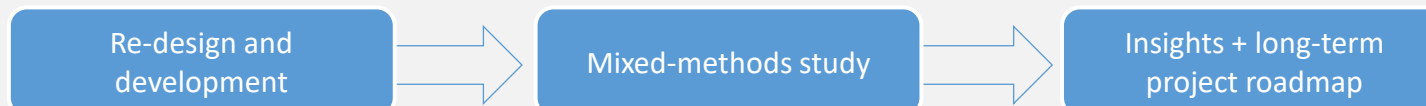
- Discovery Work



- Design Version 1



- Design Version 2



Deep Dive: **Discovery Work** [time frame: ~ 30 days]

Previous Research Synthesis

- Conducted secondary research on methods and tools that support designers and novice developers.
- Identified key themes:
 - Very few tools exist for designing interactions across multiple devices and platforms that require little to no coding.
 - No-code tools and working example code aid in learning to program specific technologies.

Contextual Inquiry

- Goal: understand how designers learn new tools and how they debug challenging situations; identify challenges and gaps in existing tools.
- Performed contextual inquiry with 4 designers who were working on building interactive art projects in a design studio. A session with each designer was 2 hours long and included observation and follow-up interview.

Outline the Design Goals

I synthesized the secondary research and contextual inquiry, and outlined the following design goals:

Support conceptual design: provide a high-level framework that allow designers to conceptualize, design and visualize complex interactions that span across heterogeneous devices.

Assist non-experienced as well as expert developers: provide end-user tools for easing the development of simple scenarios for designers (low threshold) as well as advanced programming mechanisms for tech-savvy users (high ceiling).

Span heterogeneous hardware: support the seamless inclusion of diverse off-the-shelf devices as well as hardware platforms for building custom interactives (e.g., low-cost microcontrollers).

Extensibility: support extending the tool both at the micro-level (adding new functionalities within the context of a single project or an organization) as well as at the macro-level (extending the tool for a wider community).

Deep Dive: Design Version 1 [time frame: ~ 60 days]

