Acadia National Park Trail View Website

An Interactive Qualifying Project submitted to the faculty of
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Abstract

The goal of this project was to improve upon an ongoing project by updating a holistic website created by WPI that displays the natural beauty of Acadia National Park. To accomplish this, we worked with Acadia National Park to create virtual panoramic tours of every hiking trail and include educational content about the national park. We conducted interviews and questionnaires to identify relevant information for the website, used panoramic cameras and software to create virtual tours, and monitored website traffic with analytics software. After identifying topics for the website, we created informative sidebars and added the virtual trail tours in a user-friendly format on a widely accessible website for the public to learn about Acadia whether visiting in the park or exploring online.

Acknowledgements

Our project would not have been successful without the guidance and support of everyone who helped us during our time in Acadia National Park. We would like to thank our sponsor, Acadia National Park and its representatives, Dr. Abraham Miller-Rushing and Dr. Adam Gibson, for guiding us on this project.

Our interview and questionnaire participants played a key role in the development of the website and its content, we would like to thank them for their time.

We would also like to thank Worcester Polytechnic Institute for giving us the opportunity to travel to Bar Harbor, Maine for the summer following an unprecedented year. Without this opportunity we would have not been able to truly understand and display the natural beauty of Acadia National Park on our website.

Furthermore, we would like to thank several members of the WPI community that provided professional guidance and support throughout our project. First, we would like to acknowledge our advisors, Dr. Frederick Bianchi and Dr. Courtney Kurlanska, for helping us grow professionally as individuals and as a team. With their encouragement and advice, we were able to produce a product that makes the park accessible to many populations while meeting the park's goals. We would also like to thank Ermal Toto from the Information Technology department at WPI for his assistance with the technical aspects of the website and the research librarian dedicated to our project, Karen Coghlan, for her assistance with identifying and citing credible sources.

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Executive Summary

National Park online engagement is a growing subject within the National Park Service[1]. Increasing online engagement can help the park's purpose of promoting education to as many people as possible. To increase online engagement of national parks, third-party websites can help the park reach a broader range of audiences, not just for people visiting the park in person, but for cyber tourists, people exploring the park digitally. The National Park Service already has a website, but this website does not have many interactive features a cyber tourist would potentially look for. The WPI Trail View Website is designed to pick up where the national park website leaves off. This website was started in 2020 and included some interactive trail view tours for people to experience the park digitally. This year all of the trail tours were added on the website, as well as a variety of information about the park from historical to wildlife to safety information. The website also links to many pages on the National Parks website to help maintain information accuracy.

Methodology, Goals, and Objectives

The mission of this project was to work with Acadia National Park to create an intuitive website that will increase accessibility to the park and enhance the park experience for a wider range of audiences. To meet this goal, the project was divided into three objectives, the first being to delineate and improve the comprehensiveness of trail view tours on the 2020 version of the website. The comprehensiveness of the website was assessed by thoroughly auditing every trail to make sure all pictures were free of obstructions, lighting glare, and dark images. The list of trail tours on the website was then cross-referenced with Acadia National Park maps to see which trails, if any, were missing. Once this was done, a list of trails needing to be photographed for the first time or redone was created. This list was sorted by location to make finding the trails easier for website visitors.

Our next objective was to determine the most relevant sidebar topics and identify related references. These topic preferences were identified by conducting interviews and questionnaires in the park and online. The main questions asked in each of these interviews were, where do people look for information, and what information do people look for. These questions let us understand what people want on the website and if third-party websites are relevant and something people will use. Once sidebar topics were chosen, they were organized into categories determined by our research.

Our final objective was to assess the success and user-friendliness of the website. This was done by adding Google Analytics software to the finished website to monitor and understand how people interact with the website. This information allowed the team to understand how the website is being used so that future teams can make evidence-based improvements. Figure A shows the homepage, menu bar, and sidebars on the Acadia Trails website.

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[1] Miller-Rushing, A. J., Athearn, N., Blackford, T., Brigham, C., Cohen, L., Cole-Will, R., Edgar, T., Ellwood, E. R., Fisichelli, N., Pritz, C. F., Gallinat, A. S., Gibson, A., Hubbard, A., McLane, S., Nydick, K., Primack, R. B., Sachs, S., & Super, P. E. (2021). COVID-19 pandemic impacts on conservation research, management, and public engagement in US national parks. *Biological Conservation, 257*.https://doi.org/10.1016/j.biocon.2021.109038

Figure A

Screenshot of Acadia Trails Website

Findings

While analyzing our research from our inventory, interviews and questionnaires, and website analytics software, we made several discoveries. Through the assessment of the old website, we discovered that 55 trails needed to be photographed, and 14 of those were redos. A total of 43% of the trails had to be photographed by us. We were successful in taking the 360-degree panoramic photographs of the 50 trails that were open. Once these panoramic photographs were taken, they were compiled into trail 360-degree virtual tours using Pano2VR software. It took about 1.5 to 2 hours to finish each trail tour. Once these tours were made, a quality check was done on each tour to ensure top quality. It was discovered that many trail tours had issues related to problems with the software. Once these issues were addressed, all of the trail tours were uploaded to the website.

To ensure the information included on the website is most useful, we conducted interviews and questionnaires. When asking where people search for information, we learned that 68% of people use the National Park website to find information, and 66% use third-party websites. Other resources like guidebooks, maps, and blogs had much lower percentages. This showed that, as a third-party website that links directly to the National Park Service website, most people would be comfortable using our website. This is also important since our website will host information directly from the National Park Service so that misinformation can be minimized.

Through the last survey question, asking what information people search about Acadia National Park, we found that people look for different information, whether at home or in the park. This highlighted the importance of our website including a wide range of information so it

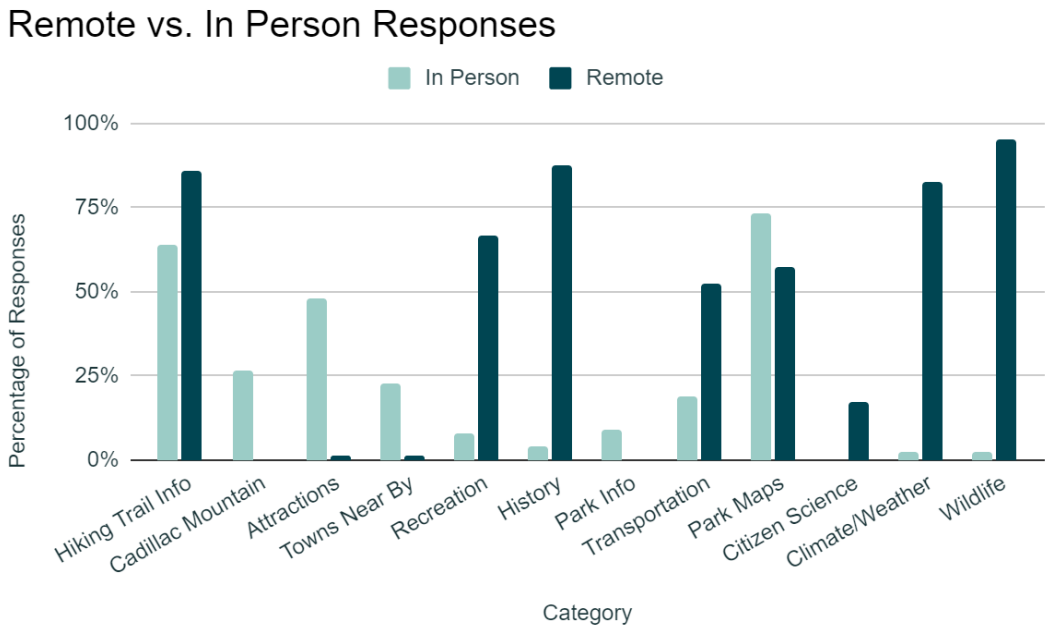
could tailor to a wide range of audiences. We had a total of 138 responses, 63 were remote, and 75 were interviewed in person. The percentage differences were most drastic in the "Climate," "History," and "Wildlife" categories. In all these cases, significantly fewer responses came from in person responses compared to the remote questionnaire responses. The bar graph in Figure B shows this along with the topics people look for about Acadia National Park. All of these categories were included on the website to ensure that every group was represented so that the website will be relevant to wider audiences.

Once the sidebars and trail pages were updated on the website, Google Analytics was added to the website. This software allowed the team to understand how visitors use and interact with the website. Through the data acquired, the project team found that the website was able to grab visitors' attention and was easily navigable. The software showed that about 46% of visitors leave the website after landing on the homepage. This rate is well within the average range for websites, between 40% and 55%[2]. From this data, it can be understood that the homepage is well designed and grabs users' attention.

Furthermore, upwards of 85% of website visitors who stayed on the website were able to access a trail view page or sidebar page within three clicks. This information informs the team that the website can be easily navigated and follows established website design rules. While the analytical data shows that the website is performing well, the team believes that it can be further improved upon by consecutive teams by adding additional sidebars and creating new ways to interact with the website.

Figure B

Remote vs. In-Person Response Data



[2] Payton, J. (n.d.). What's the average bounce rate for a website? RocketFuel. Retrieved July 22, 2021, from https://www.gorocketfuel.com/the-rocket-blog/whats-the-average-bounce-rate-in-google-analytics/

Discussion

The research conducted by the team showed that there is a need for websites to include a variety of topics pertaining to Acadia National Park. In-person and online respondents had a variety of topics that they were looking for. The team included a wide range of topics, even if a topic was only mentioned by one interview group, to ensure the website is as engaging as it can be for all audiences.

The team's research also demonstrated that when people look for information about Acadia National Park, they tend to use both the National Park Website and third-party websites as primary sources. This demonstrates the need for third-party websites to stay updated with accurate information and suggests that third-party websites should collaborate with or link to the National Park Service website. It is important for third-party websites to focus on reliability, as most park visitors will be using them as a resource.

Finally, the results of the team's interviews and questionnaires showed that no one physically in the park mentioned researching citizen science opportunities in Acadia. This was surprising as one of the primary purposes of the National Park Service is to promote education, and one way they do this is through citizen science events. If a wider range of people were aware of the citizen science opportunities available, the National Parks would educate more people and have a higher rate of participation in these events.

