

DON'T TOUCH THAT:
ENHANCING THE POST-COVID INTERACTIVE
THEME PARK EXPERIENCE

by

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Author's Declaration

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INTERACTIVE THEME PARK EXPERIENCE

Master of Digital Media, 2020

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Digital Media

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Abstract

The project identified functional performance requirements for supporting immersion and engagement while also promoting safe distancing and touchless interaction in the queue areas of attractions. Previous researchers identified that theme park queues must sustain guest engagement while also creating positive feelings towards wait times. Interactivity has been introduced within these spaces, however, pandemic control measures, like social distancing, conflict with many of these offerings. A solution is represented in this study by a prototype and implemented in a hypothetical themed attraction. By creating this element, guests will be able to stay six feet away from each other, while engaging in an immersive, themed narrative through motion sensors directed by Arduino. Experts favoured the prototype's ability to encourage contactless engagement while social distancing while enhancing an engaging experience. The proposed prototype is a tangible example of an immersive, touchless interaction with a design approach that is feasible, appealing and merits further consideration and development.

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1. Introduction

The global pandemic of 2020 has changed the course of the themed entertainment industry. Executives around the world have had to rethink their strategy around operations and design within their properties. Companies like the Walt Disney Company had shut down their global parks all at the same time for the first time since their creation. “Nobody had a plan for this. Nobody could imagine the scale of the impact of this pandemic” (Coen, quoted by John, 2020).

COVID-19 is a virus that originated in the Wuhan province of mainland China and because it was easily transmissible with a wide variety and severity of symptoms, it quickly spread all over the world. This virus is a new strain of coronavirus similar to SARS, MERS, and even the common flu (Center for Disease Control, 2020). The differences that make COVID-19 unique, according to current research, is that it is highly transmissible through small droplets in the air and the symptoms can be very mild or nonexistent for some, while being very severe for others and leaving people susceptible to serious upper respiratory illnesses like pneumonia (Barbaro, 2020). In the United States the severity of the outbreak was slow to start, but after seeing its effects around the world, many started speculating the impact COVID-19 would have on every industry.

In China, drastic measures were taken by closing down entire districts and limiting travel during Chinese New Year (Crossley, 2020). Italy was similar to the United States in relation to the slow initial concern and response, and it felt the full effect during the spring when many hospital doctors had to choose which patients to save from the virus due to the limited capacity (Barbaro, 2020). Once the global number of cases reached close to 200,000, and the U.S. having a few thousand confirmed cases, the federal government issued a recommendation to limit gatherings to 10 or fewer people (Schwellenbach, 2020).

In March of 2020, many theme parks including Disneyland, Walt Disney World, and Universal Parks and Resorts made plans to voluntarily close as their Asian parks had already done. It was apparent then that the typical operations of a theme park would need to be altered immediately and could be designed differently in the future to accommodate a new normal where there is heightened caution about contact in the park.

COVID-19 is a threat to any business that entails immersive and interactive environments. For theme parks, their draw is the fact that guests can fully engage with tactile experiences and immerse themselves into their favourite stories. Due to the layout and function of a theme park, guests are directed to congregate in specific locations, be it a retail store, restaurant, or attraction building.

A pandemic that is spread through contact and close proximity finds a place like a theme park a generous breeding ground (Center for Disease Control, 2020). Safety is a top priority in all facets of theme park design and operations (Anderson, 1999) (Formica & Olsen, 1998). Disney Parks and Resorts raised the standards when introducing the concept of the Four Keys within training of all employees (i.e.: cast members). The Four Keys, in priority order, are safety, courtesy, show, and efficiency (Johnson, 1991) (Walt Disney World Co., 1988). Fellow industry leaders adopted these standards, creating high quality service surrounding operations and safety (Wall, 2011). Now, these standards must apply to a new aspect of safety with measures to prevent the spread of COVID-19. This study will explore a proposed prototype to be used within attraction queues to expand on a contactless form of interactive design and experience.

The next chapter will review related literature and practices pertaining to attraction design regarding current precautions that are being introduced due to COVID-19, design strategies within queues, crowd mitigation, and innovative technologies that utilize touchless

engagement. The third chapter will introduce, the Curse of Nemo, a sensor-based interactive activity, built specifically for an attraction queue that urges the resistance of physical contact, thus promoting social distancing guidelines. Within this chapter, design of the initial prototype will be expanded regarding the process and specification. Next, chapter four will finalize the overall design of the Curse of Nemo. To refine the prototype, this study uses a mini-Delphi technique upon recruitment which leads to interviews with themed entertainment industry professionals. The study will use qualitative data collected from the interviews as well as reflection from testing. Finally, chapter five will discuss the outcomes and relevance to the end goal of the overall major research project. Limitations due to COVID-19 restrictions will also be reflected upon the conclusion.

2. Related Literature

To further understand the context of the proposed prototype, reflection of related literature and study is necessary. Within this chapter there will be examination of best practices in queue design in theme parks, the current climate and how COVID-19 has affected the themed entertainment industry, and existing interactive technologies that could elevate immersive experiences using touchless interfaces. Reviewing this research will help identify the needs and gaps that this proposed prototype will address.

