

# Audio Journal App Continuation

Major Qualifying Project



A Major Qualifying Project submitted to the faculty of  
WORCESTER POLYTECHNIC INSTITUTE  
in partial fulfillment of the requirements for the Degree of Bachelor of Science

**Submitted to:**

Professor Rodica Neamtu

Professor Lane Harrison

Worcester Polytechnic Institute

**Submitted by:**

Amy Orozco

Benjamin Robinson

Caleb Farwell

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## **Abstract**

As our society continues to modernize, we become more reliant on the internet and technology for the distribution of news. This presents several unique challenges for blind, visually impaired, or any other print disabled consumers. While national news agencies provide resources for these individuals, it is much more difficult to get access to the local news. Audio Journal is a nonprofit radio reading service located in Worcester, MA. Their goal is to deliver local news to the visually impaired, who usually have no way of receiving it on their own. Last year, a group of 3 students at Worcester Polytechnic Institute (WPI) created an iOS application for Audio Journal to help the organization modernize and expand to a larger audience.

The goal of this project was to improve and expand upon the work done by another MQP team last year. We developed several new features to improve the overall usability of the app, including new media player screens with different playback options, and improvements to searching for programs. We also conducted extensive testing with current users of the Audio Journal App to improve upon the features we have developed. Last year's team created a great foundation to improve upon.

## **Acknowledgements**

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## Introduction

In a technology-focused world, there are demographics that are under considered and too often forgotten. Having technology that implements accessibility allows for the inclusion of people who sometimes need it the most. Visually impaired and print impaired people depend on technology to do everyday things, such as accessing local news. Many applications available today rely on visuals, making them inaccessible to people with disabilities. Companies like Apple have created features for accessibility. They cater to all forms of disabilities and offer a wide range of features like VoiceOver, Zoom, Audio Descriptions, and more. This technology has allowed for the creation of more accessible apps.

Audio Journal is a nonprofit organization that has used Apple's accessibility features to create an app catered to its listeners. The app is compatible with Apple's VoiceOver and Audio Description features. The app can serve as an important tool for the visually impaired in Worcester County, Massachusetts. They provide local news to their listeners, all of whom are visually impaired or print impaired. They have over sixty volunteers who read print material during live broadcasts or prerecorded programs which are archived on the Audio Journal website. They have successfully created an app, which was developed by a group of 3 students at WPI. This included the research, development, testing, and publication of the app to the Apple App Store (Duckett). It allows users to access archived broadcasts, as well as the live broadcast. It has been available for less than a year. Following the app's release, the team has gathered feedback on how to further improve it.

The Audio Journal App successfully provides news to visually impaired and print impaired people. Last year's team created a brilliant app, but like many other apps, updates can

be made to better serve its users. There are new features and improvements that have been suggested. Our team's goal is to improve usability and accessibility for its users.

# **Background**

## **VIPs and Access to Print Materials**

Today, most media is spread through print format, whether that is in the form of a printed newspaper or a website. While this does not pose a problem for most individuals, visually impaired people (VIPs) or print impaired people can not access or read this information. This is a problem in many places like Massachusetts, where approximately 3% of the population is blind or visually impaired (National Federation of the Blind, 2019).

Blindness and visual impairment come in many forms. Blindness is the state of being unable to see due to an injury, disease, or genetic condition, while visual impairment is a decrease in vision, causing problems that can not be corrected by usual means, such as glasses or contacts. There are four levels of visual impairment and blindness: partially sighted, low vision, legally blind, and totally blind. A partially sighted person has partial vision in either one or both eyes. A low vision individual has a visual acuity of 20/70 in their better-seeing eye that can not be improved. A legally blind person has a visual acuity of 20/200 in their better-seeing eye that can not be improved. Finally, a totally blind individual has a complete loss of sight in both eyes (Industries for the Blind and Visually Impaired, 2021).

A print impaired person is unable to read printed material because of dexterity problems, learning disabilities, or cognitive impairment. Parkinson's disease, paralysis, multiple sclerosis, and arthritis can cause dexterity problems that make a person unable to hold printed material. Learning disabilities such as dyslexia can make reading and understanding printed material very difficult. Finally, cognitive impairments such as dementia and brain injuries can also cause print impairments (Vision Australia, n.d.).

These visually and print impaired individuals have a hard time accessing and reading printed materials, such as news, books, instruction manuals, and many other forms of printed material. Often, libraries have audiobooks, and many large news companies broadcast live on the radio, allowing access of their content to visually and print impaired people. Smaller news companies that report on local news for towns unfortunately do not always have this option. One company trying to do this is Audio Journal, a non-profit organization in Worcester, Massachusetts. Audio Journal records news from local newspapers and broadcasts to visually and print impaired people in Worcester County.

## **Audio Journal**

Audio Journal aims to make printed media accessible to the visually and print impaired community in Worcester County. It began in a closet at the Worcester Public Library in 1987 and later moved to a professional office in 2003, which is fully accessible to visually impaired individuals (Audio Journal, 2018) and people with other disabilities. Sixty volunteers help run it, reading and recording local news daily. Historically, this has been a process that starts with volunteers physically cutting out sections of the local newspaper to read or downloading articles from the internet. With their excerpts in hand, they would go to the live broadcast studio to read their articles live and also be recorded. Due to the ongoing pandemic, many volunteers have been pre-recording their readings remotely from home and submit them to be aired later in the day or week. Currently, Audio Journal is working in a hybrid mode, with some programs airing live from the studio, but most programs being prerecorded remotely by volunteers. These volunteers, who are usually retired, are taught to use the tools required either for on-air broadcasting or

remote recording. Although it is a time consuming process, it is well worth it to provide information to people who can't access it.