Recommendations & Conclusion

Given that part of the park's purpose is to expand upon education and engagement, the team recommends that Acadia National Park considers increasing awareness about the citizen science opportunities at the park. This can be done by promoting opportunities through our website as well as through the National Park Service website. Only about 8% of the respondents in our interviews and questionnaires looked for citizen science in national parks, and of this 8%, they were all remote respondents. Additionally, the team recommends that Acadia National Park considers linking their website with ours. Our website offers a unique interactive experience with virtual 360-degree trail tours and can increase online engagement with the park.

The project team set out with the goal of improving the website created by past WPI teams. The team finished panoramically photographing all of the remaining trails in the park and uploaded them all to the website. Now, every trail in Acadia National Park can be experienced virtually on the website. Additionally, the team created sidebars filled with content tailored to address the interests of our interview and questionnaire participants. Lastly, the project team applied a website analytic software to the website, which provided insight as to how users navigate the website and how it can be further improved in the future to provide audiences with a holistic experience.

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1.0 Introduction

The internet has removed barriers of communication, education, and now, recreation. While national parks attract many visitors each year, there are still many people who are not able to visit the parks in-person. Interactive websites are one way that our national parks can reach a broader audience. While each national park has a website with detailed information about the park, most do not have extensive interactive content. Incorporating a greater amount of engaging materials into their online presence can help the national park facilitate online engagement and education, thereby upholding their commitment to promote education and engagement with the park.

The 2021 Trail View Website team has continued work on a project designed to digitize all of the trails in Acadia National Park in the form of 360-degree tours, allowing park access to wider audiences. Almost every trail has been panoramically photographed, uploaded to the project website, and is available for the public to experience digitally. Improving the quality of online engagement makes it easier for people interested in Acadia, and potentially other national parks, to experience what it has to offer. The overarching goal of this project was to update and improve the existing website by creating a holistic platform that includes information about hiking safety, education in the park, trip planning, and the trail view tours of every trail in Acadia National Park.

This report will first cover research on website design, features, and creation, along with cyber tourism and the history of Acadia National Park. The methodology section then explains how each trail was cataloged, how interviews were used to understand what the public would like for sidebar topics, and how using website analytics software provided information on website user-friendliness. Finally, this report will analyze the data collected from both the interview and website analytic processes, and how this data prompted the team to make focused improvements to the existing website. As a final result, the team produced a user-friendly, holistic website that includes information and interactive trail tours that fosters education and accessibility to Acadia National Park.

2.0 Background: National Park Online Engagement

Online engagement with informative websites is becoming more common (Newman, 2021). While prominent among large companies, it is growing in popularity among public institutions, and the national parks are no exception (Newman, 2021). Currently, national parks offer online engagement, but it remains limited to only a few parks, as creating online content is limited by staff time and expertise (Miller-Rushing, et al., 2021). Of these parks, the project team could not find any that provide an interactive experience where guests can virtually visit or experience the park and walk its trails. Online interactivity is vital for public engagement with parks, especially as the public uses technology more and more while visiting national parks (Miller-Rushing, et al., 2021).

A study conducted on national parks and their websites during the COVID-19 pandemic concluded that when people cannot go to a national park, they will access that park and engage with it in an online medium (Miller-Rushing, et al., 2021). These findings hold even when there is not a pandemic because there are many barriers that could prevent someone from visiting a national park (Miller-Rushing, et al., 2021). That same research showed that while people were visiting the park websites, they would often watch videos or read about the park (Miller-Rushing, et al., 2021). This demonstrates that people choose to engage with parks online when they are unable to visit in-person. This study supports the move for national parks to create new unique ways to engage with the public through an online medium.

2.1 Cyber Tourism

One common type of online engagement is cyber tourism, a new form of tourism rising to prominence in today's age of technology. An article published in the *Tourism Review* journal discusses the role of virtual reality experiences in the context of cyber tourism. The article defines virtual tourism content as an experience that "creates a virtual environment by the provision of synthetic or 360-degree real life captured content" (Beck J, 2019). Replacing a physical experience with a digital one, can help overcome barriers such as time investment, monetary costs, and physical ability (Ross, 2015). By removing these barriers that would typically get in the way, more people can experience what is offered, rather than being limited to traveling there physically.

Cyber tourism can take many forms. One of these forms is through continuous Point-of-View videos of someone hiking through various destinations like Grand Canyon National Park, Arizona, or Marina Bay, Singapore. Another form is through virtual tours, where the user can independently explore a series of 360-degree photos to look around and explore a place as if they were there (Garden Gnome Software, 2020). One popular example of virtual touring software is Google Street View (www.google.com/streetview). This website lets people see the world as if they were walking down the street in places around the globe. The user can see the buildings, roads, and occasionally other pedestrians in a 360-degree view and click to "walk" to another point. This makes for a very immersive experience that lets people see the world's cities from their computers. Beyond a visual experience, users can supplement their virtual experience with a rich variety of information about the destination.

2.1.1 Cyber Tourism in the National Park System

In the 2011 publication by the National Park Service entitled *A Call to Action,* it is mentioned that the Parks System wants to increase online engagement. Goal 17 in *A Call to*

Action states, "[The NPS will] Reach new audiences and maintain a conversation with all Americans by transforming the NPS digital experience to offer rich, interactive, up-to-date content from every park and program." One part of this endeavor is facilitating cyber tourism in the parks. Some of the parks' websites include short video tours of various trails in the park, such as Acadia, Indiana Dunes, and Yellowstone. Others like Yosemite, Glacier, and Rocky Mountain, have webcams set up to provide live views of the park. Several third-party websites help provide interactive and digitally engaging content for the parks. Terrain360 is one example of a virtual tour third-party website. It is similar to Google Street view, but it covers trails instead of roads. Using this site, the user can explore panoramic tours of park trails for several of the biggest national parks in America, as shown in Figure 1. However, this website only includes the most popular trails in the most popular parks.

Figure 1

Terrain360 Website, Jordan Cliffs Trail Acadia National Park

Note. (Copyright 2021 Terrain360)

2.1.2 Virtual Tour Software

Today, many programs have been designed to create virtual tours with panoramic images. Pano2VR is one of the multiple softwares that can create virtual tours. Pano2VR, created by Garden Gnome Software, is a potential tool for creating virtual tours from 360-degree panoramic images. The program links together the photos both manually and automatically through GPS data attached to the images. Once the tour is built, Pano2VR has many other features to edit the tour for the best user experience possible. Some of these features include adding images or blur spots, adding links to external sources, and incorporating audio and video files. When editing is complete, the tour can be published and hosted on a website for people to explore.

2.2 Website Design

Website design must be considered when creating engaging online content such as cyber tourism websites. Several rules should be followed to generate the most comprehensive and appealing website. The main rules of focus, illustrated in Figure 2, include the "three-click rule," wayfinding techniques, and aesthetic concepts.

Figure 2

Website Design Concepts

Three-Click Rule	Wayfinding	Aesthetic Concepts
• 3 clicks or less to find the desired content • Makes navigating the website easier • Holds website user's attention for longer	• Must be easy to navigate the website • Use sidebars or menu bars on every page • Mitigates the amount of backtracking users need to do	• Main feature should appear on the homepage • Organize information in grid format • Condense text information to hold user's attention

The "three-click rule" is a valuable design rule to help engage readers (Porter, 2016). Some website designers argue that anything on a website that takes more than three clicks to find will not be looked at by most of the website's traffic (Porter, 2016). A study conducted at the University of Barcelona in Spain researched the number of clicks it takes website users to find information. The study had users complete a long task, taking nine clicks to do, and a short task, taking four clicks to do, and found that 13.7% of users could not complete the long task while all users completed the short task (Jiménez Iglesias et al., 2018). This suggests that most tasks should be done within one to four clicks on any easily navigable website and should never exceed nine clicks.

According to an article published by David Zheng, the average time spent on a website by a new user is less than 15 seconds (Zheng, 2020). In this 15-second time frame, the website needs to attract the users' attention to keep them engaged (Haile, 2014). Another study found that users leave websites within the first 10 seconds (Liu, 2010). If users can quickly find the desired information, they are more likely to stay on the website longer. A website analytical concept called bounce rate can show if people are staying on a website or leaving without interacting further. This concept is defined by Google Analytics as "the percentage of all sessions on [a] site in which users viewed only a single page [and did not interact with the page]" with one of these sessions being called a 'bounce' (Google, 2021). Having a lower bounce rate is desired and means that people visiting the website are engaging with it, instead of immediately navigating away (Google, 2021). A website can be built to ensure the user stays and can quickly

access and interact with the desired information by using both the three-click rule, the 15 or 10 second time frame, and by analyzing website bounce rates.

A well-developed website also reduces how much a user needs to backtrack on a page. A study conducted to analyze web browsing behavior found that users thought a website was more understandable if the wayfinding, methods of navigating a website, was easier to follow (Gek, 2006). A basic example of good wayfinding is having hyperlinks or a menu bar at the top of each page, allowing easy navigation through the website. The labels for each subpage in the menu of the website need to be relevant and distinct. A usability study completed in 2016 listed competing links and categories as a common design mistake. If two links have relatively similar names or content, it can be challenging for users to differentiate and find the desired information (Schade, 2016). Viewing a website non-linearly will enable users to quickly jump around to the information they want without backtracking (Gek, 2006).

One final organization technique is elaborated in a study conducted in 1998 regarding how websites are used. It was found that users generally scan and glance at a website rather than reading in-depth. According to the study, "[more users would rather have a site be] short and to the point" (Morkes, 1998). A more recent study done in 2018 supports this by concluding that "increased fixation duration reduces the possibility to perceive a website as highly appealing" which means that the longer someone stays looking at a web page the less appealing it is (Pappas, et al., 2018). Less wordy and more chronological pages on a site will benefit usability and increase the website's traffic. A great website needs to have categories in a grid format listed in order of importance regarding the website goal (Brinson, 2007). The website's main feature should be on the homepage, showing the most important item immediately to the user (Beaird, 2020).

