

HapticBubble: Supporting Playful Engagement between Remote Siblings

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Abstract

Sibling relationships play a crucial part in many people's social life. Compared to other relationships, even within a family, sibling relationships are unique and hold a special bond. Maintaining a close sibling relationship can be challenging when siblings have large age differences, which means more asymmetric relationships and social circumstances between siblings. Our research developed a system named the HapticBubble that uses playful and haptic interaction in order to promote remote communications and strengthen sibling relationships.

Introduction

- Importance of sibling relationships**
Parents and primary caregivers generally act as a secure base providing support and comfort when children experience negative emotions. In contrast, siblings are thought to fulfill each other's social needs and engage in fun and playful interactions.[1] The influence of older siblings is stronger, suggesting that they are more effective teachers and role models. Losing this relationship due to large physical distances between siblings can be detrimental to individual development and family dynamics.

- Current challenges**
With a large age-gap, siblings are vastly different in maturity level, interests, and how they spend their time. More so, children are used to getting guidance from parents and companionship from siblings, which isn't as present with significant distances and differences in age. Additionally, challenges in facilitating conversations mostly falls to older siblings and parents.

- Previous work**
A previous qualitative study was done by Georgie Qiao Jin that specifically analyzed this relationship and identified these current challenges that should be addressed to better serve these siblings.

[1] Qiao Jin, Ye Yuan, Lana Yarosh, 2022, Socio-technical Opportunities in Long-Distance Communication between Siblings with a Large Age Difference.

Preliminary Interview and Ideation

- Semi-structured Interview**
Using the qualitative research done prior to the project, we conducted informal interviews with older siblings to hear direct experiences and start the ideation process on technical probes for the team to build. These interviews were all transcribed and then open-coded to identify 7 common themes.
- IDEO Method Ideation**
Utilizing this information, our team utilized the IDEO method to generate over 100 ideas in an ideation workshop.
- Qualitative Analysis**
From this, ideas were clustered into 11 inter-connected categories. I used each team member's individual rankings on ideas and clusters as a whole to complete a statistical analysis on our idea generation.