There are other services that provide national news for the visually impaired, but having access to information about someone's local surroundings is important. It helps them feel connected to their communities and lets them know what's going on. Rayini highlights this sentiment as it states, “People with disabilities are often excluded from social activities and are not treated in the same way as their able-bodied equals”(Rayini, 2017). Audio Journal also provides information relevant to VIPs and lets them know of events that are specific for VIPs and how to access them. The same paper also found VIPs wanted information that related to their visual disabilities and how to get around in normal life (Rayini, 2017). This isn't always found in other services which provide national news. Audio Journal's main goal as stated on their website is “to connect individuals with a visual impairment, or an inability to access print material, to their communities through broadcasting of local news, information, and entertainment, with exclusive programs and content.” According to the executive director, they have successfully done this for many years and have loyal listeners and volunteers. To keep up with changes in technology Audio Journal reached out to the Worcester Community Project Center in 2019, aiming to develop a more accessible route to their broadcasted materials (Doyle et al., 2020).

### **Creation of the Audio Journal App**

A group of three WPI students began working with Audio Journal in early 2020 for an Interactive Qualifying Project (IQP). These students interviewed 21 individuals with visual impairments and determined that the best way to provide Audio Journal's services was through



an iPhone app. During the course of the project, they also created a concept design for the app, as well as determined many features that would be needed in the app.

The next year, two of those same students, along with a third, continued to work with Audio Journal on their Major Qualifying Project (MQP) to design and implement the app proposed in the previous year's IQP. They implemented the suggestions from the IQP, as well as added some features of their own. At the end of their project, they had created the app, "Audio Journal App," and published it on the Apple App Store for listeners of Audio Journal to use.

### *App Features*

The Audio Journal App contains many features making it usable by visually and print impaired individuals. First, it is compatible with Apple's accessibility features, including dynamic type and dark mode. Users are also able to change the color palette of the app in order to choose a color scheme that they can see best. In addition, users can browse through past programs in the app, as well as listen to the live Audio Journal broadcast. The team also created a favorites function where users can mark programs as favorites to access and listen to them more quickly. The team also added a search function, where users can search for programs by saying the program name. They added the ability to resume the last played broadcast, as well as the ability to view Audio Journal's weekly broadcast schedule. The team also implemented VoiceOver, ensuring that the accessibility feature works as intended on the app and provides a clear reading to the user. Finally, the team added functionality for voice control to allow visually impaired users to control the app by voice.

## **New Features and Bug Fixes**

Both last year's project group and our sponsor gave us a good direction for what new features we should develop for the app. The overall consensus was that the usability and flexibility of the app needed the most improvement and would be the main focus of our updates. Some of the other new features come directly from the request of Audio Journal App users themselves. Lastly, bug fixes will also be implemented by our team.

Regarding the usability of the app, our goal is to deliver an app that is as easy to use as possible. Because the app is designed for visually impaired individuals, it should be a priority to ensure that the app is functional and efficient for these users. Our sponsor suggested a good place to start on this would be by improving the search functionality of the app. Currently, you can search on the app for specific programs you would like to hear. However, some users have pointed out that they cannot find specific programs because they are searching in more generalized terms. For example, a user might search the word "kids" and expect to see the program "Children's Hour," but they do not because the word "kids" is not in the program name. Our sponsor provided us with a list of search term pairs which will be implemented to ensure common searches return the user's expected result.

Other improvements to usability come through bug fixes. One current issue is that the program schedule is often out of order. This is particularly an issue for visually impaired users, as the schedule being read to them completely out of order would be very confusing and hard to understand. Fixing this bug would help users greatly, as they would be able to understand the schedule much easier.

Our sponsor suggested that the flexibility of the app should also be improved. With flexibility, we are referring to giving users plenty of options to use the app the way they like best. Everyone has their preferences on how they listen, so it is crucial we cater to as many users as possible.

Our sponsor gave us a great list of different flexibility features we could add at the request of current users. One of these suggestions are improvements to the playback functionality. The current issue is that users are very restricted in how they listen to previous broadcasts. There are very minimal ways for users to skip through a program. They can either skip ahead 15 seconds at a time, or by dragging the slider, which can be difficult for visually impaired individuals to use. We plan on expanding the skip functionality by adding two different skip options, while also increasing these skip times to a half minute and one minute. This will give users a much faster and more flexible way to navigate through a broadcast.

Another change we plan to make to the broadcast is the ability to change the playback speed. We will add the ability to change the speed to 1x, 1.5x, and 2x speed. This is a feature that was highly requested by users, because some people prefer to listen at faster speeds. This is another option that allows the user to tinker their Audio Journal App experience to their liking.

A third change we plan to make is to add compatibility with Apple's AirPlay feature. AirPlay lets users easily connect their device to Apple TVs, speakers, and smart TVs. This will provide users with a wider variety of ways to listen, instead of just using their phone. For example, a listener could connect their phone to speakers in their house and listen to the Audio Journal broadcast while going about their day at home.

# Methodology

## Project Goal

The goal of our project was to enhance the experience of the app, focusing on developing and upgrading features that would improve the experience for visually and print impaired users. Figure 1 shows all the features implemented and a description for each feature. The new features we implemented were inspired by suggestions from last year's team, users' input, and from our sponsor. We planned for all features to be implemented within the first 8 weeks of the project to allow enough time to conduct a user study. With the help of Audio Journal we had 24 participants, 17 of whom are visually impaired.