2.1 Theme Park Attraction Design

2.1.1 Theme Park Design and Evolution

Disneyland opened its doors in 1955 and forever changed the business of travel and tourism. Taking much influence from carnivals and World's Fairs, Walt Disney decided to build a dream land with many attractions based on his successful films and cartoons (History, 2009). The art of theming these spaces set this property apart from existing amusement parks and attractions.

Guests now were able to immerse themselves into their favourite stories like Snow White and the Seven Dwarves or Peter Pan.

Fast forward to today, the themed entertainment industry has grown and evolved in numerous ways. Now, this industry consists of many businesses including museums, zoos and aquariums, live theatre, and theme parks (IAAPA, 2020) and in 2019, over 159.1 million people attended amusement and theme parks in North America alone (TEA, 2020). Guests from around the world come to visit these parks to experience their favourite stories come to life. Location-based entertainment gains popularity by including advanced technology, interactivity, and new products within their design (Formica and Olsen, 1998). Theme parks have had to pay attention to these trends in order to find success. As technology advances so do experiences that are

offered to visitors. Therefore, obtaining intellectual property to create new experiences for guests while also utilizing modern multimedia incentivizes guests to continue to visit these attractions.

New technology can be found in many areas of a theme park to enhance immersive entertainment and translate fantasy into reality. One example of this are new attractions where performers acting as characters interact with a live audience, creating a new experience for every show and almost endless repeatability. Adding the use of mobile devices and games around an attraction or an entire park, giving guests an extra activity, can provide a unique story or context to a larger story. A more recent aspect of theme parks that is enhanced with new technology is immersive and interactive queues, explored in the next section (Stapleton & Trowbridge, 2009).

2.1.2 Queue Design

There are many styles of queues. First, switchback queues are in where groups of visitors follow one another through a laid-out path to get to their final destination (Younger, 2016). New alternatives are being introduced such as virtual queues or “holding-pen-style” queues. Virtual queues are an option where guests can reserve their spot in line using technology, often their mobile devices, and come back to the attraction when notified. Finally, the “holding-pen-style” is one that relies on operations employees to group forms of parties, so they are able to stay in a large open room with little visual organization of a traditional line. These three styles are often used in combination, as well.

Queues are an extension of the story and a theme park experience that often prepare guests for what they are about to embark on (Younger, 2016). Therefore, queues can affect guests’ overall feelings and experiences during their time in an attraction or park, making wait times and these spaces one of the most integral parts of a theme park experience. They are often perceived as negative experiences but wait times are useful in many situations. They can provide

rest, holistic preparation for the next step, enhance anticipation, and even encourage guests and visitors to savour the moment at hand (Norman, 2009).

Preparing for the next step in the attraction is an important factor when developing queues. A queue can give guests exposition to the story but also to the physical ride they are about to endure (Norman, 2009). This often can be a turning point as to if a guest will follow through to the ride, itself. For example, a calm, slow moving ride like the Seas with Nemo and Friends at EPCOT is paired with a serene queue. The queue is filled with the film's score as guests are taken "underwater" to go on the adventure based on the film Finding Nemo. The reflections of the ocean water create a nice, easy journey as guests board the attraction. Guests would feel tricked and confused if the queue they had just walked through was bright and scary with loud noises. So, matching the time that guests spend in a queue with the feelings they will experience on the attraction, itself, is very important to guest satisfaction (Norman, 2009).

There have been many approaches to creating and implementing guidelines for designers to integrate into their spaces. Guests' perception of time is a strong factor as to their reflection of experience. Eight principles to follow when thinking about user centered design for theme park queues have been studied and reported (Ledbetter et al., 2013) (Table 1).

Eight Principles of Queue Design	
1	A queue design needs to foster engagement.
2	The queue environment should maintain the guests' level of interest in the attraction.
3	Queue environments should support positive affect.
4	Comfort should not be overlooked in queues.
5	Visually separate inequitable wait times within queues.
6	Line layout should facilitate interpersonal interaction.
7	Guests should be adequately informed about the wait duration.
8	Line design should encourage the guests' feeling of consistent progression toward the attraction.

Table 1: Eight Guidelines to Queue Design

Their first guideline, to prioritize fostering engagement, is one of main focuses of this study. To elaborate, this principle is not just about making a “fun experience”, but designers must also maintain that engagement time and time again. Also, distracting guests from the amount of time that has actually passed erases negative connotations and feelings towards the experience. This skews their attention from their watches and puts it into their surroundings.

Many new attractions are focusing on re-rideability by adding hidden effects within rides or “easter eggs”, or a hidden feature that relates to the canon of the intellectual property (Merriam-Webster, 2020), that one would only notice if experienced multiple times. Those principles are also brought into the queue space. Harry Potter and the Forbidden Journey, in multiple Universal Parks, is a clear example of this. Guests are able to walk through the grounds

of Hogwarts Castle, through various classrooms, professor offices, and student areas. In these spaces, paintings on the walls talk to guests and various props have added movements. The designers of this ride used every detail from the Harry Potter films and books to ensure nothing was overlooked. Many guests come back to this attraction just to walk through the queue, itself, multiple times. Although this project is designed for pandemic physical distancing, measures for essential pandemic physical distancing should take care to maintain user-centered qualities.