2.3 Website Features

There are many different features a website can have to support its goal, but some features are key to a successful website. Website features differ from website design in that design focuses on aesthetics and content placement, while features focus on key elements that a website should have. These features include the home page, menu bar, and sidebars. If these key features are not skillfully completed, a website will not be as intuitive and informative as it can be (Minichiello, 2017).

A home page is arguably the most important piece of a website. The user's first impression is based on this page and has the greatest impact on whether the user stays longer than 15 seconds. The home page should not be busy or overwhelming. Instead, it should be straightforward and easily convey the website's goal (Haile, 2014). In one study, the way students viewed a website's home page was analyzed (Singh, 2005). This study found that the whole makeup of the homepage is more important than the individual characteristics of the page, and it needs to be simple and straight to the point (Singh, 2005).

Menu bars are essential features that allow users to navigate the website without using the browser back button. As suggested before, menu bar links must not contradict or have similar items to other links on the menu bar. The menu bar should have no more than six main categories on the website (Jimdo, 2018). Keeping the categories to six or less allows for easier user access to the website (Zheng, G, 2015). Menu bars help to create a website that is easy to navigate and understand, upholding the website design concepts previously mentioned (Zheng, G, 2015).

Sidebars are another key feature and are essential for user-friendly website navigation. They are essential for information organization and allow users to view only the information they are interested in rather than sifting through all the information on the website (Jiménez Iglesias et al., 2018). Typically, sidebars can be found on the left side of the website page and are immediately visible once a website is open. Sidebars are always visible despite the page of a website a user is on facilitating direct navigation to any page. Each sidebar has a specific title referring to its content and links to a different website page dedicated to that content. Having a multitude of specific sidebars can help limit the number of clicks it takes a user to find the desired information, increasing the amount of time a user stays on the website (Jiménez Iglesias et al., 2018).

2.4 Website Content

A comprehensive website must have content that is relevant, accurate, informative, and appealing. Website content is the information and images included on a website and is strategically placed using website design rules. The content must be appropriate to the website's goal so that users will find the website appealing (Zheng, G., 2015). A website that does not pertain to the title presented leaves users confused and lost. Unappealing, confusing, and inconclusive content ultimately leads to the user leaving without the intent to return (Geissler, 2006).

The content within the website's pages is the core of the website and must align with the goal. The homepage contains the most important information related to the topic because it is the website's main feature. The menu bar has categories on the subject matter directly related to the website and its goal. Sidebars include content similar to the following: text, images, videos, and links to other websites. By including links and suggestions to other sources, a website can hold a lot of information and serve as a hub for guidance on a particular topic. Both the menu bar and the sidebars increase accessibility for website users to learn about the topics of that particular website.

2.5 Acadia National Park

Aligning with the National Park Service goals, Acadia National Park is looking to increase accessibility to the park for those who cannot visit in-person and provide a supplemental experience for those visiting the park. Mount Desert Island was granted national park status in 1916 and was named Acadia National Park in 1929 (Kaiser, 2018, Pg.124). Its footprint is shown in Figure 3 below. The Wabanaki confederation, European settlers, and vacationers created many of the 150 miles of trails that still remain on Mount Desert Island today, one of the many attractions of the park (McBride, B., & Prins, H., 2009). To this day, tourists and adventurers enjoy the plethora of hiking trails, ecosystems, and natural attractions Acadia offers. By improving the accessibility of information about the natural landscapes, trails, wildlife, and park history, people will be able to learn about all that Acadia National Park offers. Increasing the availability of this information aligns well with the park's purpose: to "protect ecological integrity, cultural history, scenic beauty, and scientific values…" ("Foundation Document", 2016). This purpose can be promoted by increasing the availability of information to better educate people.

Figure 3

Map of Mount Desert Island

Note. This map shows the relative geographical locations of both Mount Desert Island. The areas shaded in green represent the locations of Acadia National Park (NPS, 2020)

2.6 Previous Work Done by WPI

The Trail View project has been working to foster an engaging digital medium at Acadia National Park since 2012. The first teams were responsible for photographing and cataloging the trails of Acadia National Park (Muzilla et al., 2020). The 2020 project team developed the first iteration of the Acadia Trails website. This website was designed to make the virtual tours accessible to the public while also making informative sidebars to go along with the trails. The team was not able to fully complete a detailed website, leaving several trails without photographs or trail tours and the sidebars without information. The team suggested improving the website design and content, adding an interactive map, and including more trails and photos for virtual trail view tours (Muzilla et al., 2020). The 2021 project team expanded on the previous work by researching how to improve user engagement on the website through design, interactive maps, and informative sidebars.

2.7 Website Creation

As discussed in 2.6, this project is a continuation of the 2020 Trail View team's work. There is already an existing base for the website created using WordPress. The primary advantage of WordPress is that it is designed to work on the designers' web servers, allowing WPI to use their existing infrastructure to host the website (Khan et al., 2017). WordPress is also a modular system, meaning that the program has a robust plug-in system. Both WordPress and third-party publishers can create plug-in programs that the designer can insert and enable on their website, giving more options and functions for website creation and management (Khan et al., 2017). This allows for a designer to change the functionality of WordPress to meet their specific needs. Once a designer has planned the website's features, content, and design and gathers the tools to make it possible, the website can be created, molded, and improved to be the best it can be. Several methods have been chosen that have addressed the improvements needed for the existing website.

Using the existing website developed by the 2020 team, the Trail View team added a variety of information for a wide range of audiences. The team developed a list of sidebars based on research of two populations, restructured the design of the website according to the design rules discussed above, and improved the interactivity of the website by continuing and improving the panoramic photography and trail view tours of all trails in Acadia National Park. This continuation developed the website into a holistic, one stop shop, for tourists, cyber tourists, and educators alike.

3.0 Methodology

The goal of this project was to work with Acadia National Park to create an intuitive website that will increase accessibility to the park and enhance the park experience for a wider range of audiences. To meet this goal, the project was divided into three objectives:

1. Delineate and improve the comprehensiveness of trail view tours on the current website.
2. Determine the most relevant sidebar topics and identify related references.
3. Assess the success and user-friendliness of the website.

For the first objective, the comprehensiveness of the website was assessed by looking at which trails were included, and which trails were yet to be published as a trail view tour. This evaluation determined what must be photographed and the course of action to photograph trails and create 360-degree trail tours.

The second objective identified the most relevant sidebar topics that patrons of national parks are most interested in. These topic preferences were found by conducting interviews and questionnaires. Once topics were determined, the team provided the subject matter for each in organized sidebars.

The third objective assessed both the success and user-friendliness of the website. This required adding analytical software to the website to monitor and understand how people interact with the website.

3.1 Delineate and Improve the Comprehensiveness of Trail View Tours on the Current Website

To determine the comprehensiveness of the website, the Trail View Team created visual comparisons to fully understand what was not documented on the original Acadia Trails website. This required the team to look through 92 trail view tours on the current website and inventory photos taken by previous teams. Creating an inventory of the trails helped the team understand how much work was left to complete photographing the trails. The inventory of the current Acadia Trails website was cross-referenced with the Acadia National Park website and the *Acadia National Park Trail Map.* This allowed for a greater understanding of what was missing from the Acadia Trails website, enabling the team to go about photographing trails that had never been documented by previous teams or tours that were low quality due to blurring or dark images. Figure 4 demonstrates a sample of what the original website did not include, and which trail view tours had to be addressed. A full inventory checklist can be found in Appendix A.

Figure 4

Inventory Checklist

Trails	Included on the website	There is a map already on the website	There are panoramic images/ existing tour	There are files for this on the website	Should it be redone?	Does it need to be tended to?	Comments
A. Murray Young Path	X	X	X	x		No	
Acadia Mountain Loop						Yes	Not on wesbite
Alder Trail	X	X	X	x		No	
Anvil Trail	X	X	X	x		No	
Around Mtn Carriage Rd						Yes	not on website
Asticou & Jordan Pond Path	X	X	X	x		No	
Asticou Ridge Trail						Yes	not on website
Asticou Trail						Yes	not on website
Bald Peak loop	X	X	X	x		No	
Bar Island Trail	X	X	X	x		No	
Beachcroft Trail	X	X	X	x		Maybe	Some images are too dark
Beech Cliff Loop						Yes	Not on Website
Beech Mountain South Ridge Trail	X	X	X	x		Maybe	Some images were very dark

Note. This is a sample of the inventory checklist that was used to identify the trails that needed to be addressed or rephotographed. Green highlighting indicates the existing trail tour was sufficient, red indicates there was no existing trail tour, and yellow indicates the existing trail tour was low quality.

The team initially focused on the eastern side of the island in the Jordan Pond and Great Meadow areas, groups 1 and 2 in Figure 5 below. Both of these areas are densely populated with trails that were missing from the website or are low-quality and needed improvement. The team then moved their attention to the Western side to group three highlighted in light pink. By splitting the park into three groups, the team was able to dedicate appropriate time to adequately document all trails as high quality 360-degree tours.

Figure 5

Annotated Map of Mount Desert Island

Note. In this map of Mount Desert Island, the area shaded in beige is Acadia National Park. The trails traced in blue are complete and the trail view tour is clear. The green traced trails were missing from the original website and had no trail view tour completed. The red traced trails were on the original website but had unclear or damaged trail view tours. (Map Adventures)

Each trail view tour must be top quality, meaning no image is blurry or obstructed. Fixing the low-quality trail tours and adding missing trails required fieldwork. These trails were photographed, and the tour was built with the images using the Pano2VR software, discussed in *2.1.2 Virtual Tour Software.* Appendix E explains the technical aspects of photographing trails

and using Pano2VR software. All completed tours were added to the website to create a complete log of trails in the park.

3.2 Determine the Most Relevant Topics for Sidebars and Identify Related References

The sidebars of the website include a multitude of information to improve access to tourist information, hiking, and educational information about the park. A general understanding of the educational and tourist information website visitors look for about Acadia National Park was required to develop a website that is useful for a range of audiences. Information was collected by asking both park visitors and members of online national park groups to share their preferences through interviews and questionnaires.