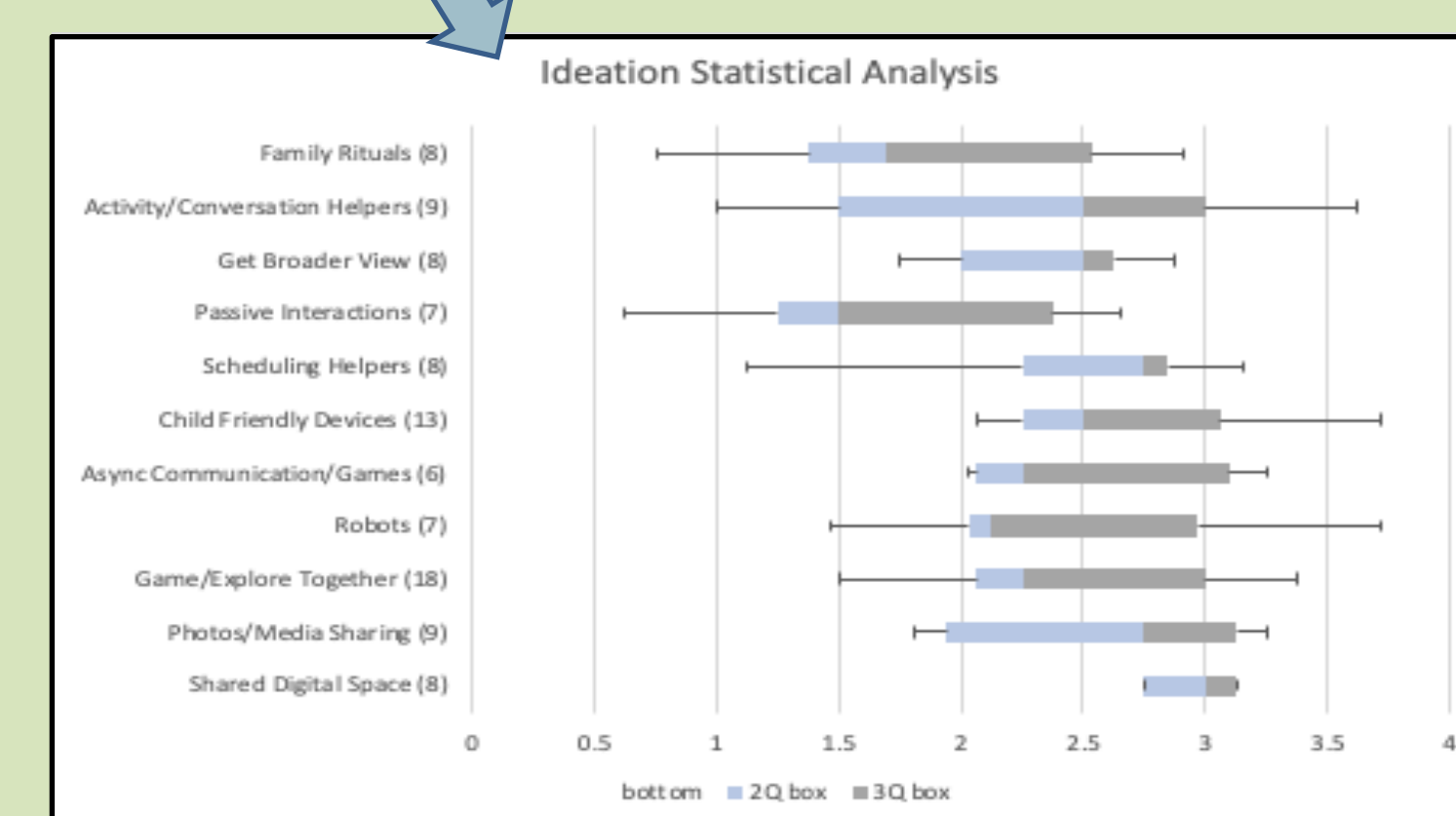
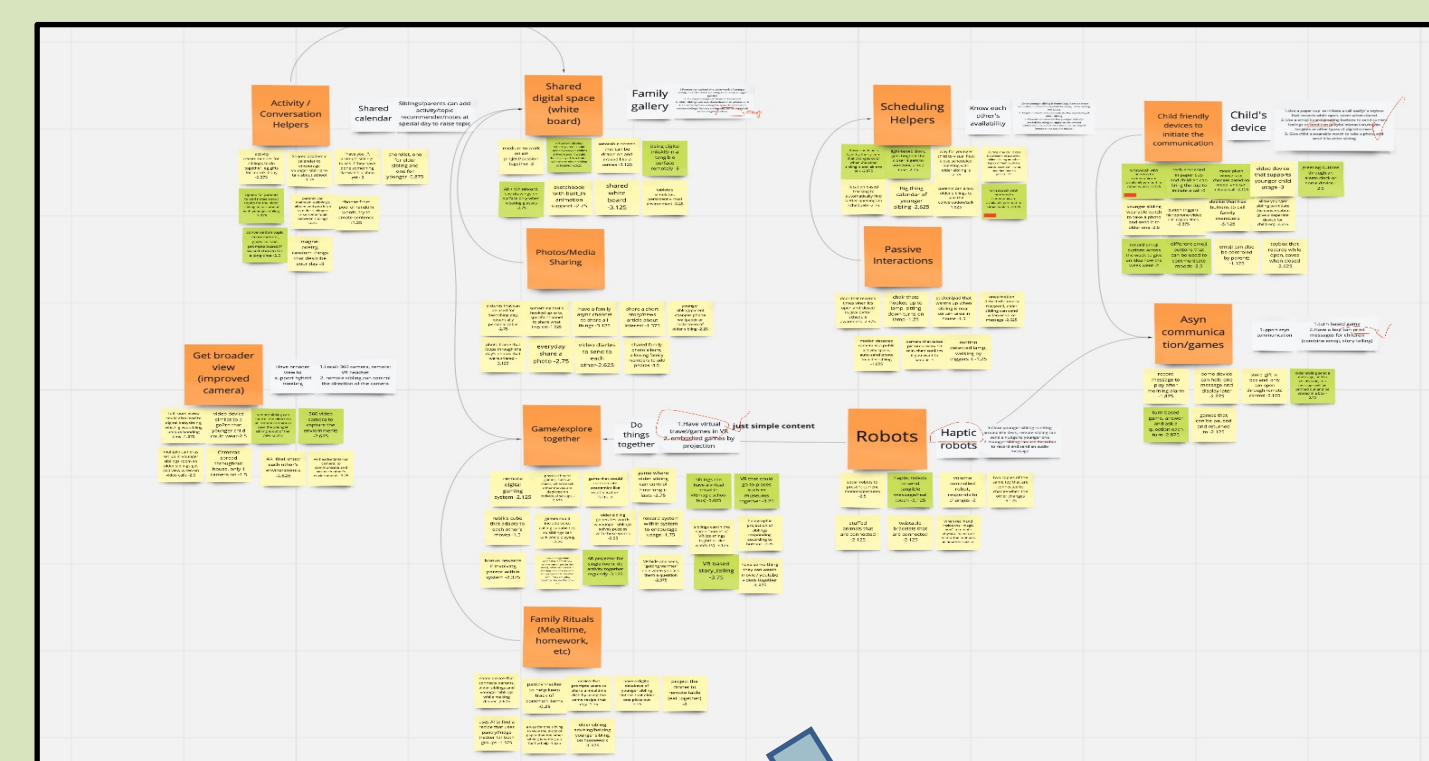


Figure 1 & 2: Miro Board with categorized ideas & statistical representation.