Feature	Description
Playback Speed	Add buttons to the audio player which increase the audio playback speed.
Longer Skip Times	Modify the skip buttons on the audio player to be a larger skip
Airplay	Add the ability to use the audio journal app with Airplay
Change Website to live website	Change the audio stream to be that of the live website
Search + Voice Search Improvement	Added more accuracy to the search functionality and fixed crashes caused by voice search
Add Airtime	Display the airtime of previous broadcasts
Fix Reading of Program Schedule	Correct the order in which voice over reads the program schedule

Figure 1: List of implemented features with description

## App Development Process

The previous year's team created an in-depth, functioning app, and provided us with a good starting point. Figure 2 shows what the app looked like at the end of last year. We met with the team in April of 2021 and were given access to the repository and their Google Drive. Google Drive contained information they used in their development process. Work on improving the app started in August 2021. Each member of the team was assigned a task and given a week or two to complete it. We had several meetings a week, one with our sponsor and advisors, one with just our sponsor, and the rest as a team. A weekly status report was given to our sponsors and advisors.

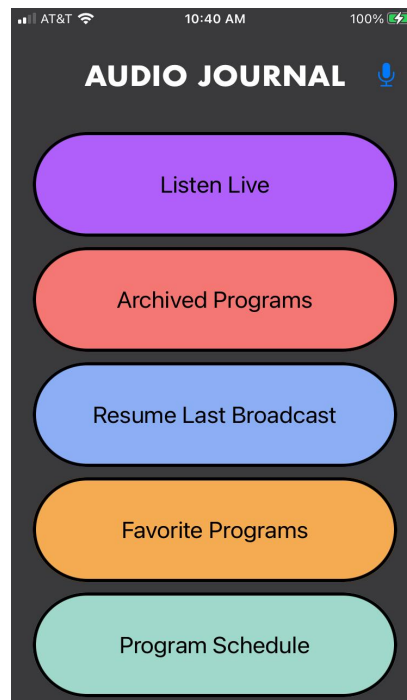


Figure 2: Home Screen

The app was created using Apple's XCode using Apple's Swift programming language and we continued to do so. Since this was a continuation project, it was important to become acquainted with the project. This included going over every file and understanding how everything worked. Doing this made it easier to add to the project. Although there were new concepts to learn during the whole process, we were lucky enough to still have contact with last year's team when questions arose.

## **Implementation**

A project schedule was created early on to keep organized and to have a concrete list of what had to be finished. It is seen in Figure 3 and outlines deadlines. All due dates were subject to change and did as the development process occurred.

KEY			B Term							C Term													
-	Working	Week:	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
•	Completed																						
<b>App Implementation</b>																							
	Playback Speed		-	•																			
	Longer skip times		-	•																			
	Fix Voiceover Favorites Issue		-	•																			
	Airplay		-	•																			
	Change Website to live website		-	•																			
	Search + Voice Search Improvements		-	-	•																		
	Add airtime		-	•																			
	Fix Reading of Program Schedule		-	•																			
	Listen while browsing other Apps		-	-	•																		
	Bug Fixes/Minor Improvements									-	-	-	-	-	-		-	-	•				
	Code Refactoring																-	-	-	•			
<b>User Feedback and Fixes</b>																							
	IRB Submission																						
	Initial Testing				-					-	-	•											
	Feedback											-	•										
	Evaluation											-	•										
	Secondary Testing											-	-						•				
<b>Report Writing</b>																							
	Abstract		-	•																			
	Introduction		-	-	•																		
	Background/Lit Review									-	-	•											
	Methodology											-	•										
	Analysis											-	-	-								•	
	Conclusions																					-	-
	Video Presentation Script																					-	-

Figure 3: Project schedule

After our first meeting with our sponsor and advisors, a concrete list of goals was created and a timeline was set. All features and changes needed to be done by mid-October, in order to give enough time to conduct a research study and implement any new changes. It was suggested we start with what seemed to be the easiest items to complete, and that is where we began. This was done to boost morale and to have something concrete done in the first couple weeks. Each member was given an item to complete. When starting, we realized how much of the code we didn't understand, and we had to devote time to understand it. This was one of our first obstacles to overcome. The first change made to the project timeline happened after the first week, and many more were to follow in the coming weeks.

### *Playback Speeds*

To improve playback speed, users were given more options. They are now able to increase the speed at which the audio is playing by 1.5 and 2. To do this we added a button that toggled between these two options and normal speed. When the audio begins this button displays the text “1.5x” and when pressed the audio speeds up by that amount and the button's text becomes “2x”. If pressed again the playback speed increases to 2x and the button's text becomes “1x” and from here the cycle repeats. These buttons work by using a pre-set function in Swift, that changes the playback speed of audio.

### *Longer Skip Times*

Previous evaluation efforts revealed that participants were interested in more control over the time position of their program. To address this, we improved the skip buttons in the new version of the AJO app. Longer skip times were incorporated by giving users the ability to go forward/backward by 30 seconds and 1 minute. It can be seen in Figure 4. This idea was suggested by a user, as it was more useful than the 15 second option that was available. In order to create these new buttons, a new media player was created, as we weren't able to change the 15 second option that came preset by Apple’s media player. The buttons work by changing the place of the audio by the corresponding amount. Labels were added so users would know the skip value.