3.2.1 Conduct Interviews of the General Public

The team used semi-structured interviews to ensure informative sidebars were included on the website for a wide range of website users. Semi-structured interviews combine open discussion and strict standardized interviews by having some open-ended questions that may be followed by direct, close-ended questions (Adams, 2010). Although the discussion-based interview requires more detailed notes, it allows researchers to understand the feelings or beliefs about a particular topic and hear about participant experience (DeJonckheere, Vaughn, 2019).

To facilitate the development of a holistic website with a variety of sidebar topics, the interviews were conducted with a wide audience. The interview audiences included Acadia National Park hikers, tourists, and general park visitors. The project interviewed 75 park visitors on park grounds, in heavily trafficked areas, allowing the team to gather information directly from park visitors. Interview locations included Hulls Cove Visitor Center, the Sieur de Monts Nature Center, Thunder Hole, Sand Beach, and Jordan Pond House. These locations are all located in the park and run by the National Park Service, are open daily, and allow the team to capture responses from hikers and tourists (Operating hours & Seasons, 2021). By conducting the interviews, the team was able to analyze the data to see which sidebar topics are most popular amongst people in the park and identify the categories to be included on the website. For an interview script example, see Appendix B.

3.2.2 Conduct Questionnaires of the Public Outside of the Park

In addition to these interviews, we also conducted online questionnaires to reach a broader audience. We targeted educators in Maine and national park Facebook groups. In total 63 responses were recorded from the online sample. By sampling a group outside of Acadia National Park, the team may be able to better understand what topics cyber tourists look for. A questionnaire was used as it is the most efficient way of collecting large amounts of data with large populations allowing for both qualitative and quantitative data collection (McLeod, 2018). This mix of data gave the team the information necessary to determine the most relevant topics for the sidebar on the Acadia Trails website. A script of the educator questionnaire is provided in Appendix C and a script of the Facebook Group questionnaire is provided in Appendix D.

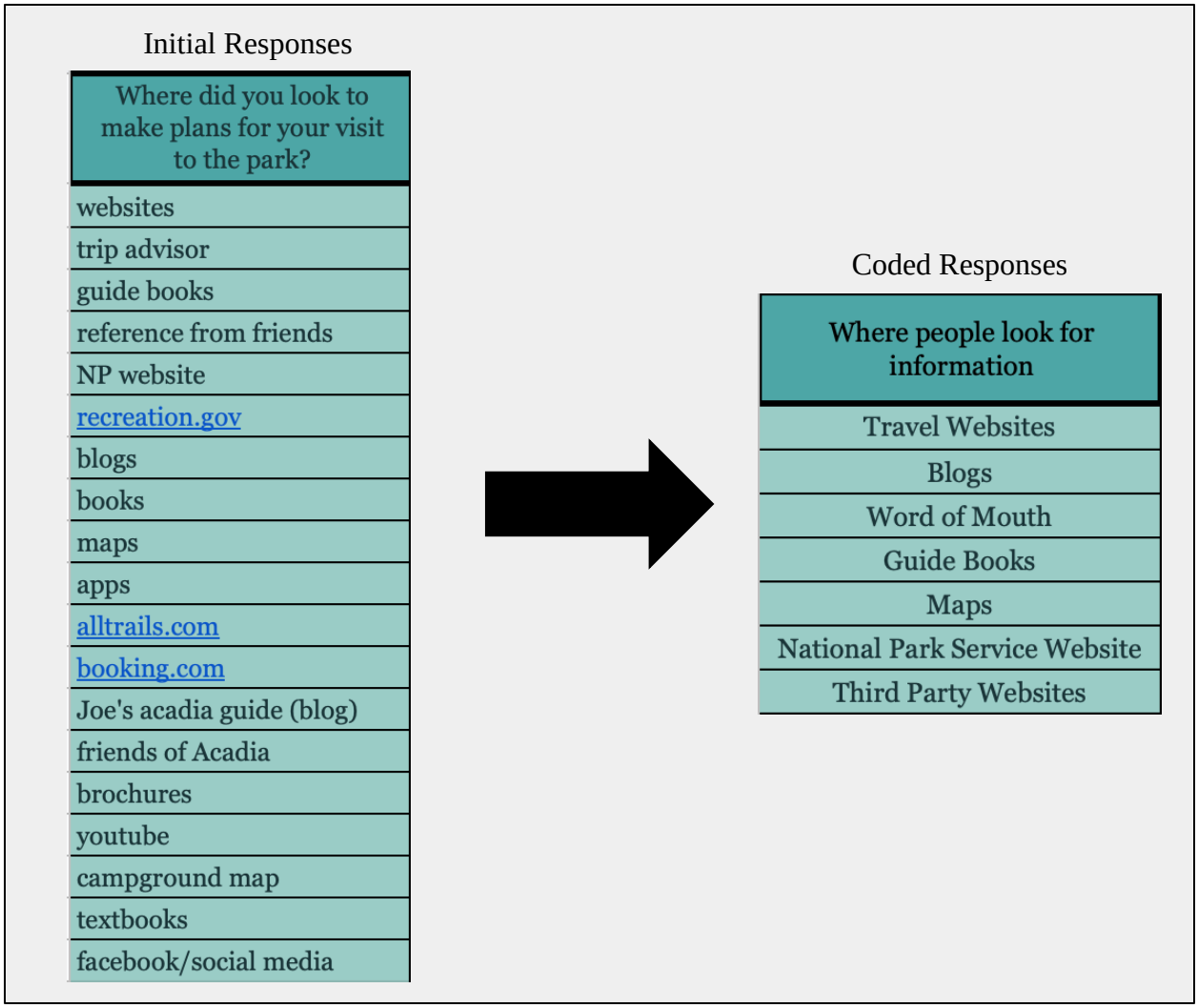
3.2.3 Interview Coding

Once the data from the in-person interviews and the online questionnaires had been collected, the project team began to analyze the data via interview coding. The team followed the Schmidt coding process (Schmidt C, 2004). This process began with reading over all of the completed interview data while taking note of the various topics and resources that had been

brought up in the interviews. Once a list of all topics and resources was complete, the team was able to create overarching categories that could fit similar responses within them. Once the overarching categories had been determined, each recorded response was placed into a category. The categories each have a total number of responses, which allowed the team to understand their popularity. An example of this process is shown in Figure 6.

Figure 6

Coding Example



Note. This is a sample of what our coding looked like based off of our results

3.2.4 Verifying Sources for Sidebars Information

Once the categories for the sidebars were determined from the previous analysis, the team then had to ensure that they were populated with high quality content. Researching available information for sidebars ensured that more details and educational material about the park are accessible for a wide range of populations. Using data from interviews and questionnaires,

sources for sidebar information include the Acadia National Park website, travel guides, books, as well as credible third-party websites.

Each source was analyzed for credibility before it was used. Sources were assessed using three criteria: date of publication, consistency with other sources, and organization/publisher (BYU Library, 2021). Evaluating the date, the sources are published is important as the information published may not be relevant to the park anymore or more current information may be available. To ensure the website is still up to date with the current park status, each website was cross-referenced with other sources. This ensured the information provided is consistent with additional references. The organization publishing the source was also taken into consideration as these publishers are subject to different expertise and could have been biased in certain aspects. For example, governmental and educational sources offered more factual information while blogs often provided opinion-based content, but also have current first-hand information that could be valuable to visitors.

3.3 Assess the Success and User-Friendliness of the Website

The website was assessed using website analytics software to ensure the design and organization of content fosters accessibility for a wide range of populations. The addition of Google Analytics software monitored user interaction, providing insight into the user-friendliness of the website. Website analytics were performed on the website to help understand how users commonly used the website and to identify points of improvement for usability (Kaushik, 2007). Website analytics can be done with a third-party service. In this case Google Analytics runs on the website invisible to the user and collects website traffic data. This program gathered data for many different metrics, such as pages visited, time of visit, and how long they were there. The team shared the website with friends, family and the WPI community and a total of 473 users were monitored over a nine-day period. Studying this data demonstrated if the website was truly following the design rules mentioned in *2.2 Website Design.* The data gathered by running analytics on the website prompted the project team to make recommendations for the next project team to consider.

4.0 Findings and Analysis

This chapter details the results from our research including the evaluation of the current website, our findings from surveys and questionnaires on website content and what we learned from the analytic software on the website. Once we have presented the results, we discuss how our findings influenced the content of the final website and future iterations of the project.

Finding 1: Many of the trails needed to be photographed or redone

The first step to ensure the team knew which trail view tours needed to be completed was to identify the missing or low-quality trail tours on the current website. The team found that there were several missing trail tours as well as existing tours that were low quality. A total of 55 trails needed to be photographed, as shown in Figure 7. Out of these 55 trails, 14 of them were low quality redo trails and 41 had not been done before. Five of the trails were closed and could not be photographed. The groupings in Figure 7 are the groups that the trails were split into based on location around Mount Desert Island & the Schoodic Peninsula.

Figure 7

Trails Needed to be Photographed

After taking 360-degree panoramic photographs of the trails, they were compiled into virtual trail tours using Pano2VR. Once the team became familiar with the software it took about 1.5 to 2 hours to complete each trail tour. The longest trail tour took about 3.5 hours due to the software setting the camera position in the opposite direction. This involved manually fixing every image on the trail.