- Final Idea**
From the analysis, we chose an idea that included asynchronous communication and a playful touch element – and named it the HapticBubble.

Materials

- Physical Hardware:**
 - RaspberryPi3 B+
 - 12V Plunger Solenoid
 - Pop-It Fidget Toy
 - 3D Printed Parts



- Software:**
 - Python3
 - FlaskModule

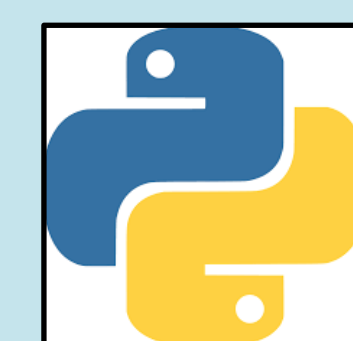


Figure 3,4 & 5: Materials used within prototype system.

HapticBubble

Prototype Overview:
The HapticBubble has a little Pop-It toy that younger siblings can push. Each push will trigger a sensor and update a website informing the older sibling of the younger sibling's push. From this website, older siblings can "pop" the younger sibling's toy remotely. The potential of this prototype carries the asynchronous communication giving siblings flexibility yet a fun way to stay in constant contact with each other.



Technical Overview of HapticBubble:
Our current model has this Pop-It fidget with a 12V plunger solenoid placed under it, encompassed in a custom 3D printed case. There is a sensor placed under the bubble that triggers when the device is pushed. The bubble-solenoid system is connected via a relay to limit voltage currents sent to the Raspberry Pi. Using the Raspian OS, Python, and Flask modules, a program was coded that created the webserver and directly connected buttons on the webpage to control the solenoid. An image of the physical hardware and webserver is shown below.

