StoryBox: Independent Multi-modal Interactive Storytelling for Children with Visual Impairment

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Motivation

Storytelling enhances imagination and creativity, along with the development of linguistic, emotional, and moral skills in children. Children with blindness and visual impairment (BVI) face limited availability of accessible storytelling media and possession of assistive tech.

Previous research attempts to make storytelling accessible in group settings like classrooms. However, these solutions remain inaccessible to the larger population of children with BVI who cannot attend schools. These insights motivated the development of an affordable interactive storytelling platform - *StoryBox*, that is accessible to visually impaired children, enabling an independently engaging experience.

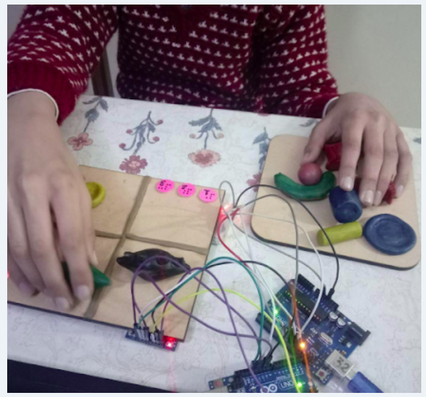
StoryBox takes inspiration from *'kaavad baanchana,'* an oral storytelling tradition from Rajasthan, India, and aims to promote this culturally rooted practice for narrating stories like *Panchatantra*, and *Akbar Birbal Tales* that deliver strong moral values to children.

Methodology

- We follow Double Diamond for this study.
- Four sighted participants (2 male, 2 female) were recruited via purposive sampling (mean: 9.75 years, std deviation: 1.92 years).
- They participate in an exploratory study during the design of character figurines.
- The same participants are contacted again for a preliminary user evaluation of StoryBox.

Prototype Design for *StoryBox*

Through an exploratory study, we find that participants associated emotions with the organically shaped figurines. 10 of 15 figurines were selected based on participant feedback to represent story characters, and were embedded with NFC sensors.



- Taking inspiration from *'kaavad'*, *StoryBox* presents tactile paintings to support story narration for children with BVI. The narrator prompts exploration of these paintings during the narration of defining story moments.
- An NFC reader embedded mat facilitates interactions with sensor-embedded figurines. The NFC readers are controlled by Arduinos that communicate with a Python-based server to deliver the narration.
- *StoryBox* provides onboarding for the selected story, followed by story narration and interaction with characters via Wizard of Oz.
- Children can ask questions about the story, discuss feelings and talk to story characters.

Findings and Discussion

StoryBox enables independent access to stories, increases comprehensibility, and aids in understanding emotional conflicts.

Engaging with character figurines.
All participants actively interacted with the tangible character figurines before, during, and after narration.

Interacting with story elements.
Character interaction fostered empathy. Participants reflected on the moral of the story and talked to the narrator about personal experiences. All participants developed an instant connection with the Monkey from S1.

"See, I told you not to go, but you did not listen to me. It is good that you could escape, but you should have listened to me." (P1 to Monkey)

"You are a bad crocodile. The monkey gave you fruits to eat. You should not do this with your best friend. You trapped him." (P4 to Crocodile)

Exploring tangible paintings.
All participants reported that the tangible paintings aided them in visualizing the scenes.

"The crocodile backs have a real-life-like texture, I can immediately tell it's the crocodile. And this is the monkey; it has such a long curved tail!" (P3)

"Are these the Jamuns? Can I count them? I think there are ten on the tree. Are any Jamuns fallen on the ground?" (P4)

Future Work

- Empirical evaluation with children with BVI to validate and iterate over the design prototype.
- Implementation of voice-based interactions as a consolidated high-fidelity prototype.
- Exploration of methods to expedite onboarding and support a wider range of interactions for an engaging experience despite multiple listens.

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