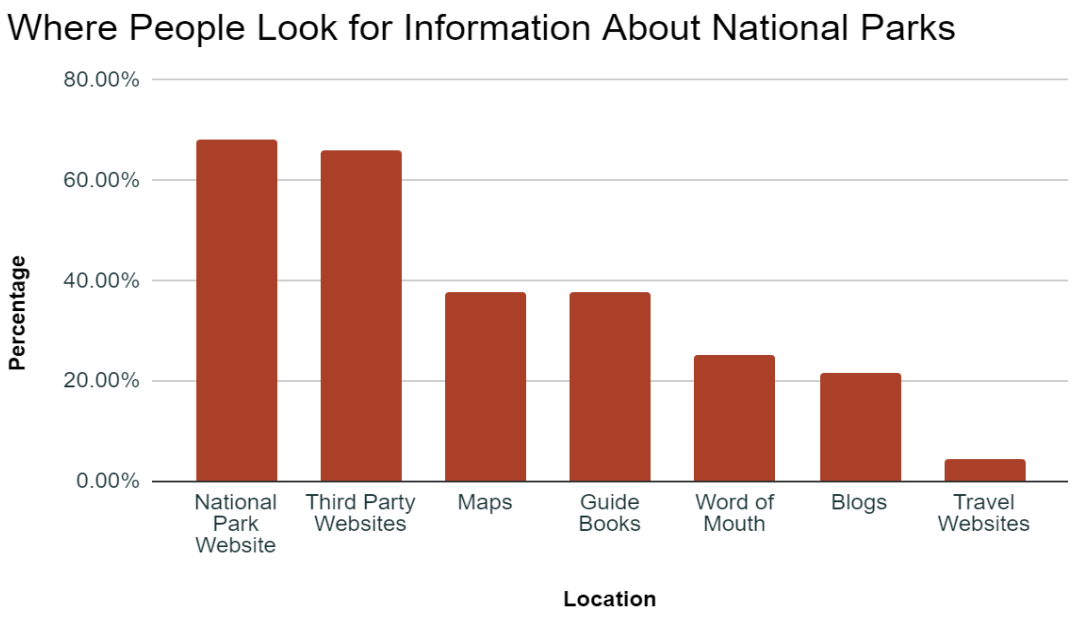
After the trails were all completed in the Pano2VR software, a quality check of each trail tour was done to ensure the tours were of good quality. The quality check checklist is shown in Appendix F. Through these quality checks, the team discovered that Pano2VR had a few software bugs that needed to be addressed. Issues included errors with blurring the camera holder and misalignment of the nodes to progress the trail view tour. Once the issues were fixed and each trail passed the quality control check, they were uploaded to the website and put into the correct pages. This successfully filled the website with every trail in Acadia National Park, besides the trails that are closed during the summer months due to peregrine falcon nesting. Completing all the trails leaves future projects more time to focus solely on the website and its design to generate a better website in the future.

Finding 2: The majority of people look for park information online

Interviews and questionnaires were conducted with the purpose to discover 1: Where people look for information and 2: What that information is. The results for the first question confirmed the need for a third-party website that is partnered with the National Park Service website. Seven sources were identified as the most common sources to find information about the park. These sources being: the National Park Service website, third-party websites, maps, guidebooks, recommendations from others, blogs and travel websites. The coding key for these categories can be found in Appendix G. As seen in Figure 9, almost 68% of the respondents said they used the national park service website and 66% said they used a variety of third-party websites. This information is important, as it gives reason to believe that the finished Acadia Trails website could be a major resource for both park visitors and cyber tourists.

Figure 8

Where People Look for Information About National Parks



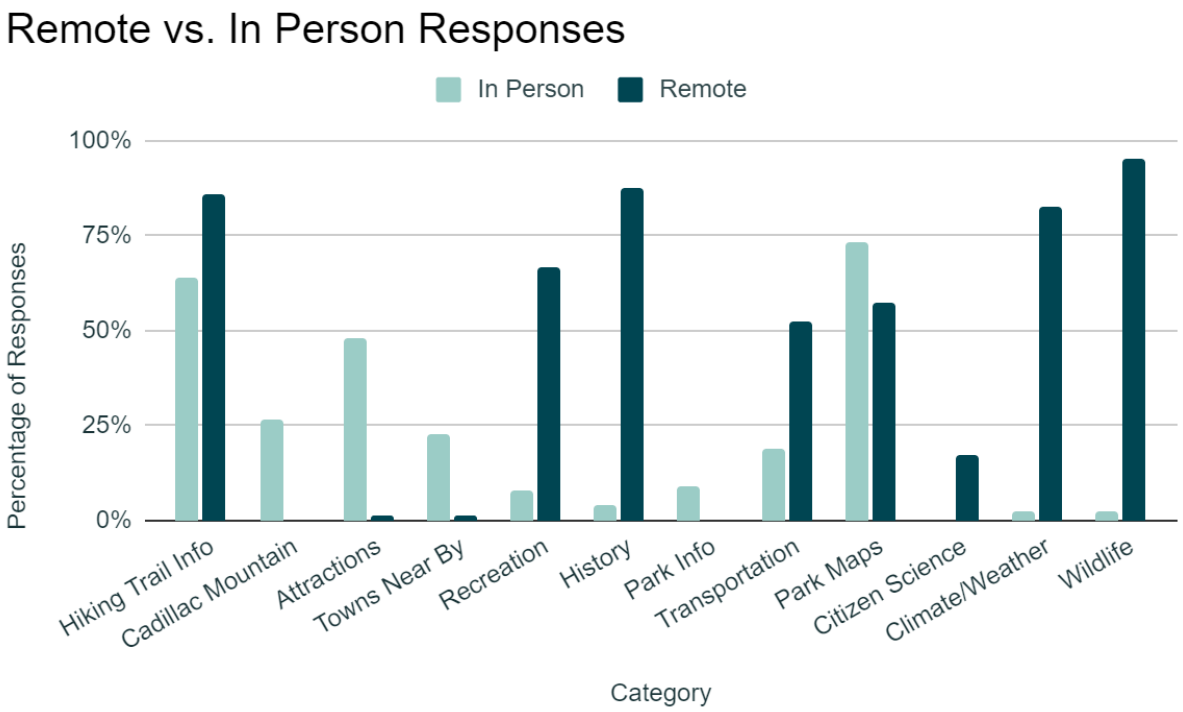
Finding 3: Virtual and In-Person visitors are interested in different types of website content

The data collected from in-person interviews and remote questionnaires demonstrated a distinct difference in responses from remote respondents versus in-person respondents. Initially, the team only anticipated a difference in responses from educators, but after publishing sidebar interview questions in the form of a questionnaire on national park Facebook groups, dramatic differences became evident. This significant discovery prompted the team to broaden the variety of content that was included on the website to accommodate a wider audience.

As shown in Figure 8 below, there were eight sidebar topics that demonstrated a dramatic difference in responses. The team had a total of 138 responses, 63 were remote respondents and 75 were interviewed in-person. The percentage differences were most drastic in the "Climate," "History," and "Wildlife" categories. In all these cases, significantly less responses came from in-person respondents compared to the remote questionnaire respondents. Other response differences were noted in the mention of Cadillac Mountain Reservations, Attractions, Towns Near By and Recreation. Using response data from both sample locations ensures that the sidebar topics on the website represent desired content from a wide population of people and provides a range of information. By including a wide range of information for many populations, the website can be used as a resource despite the physical location or motive of the website user.

Figure 9

Remote vs. In Person Response Data

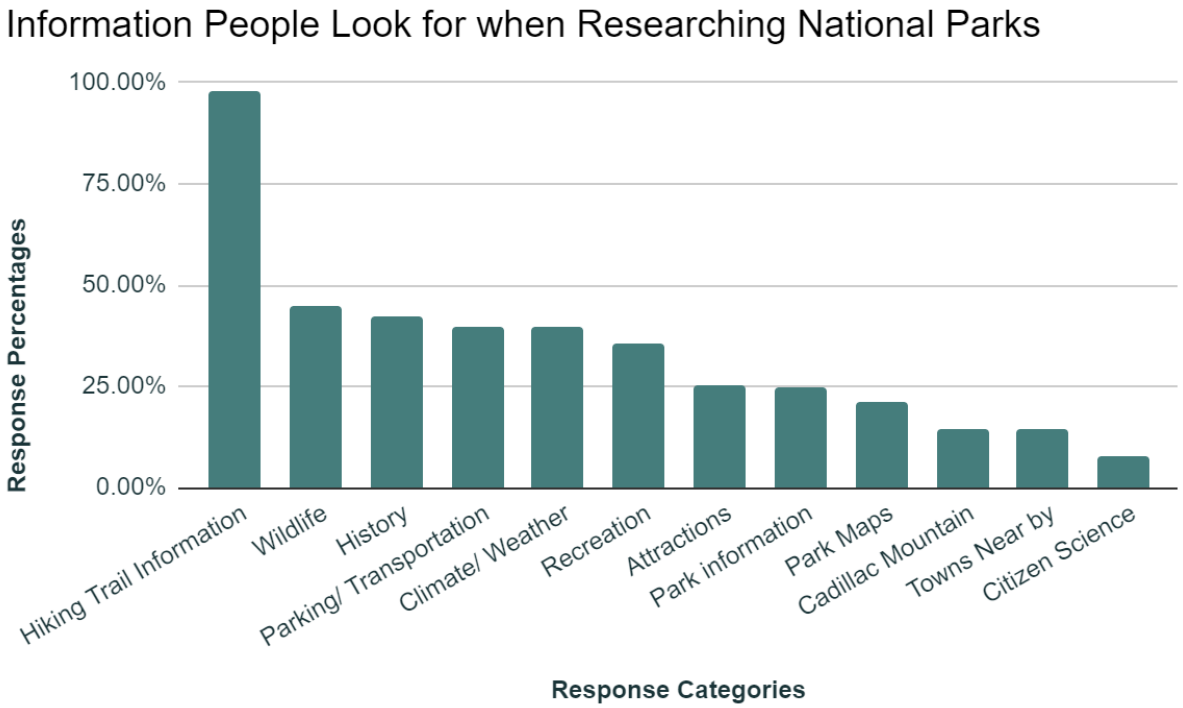


Note. This comparative bar graph demonstrates the difference in the percentage of responses from the in-person versus remote populations for the sidebar data.

Using the data gathered about what information people search about national parks, the resulting 12 categories identified the content that must be included on the website. The large number of categories demonstrated a need for a holistic, one-stop-shop, website. These categories are hiking and trail information, parking/transportation, attractions, park information, wildlife, park maps, climate/weather, history, recreation, Cadillac Mountain, towns nearby, and citizen science. The coding key for these categories can be found in Appendix G. The team was able to visualize what information people look for when researching national parks by organizing the results in a bar graph as shown in Figure 10. Unsurprisingly, nearly 98% of the 138 respondents were looking for hiking and trail information. Opposite this, less than 8% of respondents said they were looking for information about citizen science. The team expected that hiking and trail information would be a popular category but was not expecting citizen science to receive so few responses. Although citizen science was not mentioned frequently, it was still included as a sidebar, as part of the park's purpose is to expand upon education and engagement within the park. Including this in a sidebar will increase exposure of the robust citizen science opportunities at Acadia National Park.

