

Speak Your Own Adventure

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Abstract

The current tools utilized in the creation of Interactive Digital Narratives (IDN), a storytelling medium that incorporates interactive elements, are lacking in accessibility features that would allow writers with low vision or total blindness to utilize them. The objective of our team intends to develop a program for visually impaired writers that enables them to author IDNs with customizable text-to-speech narration. Based on existing practices in accessibility, some of its features are the following: customizable fonts, font sizes, rebindable controls, and screen reader compatibility. Two areas that will require additional focus during the development process are: implementing ways for authors to keep track of their position in text when working with multiple files and ensuring that writers will be able to keep track of narrative flow as it becomes more complex.

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Introduction and Motivation

Interactive Digital Narratives (IDN) are a relatively new form of expression defined by their interactivity and potential non-linearity. These distinctive features make writing an IDN a unique intellectual challenge that can be a beneficial experience for those who venture to participate. However, our team has identified a population who may be willing, but unable to attain this experience: those with visual impairments. According to the Centers for Disease Control and Prevention (CDC, 2024a), over 7 million Americans suffer from visual impairments, with visual disability being considered as “one of the most prevalent disabling conditions among children” (CDC, 2024b). Unfortunately, most existing IDN authoring tools lack any sort of accessibility features especially for those who are blind and such potential blind authors have been unintentionally left out of the field. Our team is looking to remedy this oversight and design an IDN authoring tool for visually impaired authors with either low vision or complete blindness. Our success criteria is to develop software that:

- enables users to author interactive digital narratives
- is functional and easy to use for authors with visual impairments
- builds upon industry standard accessibility features for IDN readers
- lowers the barrier of entry to IDN authorship

With monitors being the primary interface for computer information to be conveyed, navigating a computer without sight has a host of challenges that will need to be addressed in the design process. While the number of users for this software is uncertain and potentially limited, it offers a unique creative avenue for self-expression to visually-impaired authors who may have been inadvertently excluded by other IDN authoring tool developers.

In conducting the research for our team's project, we aimed to answer the following questions:

- What defines an IDN?
- How do IDNs affect their authors and readers?
- What forms do existing IDN development softwares take?
- How do visual impairments manifest?
- What defines visual accessibility?
- Are there industry standard approaches to visual accessibility features?
- What existing software tools/libraries can we incorporate into our own proposed software?

Literature survey

Interactive Digital Narrative Tools

Koenitz et al. (2015) described IDNs as “a form of expression enabled and defined by digital media that tightly integrates interactivity and narrative as a flexible cognitive frame”. In short, the term IDN refers to any narrative in which the audience can influence the sequence of events in its story. These can be found in “text-based Interactive Fiction... Hypertext Fiction, Interactive Cinema, Interactive Installations, Interactive Drama and Video Game Narrative” (Koenitz et al., 2015). The non-linearity often found in these narratives presents additional challenges when compared to authoring traditional storytelling with linear narratives. Because of this, IDN authoring has been considered for introduction into domains outside of entertainment.

Writing therapy has been demonstrated to be an effective form of cognitive behavioral therapy for the treatment of post-traumatic stress disorder and depression (Pascoe, 2016). In cognitive behavioral writing therapy, patients are required to compose a comprehensive narrative

based on their personal fears and experiences. This is then used as a basis for a dialogue with the therapist to identify appropriate coping strategies, after which the stories are shared with others. Starks et al. (2016) propose the use of interactive storytelling in writing therapy. They posit that contemplating and composing branching narratives may facilitate catharsis. Efforts have also been made to introduce IDN authoring into school settings in addition to traditional writing exercises (Carbonaro et al., 2008).

Tools of Visually Impaired Users

A variety of existing tools are designed to assist visually impaired individuals interact with digital tools and media. Such tools include screen readers, TTS, braille displays, among others (Oproescu et al., 2019). Screen readers are among the most prevalent tools for visually impaired individuals, interpreting on-screen elements and providing it to the user as audio line-by-line. This enables the navigation of websites and other software applications. However, screen readers face challenges in interpreting digital content that was not designed with accessibility in mind. This is a pervasive problem in the accessibility of digital content, reflecting the fact that such content was not originally designed for visually impaired users (Hamideh Kerdar et al., 2024).