Conceptual design and development

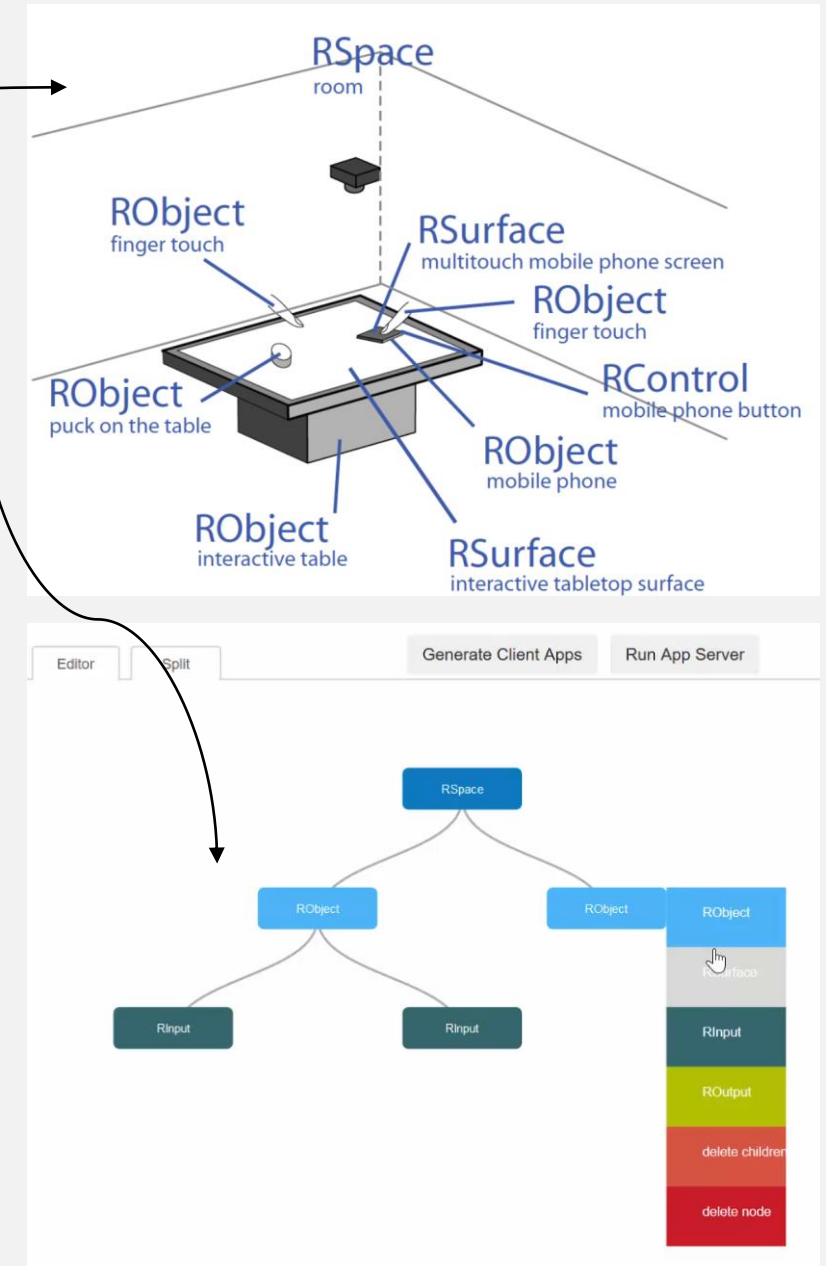
- *Supporting conceptual design:* I adopted a **hierarchical nested structure** and a unifying language to represent different heterogeneous sensors and devices within an interactive ecosystem.
- *Assist non-experienced as well as expert developers:* I designed a **visual authoring tool** for creating nested structures and simple interaction behavior. The tool also supports expert developers to write their own code.
- *Span heterogeneous hardware:* I worked with developers to create the back-end that automatically generates working (platform-specific) sample code for inter-connected devices.

Iterative design and usability testing

- Conducted two rounds of usability testing with 5 designers in each round.
- Designers were asked to create simple interactions with the authoring tool and provided devices and sensors. Conducted observations and interviews.

Insights + Design Goals for Version 2

- I identified three levels of expertise among the designers (**novice, tinkerer, expert**) and proposed designs to provide scaffolding across the three skill levels. Another key insight was to suggest possible interactions/behaviors between two devices, in the tool, to **improve discoverability**.
- Several usability issues were identified. Designers were delighted by the ease of use of the tool and suggested several additional features and device integrations.



Deep Dive: **Design Version 2** [time frame: ~60 days]

Re-design and development

- Designed a **new visual workflow** for authoring complex interactions without coding for off-the-shelf devices and custom devices created using sensors and microcontrollers.
- Added code templates to auto-generate user interface for screen-based devices, and to support new interactions/behaviors.
- Designed interventions in the workflow to support experts to work with code under the hood. In addition, fixed design and usability issues.

Mixed-methods study

- Recruited 15 participants (5 novices, 5 tinkerers, and 5 experts) to ideate, design, and develop a working prototype using the authoring tool.
- Utilized observations, questionnaires, interviews, video recordings, and logged tool usage data to assess the effectiveness and usefulness of the authoring tool.

Insights + **Long-term Project Roadmap**

- Overall, the visual tool and the auto-generated code were found to be quite useful for all the user groups to quickly prototype and test new interactions. Some of the participants expressed interest to use the tool for their personal projects.
- Defined a roadmap to package the project for **open-source release** and community development.
- Identified opportunities for embedding AI into the tool workflow to better support novices.
- Partnered with researchers to develop an augmented-reality version of the toolkit to support a hands-on way to create and modify interactive experiences.