Figure 10

Information People Look for When Researching National Parks



The coded categories were then used as the sidebar topics. The team took these topics and organized them further, creating titles that could fit multiple sidebars within them. The encompassing titles and their sidebars are shown in Figure 11 below.

Figure 11

Sidebar Categories and Topics

Visiting the Park	Things to Do	Learning in the Park
Park Information	Attractions	History
Transportation	Cadillac Mountain	Climate
Restaurants & Shopping	Hiking Safety	Wildlife
Lodging	Summit Information	Citizen Science
	Recreation	
	Family Friendly	

Finding 4: Website Users are Engaging with Multiple Aspects of the Website

The goal of the trail view project was to create and improve a holistic website that is user-friendly for wider populations. This led the project team to use Google Analytics to measure, analyze, and determine how people interact with the website, and if the updated website truly follows the design guidelines. The first thing to consider when analyzing web traffic data is a concept called bounce rate. As mentioned in *2.2 Website Design*, having a lower bounce rate is desired and means that people visiting the website are engaging with it, instead of immediately navigating away. The overall bounce rate of the Acadia Trails Website is 46.36%. This is an average score according to an article from web development and marketing experts at RocketFuel, a company devoted to these subjects (Payton, n.d.). This article states that a bounce rate from 40-55% is average for a website and explains that mobile devices have a higher bounce rate, averaging around 10-20% higher than desktop traffic. For the Acadia Trails website, 61% of all traffic was on mobile devices, with a mobile bounce rate of 48.20%. The website's desktop bounce rate was 43.48%. These statistics signify that the project team created an effective homepage for the website that prompts people to engage with the content of the website.

The three-click rule and wayfinding rules, discussed in *2.2 Website Design*, were used by the team to design the homepage, menu system, and trail pages. These steps, in addition to the incorporation of a search box and Alphabetical Trail List, make the wayfinding much simpler, and the click count low. Upwards of 85% of non-bounced sessions accessed a trail view page or a sidebar page within the first three interactions with the website.

The team gained the understanding that most website visitors will quickly scan a page and if they cannot find desired content within ten seconds, they leave. We found that 48% of users stayed on the website for longer than ten seconds. Looking at the analytical data shown in Figure 12, there is an average session length of 256 seconds when excluding bounced sessions. This means that people who explored past the homepage stayed on the website for 256 seconds on average. The average number of pageviews per session was 3.63 including bounced sessions, and 6.20 excluding them. Based on a study carried out by an analytics company, Littledata, the average pageview per session of a website is 2.6, with 4.0 being the 80th percentile (Littledata, 2021). While the Acadia Trails website is not in the top percentile for this metric, it is above average, meaning that many of those who used the website were engaged and explored beyond the homepage.

Figure 12

Session Distribution by Duration

Session Duration Bucket	Sessions	Pageviews	Average Pageviews per Session
0-10 seconds	30	72	2.40
11-30 seconds	69	201	2.91
31-60 seconds	39	153	3.92
61-180 seconds	76	430	5.66
181-600 seconds	47	378	8.04
601-1800 seconds	27	471	17.44
1801+ seconds	6	117	19.50
Total	**294**	**1,822**	**6.20**

Note. This figure excludes sessions that are bounces.

The project team created a homepage that grabs visitors' attention, improving the website so visitors can both quickly and easily move about the website. This is supported by the analytical data gathered from asking the public to use the website despite potential bias from the monitored website audience. While this is true, the project team still believes that improvements could be made to the website and its structure.

5.0 Discussion: Engaging Different Audiences

The research conducted by the team showed that there is a need for a variety of topics pertaining to Acadia National Park. In person and online respondents had varying topics that they were looking for. The team included each response category mentioned, despite inconsistencies in responses between in-person and online respondents to ensure the website is as engaging and useful as it can be for all audiences. The incorporation of a range of information on the Acadia Trails website aligns with the park's mission of increasing engagement with the park, by drawing in a wider range of the public (NPS, 2011). Furthermore, the data obtained through the team's research shows that most people use online sources when searching for park information. This highlights the importance of the creation of our holistic website, especially when the National Park Service is looking to offer additional ways for the public to engage with the park in an online format (Miller-Rushing, et al., 2021).

5.1 Discussion: The Value of Panoramic Tours

With the completion of the 2021 project team's term in Acadia, all but five trails in Acadia National Park have been photographed and turned into panoramic tours. The panoramic tours featured on the Acadia Trails website are a unique resource, in that they allow for anyone to experience the trails of Acadia National Park. Now, anyone interested in virtually walking a trail in Acadia National Park can do so. As mentioned in 2.1.1, *A Call to Action* states "[The NPS will] Reach new audiences" and digitally "offer rich, interactive, up-to-date content from every park and program." The Acadia Trails View website can meet Acadia National Park's goal of offering more interactive experiences digitally, in the form of virtual 360-degree trail tours of almost every trail in the park.

This website creates a new avenue of accessibility for Acadia National Park. Not only is it useful for those that cannot make it to the park, but it is useful for cyber tourists and those who cannot physically experience the trails. By creating this Acadia Trails website, Acadia's hiking trails can be experienced by more people. Physical limitation, age, and fitness level can now have no hold on what trails someone can experience. An article published in the *Tourism Review* journal defines tourism virtual reality as content that "creates a virtual environment by the provision of synthetic or 360-degree real life captured con-tent" (Beck J, 2019). Anyone who wants to see the trails in Acadia National Park can now do so, as the website effectively creates a virtual reality tourism space through the 360-degree virtual trail tours. These tours can also allow people planning a hike to preview the terrain before arriving at the trail and allows cyber tourists to enjoy Acadia's beauty.

5.2 Discussion: Reliable Third-Party Websites

As mentioned above, 66% of people use third-party websites to find information about Acadia National Park. This number is very close to the 68% of people using the National Park Service website, demonstrating the need for third-party websites to have accurate information in collaboration with the National Park Service website. Third-party websites can highlight and enhance the information provided on the NPS website. Some third-party websites provide personal feedback about trails and hiking routes or information a person may not know about until they are in the park, bringing a different perspective than the National Park Service website. An example of this is the website Alltrails.com as it provides detailed information of trails and allows users to leave reviews and feedback about the trails. As third-party websites provide a

different experience to national parks, park visitors use them to research the park, however, if these websites do not have accurate and updated information, they can be misleading.

According to an article published by the Institute of Electrical and Electronics Engineers, there is a significant relationship between website engagement and content credibility (Diana, et al., 2016). If multiple sources are reporting on the same subject and they all do not have the same general information, it fosters distrust among users. Whether information is incorrect or left out intentionally or unintentionally, misinformation is misleading for website users that are relying on a third-party website's content. Third-party websites should not alter, skew, or leave out accurate information to improve appearance or make content more desirable (Quandt, et al., 2019). This leads to third-party websites not being used and users not being able to experience the uniqueness they bring. In order for these websites to be accurate, they must be updated regularly to make sure they have the most up to date information. The Acadia Trails website links to the National Park Service website to ensure website users have the correct information.

5.3 Discussion: Citizen Science

The results of the team's interviews and questionnaires showed that no one physically in the park mentioned researching citizen science opportunities in Acadia. This was surprising as one of the main purposes of the National Park Service is to promote education and one way, they do this is through citizen science events. Citizen science is when data is collected by volunteers through observation of the environment to help researchers. One example of citizen science is the Downeast Phenology Trail project which is where people keep track of how long it takes for plants to fruit and flower, when birds migrate, and when insects become active (Dreher, 2019). Citizen science is important because it allows for research, with large amounts of data, to be done that otherwise could not be done without many people volunteering (Miller-Rushing et al., 2012). Citizen science allows for people in the public to get a better understanding of ecological and environmental impacts humans can have on the planet (Dickinson, 2012). Having citizens do hands-on experiments and data collection shows them firsthand what is happening to our planet whether it is through global warming or construction (Dickinson, 2012). It also educates the public on the scientific process by putting them in the shoes of researchers which can be beneficial for more people to understand how science works and how data collection processes are used to produce accurate information in science (Bonney, 2009).

In the growing digital age, there are several online citizen science opportunities people can participate in via phone apps in addition to the various in-person opportunities (NPS, 2019). By offering opportunities in various formats, the National Park Service has fostered accessibility to citizen science for people in the park and online. Based on our interview and questionnaire data, 8% of people mentioned citizen science. To further meet the park's goal of offering more interactive digital experiences and facilitating education with the national parks, the Acadia Trails website includes a sidebar dedicated to citizen science in Acadia National Park. To increase awareness of citizen science for wider populations, this sidebar includes information about citizen science and its available formats.

6.0 Recommendations for Acadia National Park

Recommendation 1: Raise awareness of citizen science opportunities for visitors.

The team found, through the use of interviews and questionnaires, that many people who were interviewed did not mention citizen science. Only about 8% of the respondents looked for citizen science in national parks. Given that part of the park's purpose is to expand upon education and engagement, the team recommends Acadia National Park increases awareness about the citizen science opportunities at the park. This can be done by promoting opportunities through our website as well as through the National Park Service website. All responses about citizen science were from remote responses, meaning no in-park visitors mentioned citizen science during interviews. To promote citizen science throughout the park, the team also recommends the park advertise opportunities to in-park visitors.

Recommendation 2: Consider linking NPS and WPI websites

Data showed that there was a large difference between remote and in-person responses when asked what information they look for about national parks. To align with the National Parks mission of making the park accessible to as many people as possible, the team recommends linking the Acadia Trails website, shown in figure 13, on the National Park Service website. WPI's website provides a unique interactive experience of Acadia through the virtual trail view tours. The project team believes that the inclusion of the Acadia Trails website on the National Park Service website can further increase the ability for Acadia to engage with the public through an online format, aligning with the park's goal of reaching a wider audience.