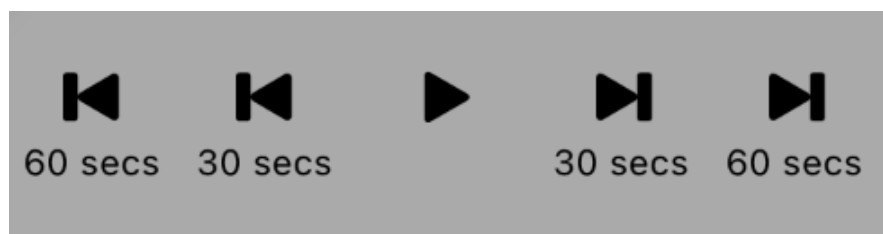


Figure 4: Skip Buttons with labels.



### *Airplay*

Airplay was an easier feature to implement as it is a pre-existing feature made by Apple. Airplay gives users the ability to play the app's audio to other bluetooth devices. To include it on the media screen, it just needed to be enabled. A difficulty we faced was having it appear on the screen, as the icon was white and so was the screen's background. To fix these, all we had to do was change the screen's background to a darker color. Once this was done, it worked as intended.

### *Change website to live website*

Our sponsor informed us the website link used by the app to retrieve information had to be changed. The old link connected to the staging environment of the website, not the production environment. The new link connected to the production environment and did not need a password to access the desired information. To make this change we just had to replace all instances where the old link was used with the new one.

### *Search Improvement*

We wanted users to not have to put the exact program name and for them to still find the desired program. To do this, our sponsor provided us with a list of words associated with programs. We then used this list to create a hashtable, and if the user searched a word that was associated with that program name, that program name would appear. This also served as a solution to the issues we had with autocorrect. Autocorrect would change the spelling of words, which would cause no results to appear, so we added this corrected spelling to be associated with said word.

### *Add Airtime*

We wanted to add airtime of any selected program. This means displaying what time and day the program airs live, so users could listen to it live if they wanted to. Figure 5 is an example of an airtime for a selected program. It appears below the program title. To get this information, a JSON file is read from the Audio Journal website, which contains all the airtimes of all the programs. We faced issues having the airtime display in correct order and for all the given days. To fix this, the information is sorted before being displayed. Another issue was having all the information fit on the screen. This was fixed by eliminating the vertical constraints of the text box.

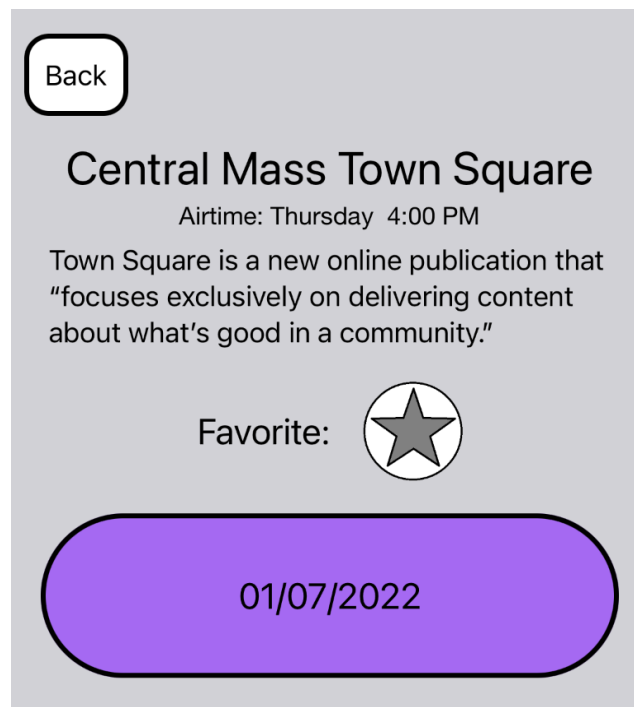


Figure 5: Example of an airtime

## *Media Player Screen*

Many of the features implemented are part of the new media player screen created. We decided to create a new media player screen instead of using the one Apple provides because it allowed us to create more custom controls. All the functionality of the controls had to be programmed. There are also two versions of this screen, as the screen for live broadcasting does not contain all the controls found on the screen for archived broadcasts. The two screens can be seen in Figure 6. The screen used for archived programs contains the Audio Journal logo, skip buttons, playback speed buttons, play/pause buttons, the ability to scroll on the progress bar, time labels, and an airplay button. The screen used for live broadcasting only contains a play/pause button, airplay button, and the Audio Journal logo. It was also important to make sure all items found on the screen had descriptive labels, so if a user used Voiceover they would know the function of the buttons.



Figure 6: Archive Broadcasting (left image), Live Broadcasting screen (right image)

When implementing these screens in the app we faced one major issue, when playing live broadcasts the audio would play twice. We were unable to solve this issue and had to settle with audio not playing when the screen starts and the user having to press the play button. This is not an issue for listening to archived programs, so the audio starts when the screen appears.

### *Internal Testing*

Once we had finished implementing all the new features we asked our sponsor to test the most recent version of the app. She would tell us if there were any issues with the app, and what needed to be fixed. This was done several times until an adequate version of the app was reached. Once this happened we started the user study where participants could test that app.

## **User Study**

To test our new implementations, a user study was conducted. With the help of our sponsor at Audio Journal, 29 testers used a beta version of the app. Of those testers, 17 were visually impaired. The feedback gathered was used to improve the app before the update was published on the App Store.

### *Target Population*

Since the majority of Audio Journal App users are visually impaired, it was important for the test subjects to fall into these categories as well. This would provide us with the most relevant feedback. Our sponsor at Audio Journal was able to find 29 people who were willing to participate, and many had used the app previously. Having previous users of the app participate in testing enabled the team to gather feedback on what features the previous users felt were improvements, and what features possibly made the app more confusing.