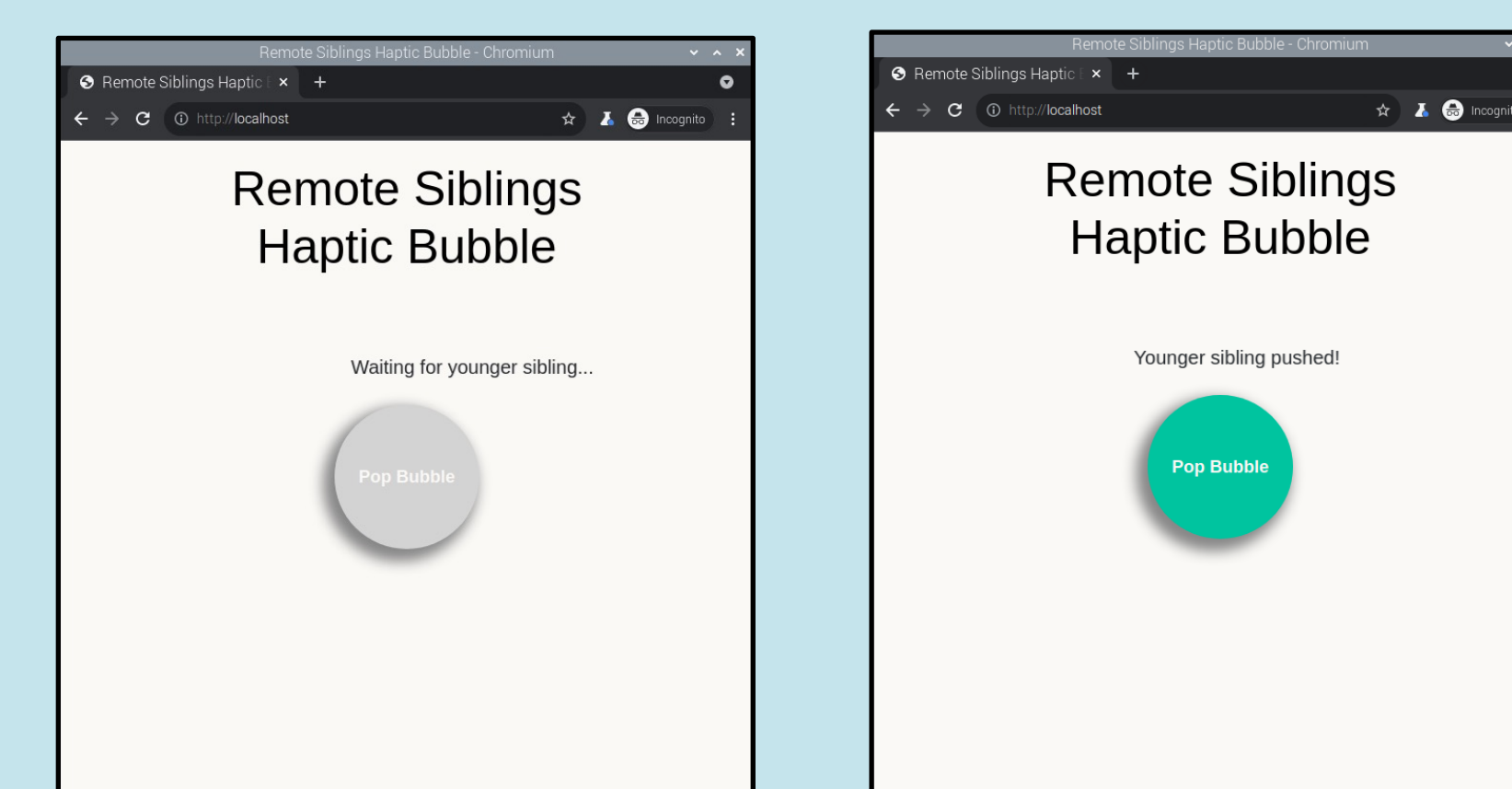
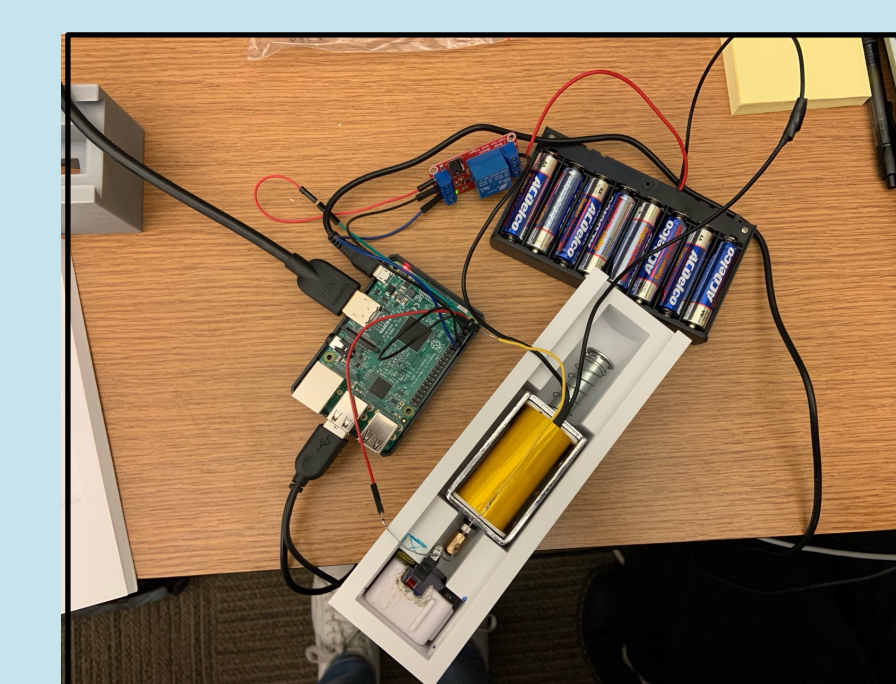


Figure 5,6 & 7: Physical hardware and webserver screenshots.

Usability Test & Results

During our usability test with the Remote Sibling team members, we tested the hardware system in its entirety along with the webserver. A tutorial of the toy was first given and then team members tried it in pairs. After a few minutes, the individuals switched sides so they could experience the younger sibling and older sibling. All participants were able to use the system easily and found the process easy to follow.

From our internal post-demo workshop, we brainstormed several new features and specific areas of improvement to implement before the pilot study and deployment.

- Adding a push-notification element so when the younger sibling pushes, older siblings are notified immediately – creating more synchronous communication
- Embedding 3 LED lights within the current system (green, yellow, red) to represent availability that could also be controlled by the same webserver by older siblings.

Upcoming Steps

Following the development process and the pilot study, our next step will be to conduct a 4-week deployment of the HapticBubble within the homes of 3-5 sibling pairs. We will collect usage data from the sensor as well as weekly check-ins with each of the siblings. At the end of the deployment cycle, the goal is to host a workshop session for siblings to discuss and converse with the research group about the overall experience, current prototype enhancements, and any additional ideas, thoughts, or comments.

Following the deployment and workshop, our objective is to write a paper on our findings from the study.

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