Figure 13

Screenshot of Acadia Trails Website

7.0 Recommendations for Future Teams

There are several aspects of the website that the project team was unable to complete due to the limited time available for the project. First, the team was unable to finish the photography and completion of Pano2VR tours for some trails in the park. While the team has been able to cover most trails, the Jordan Cliffs Trail, Precipice Trail, Valley Cove Trail, Penobscot Mountain Trail and Orange & Black Path have yet to be documented due to closures. Every summer these trails are closed to protect the nesting sites of Peregrine Falcon. The project team recommends that a group is sent to finish those trails in later August when the falcons have left or that a local organization such as Friends of Acadia is asked to assist with documenting these areas.

7.1 Improving Photography Preparation

To ensure fast and easy startup for the future project teams it is suggested that teams learn how to use Pano2VR software before starting at the project site. The learning curve associated with the software had minor setbacks once the group started work in Acadia. It is also advised to test out the software using pictures taken by the team before doing real panoramic documentation to make sure to get the camera angles correct and how to upload the photos to Pano2VR.

When taking pictures, the current project team found that holding the camera at least 2 feet above the photographer's head allowed for easy blur-ability of the person in the picture. This ensures a higher quality end product. The team advises future teams to use some type of stick to hold the camera above the head; a threaded rod was used by the 2021 project team.

The team advises future teams to use a newer version of the Ricoh theta camera since this year many bugs were found using the outdated cameras. For example, the Android version of the app had issues with the Ricoh Theta S and could not reliably connect in the field. Using the newer cameras would allow better quality photos as well as having the latest technology to help make the Pano2VR software work better.

7.2 Interactive Mapping

One part of the website that needs improvement is the map that is featured on the home page and the group pages. This map is a static map of Mount Desert Island and does not have any trails labeled on it. It was our team’s hope to create an interactive map system that would allow people to select trails from a map in a more organized manner. This map would have still shown trail groupings, but website visitors would have been able to click on the group on the map and be taken to a zoomed in map of that group. These zoomed in maps would then show every trail in that group and have the ability for website visitors to click on any trail and be taken to that trail page. Our project team was unable to create a proof of concept for this, as we did not possess the experience necessary to fulfill this vision. We believe that creating this map would greatly improve the interactivity and visitor engagement of the website.

7.3 Incorporating Data from Streetlight

To improve the website further, the project team recommends including popularity graphs and data about busiest times for summits, trails, and attractions. This data can be gathered by using Streetlight. By getting a data pull from these areas and the nearby parking, it is possible to find the busiest times of the day for a given trail, summit, or attraction, which lets people make informed decisions when planning their trip. Currently, a Streetlight data proof of concept is shown for the Jordan Pond attraction as well as for various summits and the Gorge path trail.

As this website is getting closer to being fully shared with the world, the project team feels that this unique addition will help this website become a resource to those interested in learning about and visiting the park.

7.4 Website Metadata and Maintenance

Although it is possible to find the website on search engines such as Google.com, the website does not show up when using most search terms. To make the website appear more frequently in searches, the project team recommends the addition of metadata to the website. Metadata, in the context of web design, is data that is embedded in the code of a webpage. Search engines use this to figure out what content is on the website to show the page in relevant searches (Baca et al., 2016). With the amount of information on the internet, it would be hard for a program to read and analyze all of it, but by reducing a page to a few key pieces of information, search engines can search their databases quickly to find your page. If a future team were to properly denote the metadata for the website, the pages would be more likely to come up in searches, and therefore be more accessible to a wide range of audiences.

The project team set out to improve the website created by past WPI teams. The purpose of this website is to provide information about Acadia National Park to both park visitors and cyber tourists. Understanding what information, the public wants on the website was accomplished through interviews and questionnaires of people both in the park and online. These data collection methods gave the team the necessary information to create sidebars filled with content that would be of use to everyone looking for information relating to Acadia National Park. Along with creating informative sidebars, the project team created virtual panoramic tours of every trail in the park that had yet to be well documented on previous versions of the website. These trails were then added to the website, ensuring all trails in the park are accessible via the website. Lastly, the project team applied a website analytic software to the website, which provided insight as to how users navigate the website and how it can be further improved in the future to provide audiences with a holistic experience.

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Appendix A: Inventory Checklist

Trails (west in green, east in red, Schoodic in blue)	Included on the website	There is a map already on the website	There are panoramic images/ eXisting tour	There are files for this on the website	Should it be redone?	Does it need to be tended to?	Comments
A. Murray Young Path	X	X	X	X		No	
Acadia Mountain Loop						Yes	Not on wesbite
Alder Trail	X	X	X	X		No	
Anvil Trail	X	X	X	X		No	
Around Mtn Carriage Rd						Yes	not on website
Asticou & Jordan Pond Path	X	X	X	X		No	
Asticou Ridge Trail						Yes	not on website
Asticou Trail						Yes	not on website
Bald Peak loop	X	X	X	X		No	
Bar Island Trail	X	X	X	X		No	
Beachcroft Trail	X	X	X	X		Maybe	Some images are too dark
Beech Cliff Loop						Yes	Not on Website
Beech Mountain South Ridge Trail	X	X	X	X		Maybe	Some images were very dark
Beech Mountain Loop	X	X	X	X		No	
Beehive Trail	X	X	X	X		Maybe	image quality is a bit poor compared to othe
Bernard Mountail Trail	X	X	X	X		No	
Birch Spring Trail	X	X	X	X		No	
Bowl Trail	X	X	X	X		No	
Breakneck Road						Yes	Not on website
Bubble & Jordan Ponds Path	X	X	X	X		No	
Bubbles Divide	X	X	X	X		Maybe	Few pictures with solar glare
Bubbles Trail	X	X	X	X		No	
Buck Cove Mountain Trail	X	X	X	X		No	
Cadillac Cliffs Trail	X	X	X	X		No	
Cadillac North Ridge Trail	X	X	X	X		Maybe	Few images with over eXposure to light
Cadillac South Ridge Trail	X	X	X	X		No	
Canada Cliff Trail						Yes	Not on the website
Canon Brook Trail	X	X	X	X		No	
Champlain North Ridge Trail	X	X		X		Yes	There is no tour only a map
Champlain South Ridge Trail	X	X	X	X		No	
Cliff Trail						Yes	not on website
Cold Brook Trail	X	X	X	X		No	
Compass Harbor Trail						Yes	not on website
Day Mountain Trail	X	X	X	X		No	
Deer Brook Trail	X	X	X	X		No	
Dorr North Ridge Trail	X	X	X	X		No	
Dorr South Ridge Trail	X	X	X	X		No	
Duck Brook Connector						Yes	not on website
Eagle Lake Trail	X	X	X	X		No	
Eagles Crag Loop Trail	X	X	X	X		Maybe	fog made the view hard to see
East Trail						Yes	Not included on website
Eliot Mountain Trail						Yes	not on wesbite
Emery Path	X	X	X	X		No	
Flying Mountain Loop						Yes	Not on website
Friends Path						Yes	Not on website
Giant Slide Loop	X	X	X	X		No	
Gilley Trail	X	X	X	X		No	
Goat Trail	X	X	X	X		No	
Golf Course Trail						Yes	not on website
Gorge Path	X	X	X	X		No	
Gorham Mountain Trail	X	X	X	X		No	
Grandgent Trail	X	X	X	X		No	
Great Head Trail	X	X	X	X		Maybe	some pictures may need to be redone
Great Meadow Loop						Yes	not on website
Great Notch Trail	X	X	X	X		No	
Hadlock Brook Trail	X	X	X	X	X	Yes	some pictures need to be redone as they are
Hadlock Ponds Loop	X	X	X	X		No	
Harbor Brook Trail						Yes	not on website
Harborside Trail						Yes	not on website
Hemlock Road	X	X	X	X		Maybe	some pictures may need to be redone
Hio Road						Yes	Not on Website
Homans Path	X	X	X	X		No	
Hunters Beach Trail						Yes	not on website
Hunters Brook Trail	X	X	X	X		No	

Hunters Cliff Trail						Yes	not on website
Jesup Path	X	X	X	X		Maybe	some photos are a bit dark
Jordan Cliffs Trail	X	X	X	X	X	yes	photos are blurry
Jordan Pond Carry	X	X	X	X		no	
Jordan Pond Nature Trail	X	X	X	X		no	
Jordan Pond Path	X	X	X	X		no	
Jordan Stream Path	X					Yes	the tab is made but no info is on it
Kane Path	X	X	X	X		no	
Kebo Brook Trail	X	X	X	X2		no	listed under 'other trails'
Kebo Mountain Trail	X	X	X	X		maybe	
Kurt Diederich's Climb	X	X	X	X		maybe	some photos are dark
Ladder Trail	X	X	X	X		no	
Ledge Trail						Yes	not on website
Long Pond Trail (Great Pond Trail)	X	X	X	X		No	
Lower Day Mountain Trail						yes	not on website
Lower Harbor Trail	X	X	X	X2		No	
Man O' War Brook Fire Road						Yes	Not on website
Mansell Mountain Trail	X	X	X	X		No	
Murphy Lane						yes	not on website
Norumbega Connector Trail	X	X	X	X		maybe	photos are a little dark but not sure if it need
Norumbega Mountain Loop	X	X	X	X		no	
Ocean Path	X	X	X	X		no	
Orange & Black Path						yes	not on website
Otter Cove Trail						yes	not on website
Parkman Mountain Loop	X	X	X	X		No	
Pemetic East Cliff Trail	X	X		X		yes	missing interactive map
Pemetic North Ridge Trail	X	X	X	X		maybe	
Pemetic North West Trail	X	X	X	X		No	
Penobscot Mountain Trail	X	X	X	X	X	Yes	dense fog and pictures out of order
Pemetic South Ridge Trail	X	X	X	X		No	
Perpendicular Loop	X	X	X	X		No	
Pipeline Trail						yes	not on website
Precipice Trail						Yes	Not on website
Quarry Trail						Yes	not on website
Quarry Trail (NEH)						Yes	not on website
Razorback Trail	X	X	X	X		Maybe	Photographers head is in almost every imag
Sargent East Cliffs Trail	X	X	X	X		No	
Sargent Northwest Trail	X	X	X	X		No	
Sargent South Ridge Trail	X	X	X	X		No	
Satterlee Trail						Yes	not on website
Schiff Path	X	X	X	X		No	
Schoodic Head	X	X	X	X		No	
Schooner Head Path						Yes	not on website
Ship Harbor Nature Trail						Yes	not on website
Shore Path						Yes	Not on website
Sluiceway Trail	X	X	X	X		No	
Spring Trail	X	X	X	X		No	
St. Sauveur Loop	X	X	X	X		No	
Stratheden Trail						Yes	not on website
Sundew Trail						Yes	Not included on website
Triad Pass Trail	X	X	X	X		No	
Triad Trail	X	X	X	X		No	
Valley Cove Road						Yes	not on website
Valley Cove Trail						Yes	not on website
Valley Peak Trail	X	X	X	X		No	
Valley Trail	X	X	X	X		No	
West Ledge Trail	X	X	X	X		No	
West Ridge Trail						Yes	Not on website
Western Mountain Loop						Yes	not on website
Wonderland Trail	X	X	X	X		No	
Ampitheater trail	X	X	X			No	