### *Procedure*

First all forms and questions that were going to be sent to participants needed to be approved by the IRB (Institutional Review Board). An IRB Consent form was created and sent to the review board for approval. This form can be found in Appendix A. Once approved, the team sent out an introduction email to all participants. Attached to the email were instructions for TestFlight and how to use the app. These instructions are found in Appendix B. TestFlight is an application that allows users to test beta versions of apps before the new versions are published in the App Store. All 24 participants were added as users for TestFlight. It took a couple of days

for them to be added. When a participant is added as a user, TestFlight grants them access to the beta version of the app. From there, they can test the app and report back any feedback or crashes. We followed up the introduction email by calling the testers a couple days later. The call was to make sure all participants were able to download the app and for them to ask any questions. We planned to ask questions concerning the app a week after this. In our initial call, we asked if they preferred to be asked the interview questions through the phone or by email. If they wanted to interview over the phone, another meeting was set up about a week later where we would go through each question and write down their responses. Either way they would be emailed the questions. The questions can be found in Appendix C.

After all the participants' feedback was gathered, we compared and analyzed the data to learn common ideas and suggestions. Gathering responses took longer than expected, as the user study happened before the holidays and some people decided to drop out. Overall, only nine participants provided responses. The feedback was organized into three sections: bugs and issues with the app, suggestions for improvements, and comments about accessibility. The more times a comment was made by different users, the more importance it was given. Bugs and issues with the app were held with the most importance and urgency, as they had to be fixed as soon as possible.

## **Analysis**

### *Feedback*

All testers were sent a series of questions about their experience using the app. The questions given to the users consisted of two parts: an open response section and a ranking/selecting section. The first couple of questions were demographic questions, so we knew what background each user had in regards to the app. Then users were given different prompts and could respond using 1-5, with 5 being they strongly agreed with the question. This gave us information about the users themselves and the experience with the app. The open response section allowed users to be open about their opinions and provided us with useful information on the app. In total we got 9 responses.

In the ranking/selecting section, trends began to emerge. Seven out of the nine users use smartphones to listen to broadcasts. We also learned 87 percent of testers who responded used some sort of accessibility feature. Figure 7 shows the accessibility features used by testers. This is useful information as the app was created with accessibility in mind and getting relevant feedback on the subject matter was useful. All testers ranked the app 4 or higher in regards to navigating the app, as seen in Figure 8. From this we can infer the additions we made didn't affect the usability of the app and could be used intuitively. It was reassuring, as most testers used accessibility features. This section helped us understand users' impressions of the app.