It is common for applications and websites to be designed primarily for sighted users, without sufficient consideration of users who are blind or have low vision (Hamideh Kerdar et al., 2024). This can result in a lack of text descriptions for images, incompatibility with assistive technologies, and other issues that render applications confusing and challenging to navigate . There are many design considerations that are often overlooked:

- Avoiding visual clutter and ensuring that no essential information is conveyed solely through visual elements.
- Lists should be screen reader-friendly, of limited size, and be compatible with assistive tools and keyboard shortcuts.
- Buttons should be clearly visible and appropriately sized, layouts should be simple and require no mouse for navigation.
- Users should be able to zoom in without encountering horizontal scrolling issues.
- Font size and colors should be customizable.
- Decorative elements should be marked so that screen readers can skip them.
- Pop-ups should be used sparingly to prevent disrupting the user's focus on their current position.
- Descriptive headers with jump-to links can facilitate easier navigation, and a predictable, logical navigation structure is crucial for a good user experience.

It is our intention to address these issues in order to provide an intuitive and effective environment for visually impaired users to express their creativity through the creation of their own IDN.

We intend to prioritize compatibility with the open-source screen reader NonVisual Desktop Access (NVDA) for Windows, developed by NV Access (2024). Although NVDA is only the second most popular screen reader, it is trending to overtake the most popular screen reader, JAWS, in popularity (Gratzer, 2024). Moreover, NVDA is free. In addition to its primary feature of providing audio feedback and methods to navigate applications, NVDA also offers braille support. A wide range of customization options and extensions are available to accommodate the unique preferences and requirements of each user. NVDA comes with

numerous keyboard shortcuts that make navigating applications and websites easier. Accounting for these shortcuts when designing our application will ensure that existing users can adopt our application faster. Additionally, NVDA has a variety of options that can help with testing our application, such as a rectangular highlight box that shows what NVDA is currently reading.

Designing our IDN

There are numerous IDN tools currently available (Starks, 2018). A majority of these tools can be classified into two main categories: inline scripting language-based and node-based. The former category includes tools such as Ink, Ren'py, and Yarnspinner, which utilize a text-based scripting language to facilitate narrative flow. The latter category encompasses tools like Twine, Articy:Draft, and Arcweave, which employ visual node graphs to manage branching. Since our tool needs to be screen-reader compatible, adopting visual graphs would likely be challenging and as such our team will follow the inline scripting language approach.

Avoiding visual graphs does have some potential drawbacks. Green et al. (2021) formulated UX design principles to be considered when developing IDN tools that were derived from a study performed on the differences in user behavior when working in tools with different interfaces. The principles broadly suggest that visual metaphors to represent story structure and connectedness improve a writer's ability to have a clear understanding of narrative flow of their work. This in turn leads to them having to test less, creating more branches in their stories, and having an overall easier experience with complex story structures. In light of this, extra effort will be needed to design solutions that will improve the ease of completing tasks which are significantly aided by visual metaphors.

MuseScore, an open-source music notation program, was developed with a version of the Qt framework, the same framework we intend to use. While early versions of MuseScore lacked accessibility support, a concentrated effort was made to improve this in later versions, although with many associated challenges (Jonas & Sabatella, 2020). One of these challenges was the menu navigability of the software when using a screen-reader. By designing navigation to be done through a combination of the tab and arrow keys, finding a desired menu item was made significantly faster and easier when compared to the default tab key navigation. Another menu design choice to consider was found in the results of a survey indicating that menu structures with more depth such as three-layer menus are hard to navigate for blind users when compared to flatter, broader menu structures (Hochheiser & Lazar, 2010). It was also found that in two level menu structures, the initial level should have less options than the secondary level. These insights could become significant to us if the project's development leads to many menu-accessible functions being implemented.