Appendix B: Interview Script for General Public to Determine Most Relevant Sidebar Topics

We are a team of students from Worcester Polytechnic Institute, located in central Massachusetts. We are working in conjunction with Acadia National Park to improve a new website for the park. We are creating an interactive website about Acadia National Park with an interactive map that includes 360-degree tours of all hiking trails in the park and informative sidebars. As part of this project, we are using interviews to identify what information is most sought after to include on the website. This interview should take about five minutes to complete. Your participation in this interview is completely voluntary and you may opt-out at any time. Your responses will remain anonymous. If you request, we can provide you a copy of your results at the conclusion of our questions. If you need to contact us for any reason our team email is gr-barharbortrailview@wpi.edu and our advisor's email is cbkurlanska@wpi.edu. Do you have any questions before we begin?

Questions:

1. Are you 18 or older? *(If no, the interviewer will seek parental permission before continuing)*

2. Is this your first-time visiting Acadia National Park?

3. Where did you look to make plans for your visit to the park?

4. What information were you looking for while planning your visit?

5. Was it hard to find the information or content you were looking for?

6. What would you like to have known more about before coming to the park?

Appendix C: School Teacher and Educator Website Content Questionnaire

We are a team of students from Worcester Polytechnic Institute, located in central Massachusetts. We are working in conjunction with Acadia National Park to improve a new website for the park. We are creating an interactive website about Acadia National Park with an interactive map that includes 360-degree tours of all hiking trails in the park and informative sidebars. As part of this project, we are using questionnaires to identify what information is most sought after by educators to include on the website. This questionnaire should take about five minutes to complete. Your participation in this questionnaire is completely voluntary and you may opt-out at any time. Your responses will remain anonymous. If you request, we can provide you a copy of your results at the conclusion of our questions. If you need to contact us for any reason our team email is gr-barharbortrailview@wpi.edu and our advisor's email is cbkurlanska@wpi.edu.

Questions:

1. What topics about Acadia National Park do you incorporate in your lessons? *(Select all that apply)*
    - Animal science
    - Plant science
    - Climate Change
    - Geological History
    - American History
    - Cultural History
    - Trail History
    - Citizen science
    - Other:
2. When researching topics about Acadia National Park, where do you look for this information? *(Select all that apply)*
    - National Park websites
    - Third-party websites
    - Travel guides
    - Textbooks
    - Other:
3. When visiting Acadia National Park for field trips, which park features do your students experience? (*Select all that apply. Please indicate N/A if you do not take field trips to the park)*
    - N/A
    - National Park Service field trips (Junior Ranger Day, Sedimentary Sleuths, Ecosystem Explorers, etc.)
    - Sieur de Monts Nature Center
    - Hiking trails
    - Carriage trails
    - Thunder Hole
    - Whale watching boat tour
    - Puffin boat cruise
    - Lighthouses

- Kayaking
- Canoeing
- Sailing
- Plant observation
- Animal observation
- Other:

Appendix D: Cyber Tourism Questionnaire

We are a team of students from Worcester Polytechnic Institute, located in central Massachusetts. We are working in conjunction with Acadia National Park to improve a new website for the park. We are creating an interactive website about Acadia National Park with an interactive map that includes 360-degree tours of all hiking trails in the park and informative sidebars for both in-person and online visitors. As part of this project, we are using questionnaires to identify what information is most sought after to include on the website. This questionnaire should take about five minutes to complete. Your participation in this questionnaire is completely voluntary and you may opt-out at any time. Your responses will remain anonymous. If you request, we can provide you with a copy of your results at the conclusion of our questionnaire. If you need to contact us for any reason our team email is gr-barharbortrailview@wpi.edu and our advisor's email is cbkurlanska@wpi.edu.

Questions:

1. What topics about national parks would you look for on a website? *(Select all that apply)*
    - Animal science
    - Plant science
    - Climate Change
    - Geological History
    - American History
    - Cultural History
    - Trail History
    - Citizen science
    - Hiking
    - Transportation
    - Recreation
    - Other:
2. When researching topics about national parks, where do you look for information? *(Select all that apply)*
    - National Park websites
    - Third-party websites
    - Travel guides
    - Textbooks
    - Maps
    - Blogs
    - Word of Mouth
    - Other:

Appendix E: Technical Development of the Website

This appendix outlines various technical steps that will be used to produce the project deliverables, as mentioned in the methodology section.

Photography

The team will use Ricoh Theta m15 and Ricoh Theta S, specialized cameras that take 360-degree panoramic photographs. The cameras have a thin frame with two bulging lenses on opposite sides. To use it, the photographer holds the camera directly above their head, and takes repeat photos. Taking repeat photos will help to avoid issues such as glare or blurriness. This process will be repeated as the photographer progresses along the trail. They will move forward at different intervals, far enough that the scenery changes, but close enough the jump is not jarring. For example, in a winding forest path, there will be more shots taken, because the trail changes quickly. On an open field, less photos are needed as there are less things obstructing 360-degree view. If the photo is a replacement photo, using the GPS data of the original, the camera will be held in as close to the original spot as possible.

Creating the Tours

Once the photos are taken, they will be turned into virtual tours. This will happen through the use of Pano2VR. The team members who make the virtual trail will import the images and use the auto tour function of the program to create links between the photos. As this tool is not always the most accurate, the team member will then adjust the link positions to the proper location.

Hiding the photographer is one challenge 360-degree images face. In Pano2VR, there is a tool called the Patch tool. The Patch tool lets you alter the image by either placing another image over top, or by placing a blur over a specific area. By using the blur option on the bottom of the panorama, where the photographer is located, the person can be removed from view. This can also be used with something called a Master Template, that applies the change to every panorama inside of the tour. Use of the master template makes the patching process extremely efficient.

The Patch tool can also be used on individual panoramas. The team will try to avoid including other people in the frame, however, on the most popular trails, this is not always possible. If there is a photo with other hikers in the view, it is possible to use this too to blur their faces. This will help protect the privacy of everyone in the park.

Editing the Website

To edit the existing website, the team will be using Wordpress. Going to Acadiatrails.wpi.edu/wp-admin and logging in with an administrator account, the backend of the website can be accessed. Access to the backend allows a team member to edit the website and use various plugs such as the analytical ones mentioned previously in 3.3.2.

When dealing with large files, the team will use the server the website is hosted on to transfer the files. By using free softwares such as PuTTY and FileZilla the team can log into the Linux virtual machine that is hosting the website, and then upload files to the server. And once the files are uploaded, it can be imported into the website. The process can be done in reverse as well, allowing the team to access the current tours and edit them.

Appendix F: Trail Tour Quality Control Checklist

Trail Tour Quality Check

Name of Tour:

Do all images pass these criteria?

- Good lighting (able to see everything clearly)
- Next node is in the frame of view when first arrived at pic
- All camera holders' heads blurred?
- Trail appears to be in correct order
- Overall quality of picture is good(not blurry minimal sun glare)

Does Trail pass given the criteria?

- Yes
- No

If no please put image numbers with issues and what the specific issues are below:

Image # xx-yy issue(s):
Image # xx-yy issue(s):
Image # xx-yy issue(s):
Image # xx-yy issue(s):
Image # xx-yy issue(s):
Image # xx-yy issue(s):
Image # xx-yy issue(s):

Appendix G: Coding Key

When asking what resources visitors used to plan their visit to the park, multiple websites were given as answers. These were then split into different website categories, enabling the team to better understand what types of resources park visitors are using to plan their trip.

Travel Websites:
- Trip Advisor
- Booking.com

Blogs:
- Blogs
- Joe's Acadia Guide

Word of Mouth
- Reference from friends

Guide Books

Maps:
- Maps
- Campground maps

National Park Service Website

Third-Party Websites:
- Websites
- Recreation.gov
- Alltrails.com
- Friends of Acadia
- Facebook
- Youtube

Citizen Science

Towns Near By:
- Camping spots
- Restaurants
- Bar Harbor
- Lodging
- Hotels

Cadillac Mountain:
- Cadillac Mountain
- Information on reservation system

Recreation:
- Biking
- Kayaking
- E-bikes
- Recreation
- Swimming

History:
- Historical information
- American History
- Cultural history

Climate:
- Climate change
- Geological information
- Weather

Parks Maps:
- Maps
- Maps of smaller trails
- Interactive mapping
- Trail maps
- Park maps
- Better mapping indication
- Distances between places
- Map of the entire park
- Free good trail map
- More descriptive trail maps

Wildlife:
- Animal science
- Plant science
- Wildlife information

Park information:
- Carriage trail maps
- Closures
- Park Passes
- Park Hours
- Thunder Hole Tide Chart
- The App
- Bathrooms
- How to navigate the park
- How many people will be in the park
- Senior discounts
- Student entrance passes

Attractions:
- Fun Things to Do
- Kid Friendly things to do
- Wild Gardens
- Tours
- Jordan Pond House
- Thunder Hole
- Bass Harbor
- Park Loop Road Locations
- Music Related Fun Things to Do

Parking/ Transportation:
- Parking
- Island Explorer
- Transportation

Hiking Trail Information:
- Hiking / trails
- Beehive trail
- Difficulty of trails
- Dog friendly trails
- Trail history
- Trail maps
- Trail Entrances
- How long trails take
- Bar Island Path
- Shore Path