### Accessibility Features Used

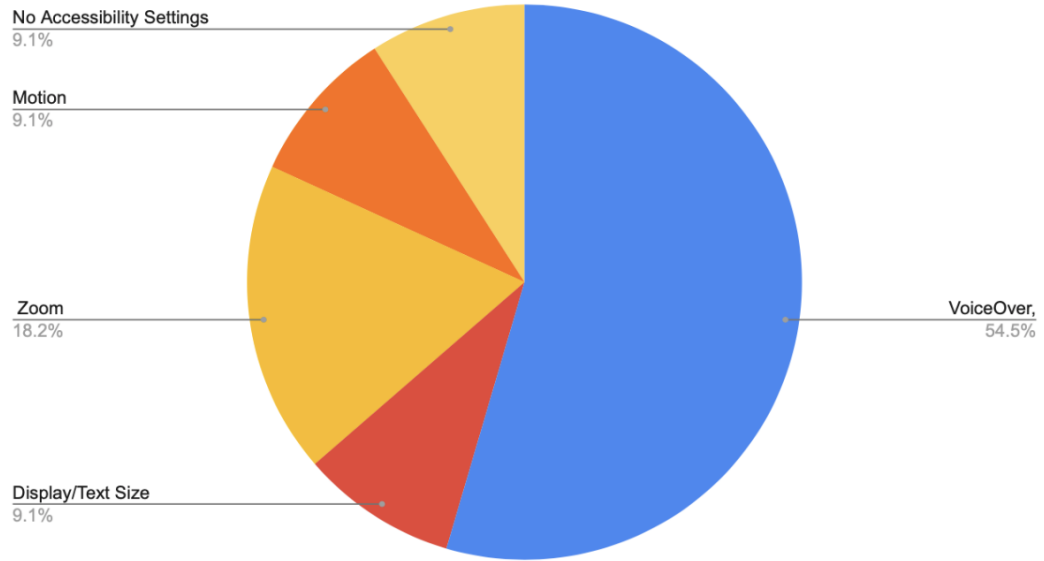


Figure 7: Accessibility Features used

### Ability to Navigate the App (Score 1-5)

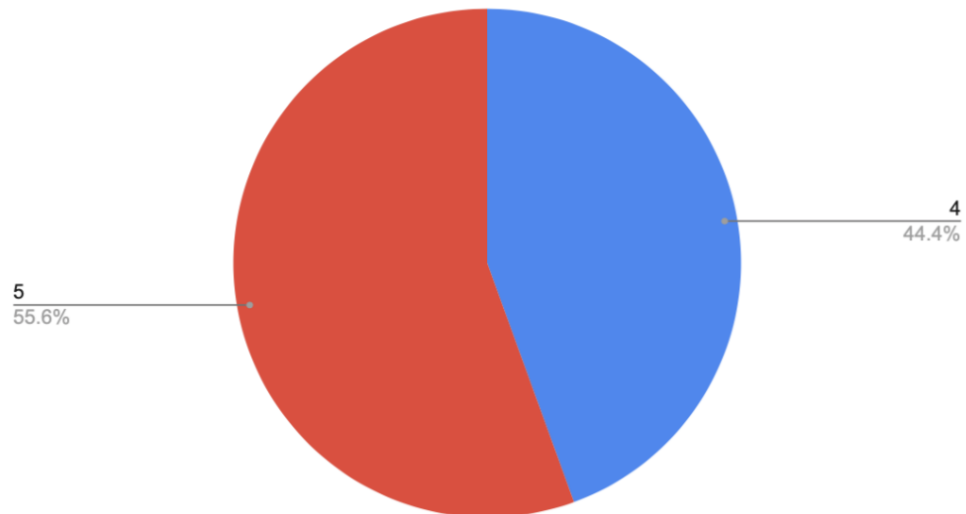


Figure 8: Ability to Navigate the App



The open response question focused on specific features of the app. Testers were asked about: media screen, media screen buttons, airplay, voice search, overall usability, any recommendations they had, and if they found any bugs/issues. Overall the feedback was positive, and helped gauge what worked and what didn't. Figure 7 highlights some of the users' responses. The user study helped us discover bugs we had missed while testing and improvements to make on features. We were particularly interested in learning about the media player, as it was the biggest change we made. All the media player buttons worked as intended. Two testers had suggestions in order to make it easier to use for people who use accessibility features. Criticisms we found to be the most useful, as it helped us improve the app for the next version.

### *Criticisms*

From the testers' responses, multiple features that needed to be fixed or improved were identified. The first issue was that the app would sometimes crash during the initial loading screen. This was reported by all testers. This problem was investigated, and the team found that it was caused by a race condition in the code. The race condition was corrected, and the crashing issue was fixed.

Another issue users found was that the VoiceOver labels on the archive media player were confusing, and visually impaired users were not able to understand them well enough to control the media playback properly. This issue was reported by 44% of testers. With this information, we then changed the VoiceOver labels on the archived media player buttons to be more descriptive and understandable by visually impaired users.

A third problem testers faced was issues with the search by voice feature. When they tried to use the microphone button to search for a program, the app would often crash or enter “microphone” into the search bar. This issue was reported by 22% of testers. To fix this issue, and better integrate Apple’s VoiceOver controls, we removed the microphone button, and instead have users use Dictate Mode, which is a built in feature of Apple that translates speech to text.

A fourth issue 22% of testers had was that the buttons on the media players were too small, and hard to use for partially sighted individuals. This was fixed by increasing the button size so that the buttons could more easily be found and pressed by users.

### *Difficulties*

While we gained plenty of valuable information through our testing, there were plenty of difficulties and setbacks we experienced during the process. The biggest difficulty we experienced was that only 9 out of 29 (31 percent) of our testers ended up sending the testing questionnaire back to us. There are a number of potential reasons why many testers did not send back data. There were a few testers who dropped out, letting us know that they didn’t have the time to do testing. We believe that other testers were also in a similar situation, but didn’t reach out to inform us of this. Another potential reason we had a lack of responses was due to the timing of our testing. Our initial testing emails were sent out from 12/8/21 to 12/10/21, while other new testers were not contacted until late December. While this was out of our control, we do believe that the holidays played a large role in why so many people were unable to finish their testing. Other complications could be continued stress from the Covid-19 Pandemic or lack of technical experience to do the tests.

Another difficulty we had was through the way we presented our questions. After receiving feedback from our testers, we found it hard to quantify a lot of the data. A lot of the questions asked were intended to be responded to with a short response. While this gave us plenty of great feedback, it didn't provide a way to group the data together and perform an analysis on it.

## **Future Work**

### *Features*

Despite the good number of features we were able to develop during this project, there are still a number of ideas that were left on the drawing board due to time constraints. We have three large scale ideas that could be implemented by a future group: adding an extension for Worcester Art Museum, creating a "Shell" app, and creating an android version of the app.

One idea that was discussed was adding the ability for the app to act as a guide for museum exhibits. We were in brief talks with the Worcester Art Museum about adding this feature for compatibility with specific temporary exhibits. This is something they are still interested in as of February 2022. This could be a viable option for the following team.

Audio Journal services are currently limited to Central Massachusetts, as it is impossible to create enough content to handle other areas with the limited time and supplies they have. While brainstorming ideas on how to expand these services to other parts of the country, our sponsor came to us with the recommendation to create a "Shell" app. This "Shell" app would be a generic take on the Audio Journal App, in which other organizations could easily modify and upload their own content to. This would be distributed to other organizations around the country

who may not have the resources to develop their own application from the ground up, as that can be a very expensive and time consuming process.

Lastly, we recommend the creation of an Android application to go alongside the current iPhone application. While Android does have fewer accessibility options than Apple, we still think it would be valuable to reach this large percent of the market. As of Q1 of 2021, Android has 38 percent of the market share in the United States (Business of Apps, 2022). Without an android application, we are potentially losing out on almost 40 percent of visually and print impaired cell phone users.

### *Recommendations*

We learned a lot throughout our time working on the Audio Journal App, and we have recommendations for the following team or anyone working on a similar app. These recommendations can be split into user study and development.

When it comes to conducting a user study, we have two recommendations. The first is to choose a testing period that doesn't overlap with any major holidays. This is a mistake we made, and this was a reason some users dropped out or took long to respond. It also made it difficult for team members to meet and to stay up to date with incoming emails. The second is to use calling as the main form of communication, as it is the best way to communicate with testers who are visually impaired. It seemed like emails would get lost and had to be resent many times during the testing period. Phone calls allowed for the tester to go into more detail and for us to get answers to all the questions. Overall it made the process faster.