Although our tool is intended to be for writing narratives, it will also be using a custom scripting language, meaning its workflow is likely to have similarities with programming. In a study conducted by Albusays et al. (2017), the following were identified as common challenges for blind software developers when navigating code: the debugging process in general, difficulty finding information without reading the codebase linearly, lack of indentation support in screen readers, navigating through nested elements, and quickly returning to a specific line after viewing other files. The survey respondents indicated that they employ simple editors for the purposes of storing code snippets and tracking errors, as well as for creating custom scripts, comments, and shortcuts. When asked which features they would find most beneficial, the respondents proposed displaying codebases in a tree view format, the integration of auditory

feedback for various events, such as the introduction of a syntax error, and the enabling of bookmarking (Albusays et al., 2017). Some developers prefer integrated development environments (IDEs) like Visual Studio, while others opt for simpler text editors because many IDEs have components that are inaccessible to them (Mealin, 2012).

Proposed work

We intend to develop the software primarily in Python using the PyQt framework and along with outside libraries such as PyInstaller for packaging the completed narratives, Coqui-AI for TTS functionality, and Whisper for speech recognition. The proposed software consists of two functionally distinct programs:

1. The text editor for creating stories:
 - a. Screen reader support - This will be tested using the NVDA screen reader, which is a popular, open-source screen reader for Windows.
 - b. Customizable fonts (font family, color, and size)
 - c. Contextual highlighting for using sound/screen effects
 - d. Quick switching between dialogue files
 - e. Speech-to-text macro
 - f. Exports file to be used by the story player
2. The viewer for running and playing completed stories:
 - a. Reads (TTS for narration, screen-reader for GUI) packaged story
 - b. Plays screen/sound effects
 - c. Screen-reader compatible prompts and macros for option choice
 - d. Customizable fonts (font family, color, and size)

While our primary target audience is potential IDN authors with visual impairments, we intend for the software to be usable by sighted users, although they are more likely to use one of the other existing IDN authoring tools. Our target audience are authors that would probably want to share their stories with sighted and visually impaired readers, this will influence the design of the viewer but not necessarily the editor.

Project plan

Week of	Milestones
September - Design & Initial Implementation	
9/9	<ul style="list-style-type: none"> ● Architecture Diagram ● Familiarize team with tools ● Setup Github & file architecture
9/16	<ul style="list-style-type: none"> ● Design in-app workflow (scripting language, keybinds, etc) ● Start implementing IDN domain specific language (DSL) parser ● WIP editor UI
9/23	<ul style="list-style-type: none"> ● WIP narrative player UI ● Prototype DSL parser complete ● Variable name functionality ● Functionality for rebindable key shortcuts ● Basic UI font customizability
9/30	<ul style="list-style-type: none"> ● Presentation 1 ● Basic TTS functionality ● Multiple text file support ● Choice functionality
October - Implementation	
10/7	<ul style="list-style-type: none"> ● Text line jump shortcut ● Sound effect support
10/14	<ul style="list-style-type: none"> ● Basic voice command functionality
10/21	<ul style="list-style-type: none"> ● Editable TTS parameters

	<ul style="list-style-type: none"> • Screen effect support
10/28	<ul style="list-style-type: none"> • Documentation including new user guides • Design validation plan • Presentation 2
November - Final touches & quality of life	
11/4	<ul style="list-style-type: none"> • Implement unit & end-to-end tests
11/12	<ul style="list-style-type: none"> • Debugging • Quality of life improvements
11/18	<ul style="list-style-type: none"> • Debugging • Quality of life improvements
11/25	Finish all project submissions parts

We intend to follow the schedule outlined above and each developer will work on both the editor and viewer. Tasks will be self-assigned weekly after group meetings.

Conclusion

The creation of Interactive Digital Narratives (IDN) presents a distinctive and complex challenge for authors, one that is inaccessible to those who are visually impaired. The absence of built-in accessibility features in IDN authoring software presents a significant obstacle for some, particularly without outside assistance. Knocking down this barrier and creating such features would allow practically anyone to author IDNs. To this end, we will be developing a tool that allows users with impaired vision to easily create IDNs. Despite the many IDN tools, none of them facilitate the creation of IDNs by people with impaired vision. Our goals are to enable users to author interactive digital narratives, create a functional and easy-to-use tool for authors with visual impairments, build upon industry-standard accessibility features for IDN readers, and lower the barrier of entry to IDN authorship. By focusing on these goals, the team aims to create a valuable asset for visually impaired people seeking an accessible path to IDN creation.

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