When working on the app itself, we have two recommendations. The first is to test thoroughly and test using accessibility features. There were times when features we implemented

seemed to work, but after our sponsor tested she would inform us of edge cases we had missed. Also when we did our user study, we discovered that some of our button labels were not useful and had to be redone. It's important to make sure everything works with accessibility features, as they will most likely be used by the app users. Our second code recommendation is to keep up with code cleanliness. It is something we often forget to do, and it made it harder to understand what we had written when we looked back at it. Since this project will continue after us, it is important the next team will understand how everything works, and in general code should be intuitive.

## **Conclusion**

Overall, the team feels that the project was a success. We were able to successfully upload the updated version of the app to the App Store in February. While we didn't have the smoothest testing experience, our testers found that the app was improved on multiple fronts. They agreed that the many additional features and bug fixes went a long way in improving the overall user experience. We hope to see next year's team continue to build on what we have accomplished and continue to improve the Audio Journal App experience for visually and print impaired individuals.

The app has a lot of potential and will be a useful tool for the visually impaired community in Worcester. It can be used by other organizations, like the Worcester Art Museum and other similar organizations, to make them more accessible and help visually impaired people feel part of the community, as well as be used by other radio services outside of central Mass. We

have high hopes for the future of the Audio Journal App and believe it can improve the lives of many people.

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# Appendices

Appendix A: IRB Consent Form

Appendix B: Testing Instructions

Appendix C: Questions after initial testing phase

# **Appendix A: IRB Consent Form**

## **Informed Consent Agreement for Participation in a Research Study**

**Student Investigators:** Caleb Farwell, Amy Orozco, Ben Robinson

**WPI Faculty Advisors:** Rodica Neamtu, Lane T. Harrison

### **Contact Information:**

#### **Student Investigators:**

Caleb Farwell, Email: [cwfarwell@wpi.edu](mailto:cwfarwell@wpi.edu)

Amy Orozco, Email: [aforozco@wpi.edu](mailto:aforozco@wpi.edu)

Ben Robinson, Email: [brobinson@wpi.edu](mailto:brobinson@wpi.edu)

#### **Faculty Advisors:**

Rodica Neamtu, Email: [rneamtu@wpi.edu](mailto:rneamtu@wpi.edu)

Lane T. Harrison, Email: [lharrison@wpi.edu](mailto:lharrison@wpi.edu)

**Title of Research Study:** App For Audio Journal

**Sponsor:** Audio Journal

### **Introduction:**

Hello, you are being asked to participate in a research study. We are part of a team from WPI conducting research on the usability and accessibility of our app. This research will be published, but no personal information will be included. Before you agree, you must be fully informed about the purpose of the study, the procedures to be followed, and any benefits, risks or discomfort that you may experience as a result of your participation. This form presents information about the study so that you may make a fully informed decision regarding your participation.

## **Purpose of the Study:**

Our team is working with the company Audio Journal, which is a radio reading service in Worcester, Massachusetts that broadcasts to blind and visually impaired people in Central Massachusetts. In addition to broadcasting local news, they also have their own specialty programs. We are continuing last year's project. New features have been added and minor issues have been fixed. The purpose of the study is to test the Audio Journal iPhone/iPad app. We are looking for blind or visually impaired participants who own an iPhone or an iPad to help us with testing the app. Our overall goal is for users to navigate the app effectively, and that all of the features work as intended. While blind and visually impaired people are the main focus of this study, we are also looking for some people without blindness or visual impairments to test the app as well. As a part of this study, we will be writing a written report of our findings.

## **Procedures to be followed:**

- All materials for this study will be sent via email.
- You will be sent a set of instructions that will tell you how to download the app and guide you through the first step of the testing process.
- At the end of this process, you will be asked to answer a set of questions.
- After you answer these questions, you will use the app on your own for one week. At the end of the week, you will be asked to answer a second set of questions to finish the testing process.
- Answers to questions should be sent as a reply to the email that sent you the questions and instructions.
- Your identity and responses to individual questions will be kept confidential.

## **Risks to study participants:**

Standard risks associated with using smartphones

## **Benefits to research participants and others:**

Your participation will help us to improve access to Audio Journal's content, giving listeners more control over how they listen. You will have first access to new features.

**Your participation in this research is voluntary.**

Your refusal to participate will not result in any penalty to you or any loss of benefits to which you may otherwise be entitled. You may decide to stop participating in the research at any time without penalty or loss of other benefits. The project investigators retain the right to cancel or postpone the experimental procedures at any time they see fit.

**For more information about this research or about the rights of research participants, or in case of research-related injury, contact:**

WPI IRB Manager: Ruth McKeogh, Tel. 508 831-6699, Email: [irb@wpi.edu](mailto:irb@wpi.edu) or

WPI Human Protections Administrator: Gabriel Jonson, Tel. 508 831-4989, Email: [gjohnson@wpi.edu](mailto:gjohnson@wpi.edu)

**By signing below**, you acknowledge that you have been informed about the study, and consent to be a participant in the study described above. If you are under the age of 18, your parent or legal guardian must also sign this form. Make sure that all of your questions are answered before signing this form. You are entitled to retain a copy of this consent agreement.

**Printed Name** \_\_\_\_\_

**Study Participant Signature:** \_\_\_\_\_ **Date:**

(if participant is under 18 years of age)

**Printed Name of Parent/Guardian:** \_\_\_\_\_

**Parent/Guardian Signature:** \_\_\_\_\_ **Date:**

(for investigator use only)

**Investigator Signature:** \_\_\_\_\_ **Date:**

# Appendix B: Testing Instructions

## Audio Journal App Testing Instructions

Thank you for choosing to participate in the testing of the Audio Journal App. If you have any questions about the testing process, need help installing the app, or no longer wish to participate in the testing process, please send an email to [gr-audiojournalteam@wpi.edu](mailto:gr-audiojournalteam@wpi.edu).

### Instructions for Downloading the Audio Journal App Beta

1. Go to Apple's App Store and download TestFlight
2. You should receive an email from TestFlight inviting you to test the Audio Journal app. Open the email on your iPhone and press the button that says "View In TestFlight". This should redirect you to a web browser.
3. On the webpage you will find the redemption code needed to download the app in TestFlight. Keep note of the code, as you will need it for the next step.
4. Open TestFlight on your phone, choose the "Redeem" option, and enter your redemption code.
5. After you've entered the code, press the "Install" button to install the Audio Journal App on your phone. You will need to enter your Apple ID.
6. Once the app is installed, press the "Open" button to open the app. An app icon should also be added to your phone's home screen that you can also use to open the app.

### How to Update the App

1. Open TestFlight (not the Audio Journal App)
2. If there is a new version available, the "Open" button next to the Audio Journal app icon will instead say "Update".
3. Press the "Update" button to install the new version.

### How to Uninstall the App

1. You can uninstall the Audio Journal app like any other app on your phone. For more information on how to uninstall apps on your iPhone, please consult the instructions at <https://support.apple.com/guide/iphone/remove-apps-iph248b543ca/ios#:~:text=Do%20any%20of%20the%20following,to%20delete%20it%20from%20iPhone>.

### **App Information:**

The Audio Journal App is created for iPhones and iPads. The purpose of the Audio Journal app is to make available a listening method with access to live and archived broadcasts that will carry Audio Journal into the future. Audio Journal programming includes local news from Central Massachusetts, as well as a number of specialty programs.

The app currently has the following features:

- The ability to tune in to Audio Journal’s live broadcast
- The ability to browse archived broadcasts
- The ability to “favorite” programs
- The ability to change the color palette of the app for better contrast
- Compatibility with Apple’s accessibility features
- A search bar to help users find programs
- The option to continue listening to the last broadcast you opened
- To option to navigate the app using Voice Control

We have added the following features

- The ability to select a playback speed
- Longer skip times
- Airplay, an Apple feature that allows connection to Bluetooth devices such as Apple TVs and speakers
- Improved search and voice search
- Added airtime to archived program pages
- A new media screen

We will be updating the app as we fix bugs, so check to see if a new version of the app is available before testing. You will be able to keep the app after testing.

### **Testing Instructions:**

The testing will begin with a **guided testing phase**, where you follow a set of instructions and observe the results. Use whatever accessibility options you normally use to navigate apps on your iPhone or iPad. These instructions will not guide you step by step on how to use the app, but will instead ask you to find and test the features on your own. We encourage you to look through the app’s Help Menu to learn more about the features. If you still have trouble completing any of the instructions after reading through the Help Menu, please skip the current step and move on to the next.

Once the guided testing phase is over, you will answer a set of questions about your initial experience. If you would like to set up a phone call for us to ask you the testing questions, please send an email to [gr-audiojournalteam@wpi.edu](mailto:gr-audiojournalteam@wpi.edu) and we’d be happy to accommodate you. It is important that you answer these questions as soon as you can after testing, so please plan accordingly.

### **Guided Testing Phase:**

1. Tune into Audio Journal's live broadcast by clicking the "Listen Live" button. Our custom made media screen will open, and press the play button to listen to Audio Journal's live broadcast (after a short advertisement).
2. Use the app's archived programs to find an individual program listing. Each listing includes the program's description and a list of previous broadcasts by date.
3. Once you're on the listing for a particular program, you have the option to add that program to your "Favorites List". Add a program to your Favorites List, then choose a broadcast to listen to by date.
4. When playing an archived program, familiarize yourself with the media player controls. These controls include the play/pause button, skip buttons, playback speed buttons, and slider. Notice that the archived media player has more controls than the live media player.
5. Access your selected Favorite program from the Favorites Menu. Do not use the Browsing Menu.
6. If you know the name of a particular program you want to hear, or are looking for news specific to your community, you can use the search function. Try searching for "Accent on Ability", "Community News - Gardner", or "Speaking Volumes".
7. Use the Voice Control feature to search for the same program from the previous step.
8. This marks the end of the guided testing phase. At this point, you should answer the initial testing questions.



# Appendix C: Questions after initial testing phase

## Questions after initial testing phase

Which accessibility options did you use when navigating the app? Check all that apply

- VoiceOver,
- Display/Text Size
- Zoom
- Magnifier
- Motion
- Spoken Content
- Audio Descriptions
- Voice Control
- No Accessibility Settings

On a scale from 1 to 5, with 5 being most proficient, how would you rate your skill as an iPhone user?

Are you a current or former Audio Journal listener?

If Yes:

What is/was your main way of listening to broadcasts? Check all that apply

- Smart Speaker
- Smart phone
- Website link
- Landline phone
- Cable tv
- Receiver

Have you used the Audio Journal website to access previous broadcasts?

- Yes
- No

Have you previously participated in testing the Audio Journal app?

- Yes
- No

**Opinion Based Numerical Questions:**



- Audio continuing after leaving the media player window

If yes, please describe in as much detail as possible what didn't work.

Did you have any other difficulty using the app?

If yes, what was difficult?

(Only answer the next question if you used VoiceOver when testing the app)

When navigating the app with VoiceOver, did all of the buttons have descriptive labels? If not, which labels would you change?