2.1.3 Crowd Mitigation and Guest Satisfaction

Prior to COVID-19, theme park attendance was steadily increasing. Walt Disney World's Magic Kingdom, alone, attracted 20,963,000 guests in 2019 (TEA, 2020). Consumers are the most influential factor to the success of theme park industry success and their demand of new and exciting experiences, mixed with overall satisfaction during their visit, impact the longevity and survival of a theme park (Milman, 2001). Much of guest satisfaction relies on crowd mitigation and how visitors feel in relation to the presence of other tourists (Yuan & Zheng, 2018). As capacity limits grow in theme parks, crowding will only become more of a problem. This can lead to large amounts of dissatisfaction among guests (Brown, Kappes, & Marks, 2013). A 1991 study surveyed ten families in the United States on various factors of their visits to theme parks and showed that "crowds" were the third largest issue that would affect the family's overall enjoyment, the first two being "lodging" and "climate" (McClung, 1991).

Theme park designers refer to venues that disperse crowds and occupy guests as "people eaters". These are traditionally retail areas, restaurants, and attraction buildings (Younger, 2016). The more enclosed spaces built, the more imperative it will be when creating a safe environment by prioritizing hygiene. Positive experiences due to the proximity of guests from one another will stem from ensuring their health is being prioritized. As the CDC offers insight on how to

keep the public safe in areas that, traditionally, attract large amounts of people, theme parks must change what guest capacity looks like. Large capacity parks, like Universal or Disney properties, have approximately 110 acres of guest area creating a density that is between 500 and 650 people per acre (Kissling, 2020). Major theme park operators must rethink what capacity and crowd mitigation looks like within their attractions, retail spaces, and restaurants. These new approaches to crowd control can start with queues.

2.2 COVID-19's Effect on the Themed Entertainment Industry

2.2.1 Current Precautions in Place Due to COVID-19

Theme parks must abide by CDC measures to ensure the safety of their guests and employees. In May of 2020, select retail and food venues began opening on the property of Universal Orlando Resort and Walt Disney World Resort. These companies made it clear to guests that their operations teams are doing all they can to prioritize health practices (Disney Springs, 2020). Both properties laid out markers on the ground of safe distances to stand in lines, temperature checks, arrows to create one-way traffic for pedestrians, as well as mandatory mask-wearing throughout the property (Simon, 2020).

In light of the announcements that Disney-owned and operated parks in the United States were introducing phased openings come July 2020, Disney Parks and Resorts made a public announcement to all future guests. They promoted safety using themed language as well as intellectual property integration within CDC guidelines (Hymel, 2020). For example, a new campaign uses characters and imagery from the Incredibles franchise with slogans like, “Together we can make today incredible” (Smith, 2020).

Below are precautions put in place in various theme parks starting to open:

- Mask coverings

Guests and employees will be required to wear face masks at both Walt Disney World and Universal Orlando Resort in Florida (Mitchell, 2020). At park entry, security will be checking for masked guests over the age of two years old (Flaherty, 2020) (Universal Orlando Resort, 2020). There will also be roaming employees ensuring that these precautions are followed. Many retail areas will be offering masks to purchase for guests who may have forgotten theirs at home or are looking for masks with their favourite characters on them.

- Temperature checks

Employees will conduct contactless temperature checks for both guests and fellow theme park team employees upon arrival. On the Disney Springs website they state that “anyone displaying a temperature of 100.4 F or above will be directed to an additional location for rescreening and assistance” (Disney Springs, 2020). It is unknown, the severity of repercussions for having a high body temperature (Macdonald, 2020).

- Added hand washing stations (Fig. 1)

To help guests avoid contact in various forms, including the touching of door handles, Disney Springs has added hand washing stations with soap around the property. Guests will use their foot to pump water from these portable sinks. Hand sanitizer will also be readily available on property, as well as to purchase (Vieregge, 2020).



Figure 1: Added hand washing stations in Disney Springs (June 11, 2020)

- Social Distancing (Fig. 2)

Social distancing has become one of the most important ways to slow the spread of COVID-19. Upon planning to reopen, theme park operations and designers have kept this in mind and created numerous visual cues to encourage social distancing. Floor markers are one of the most prominent things guests are seeing throughout the property. These markers are bright and attention grabbing with clear messaging, ensuring no confusion.



Figure 2: Social distancing floor markers in Disney Springs (June 11, 2020)

While all four practices are essential, maintaining physical distancing will require constant adaptation of every step of the guest's experience. Implementing floor markers and spreading guests six feet apart could indirectly produce negative feelings. A queue of larger groups of people will occupy more space. Guests may associate a queue of that length with a prohibitively long wait time and become discouraged (Ledbetter et al., 2013). Wait times will grow as ride vehicles' capacity will be cut, and overall throughput will be affected, as fewer people will be in attractions daily (Hart, 2020). With these negative implications, theme park designers and engineers must rethink what traditional queues look like and call for.

2.2.2 Industry Conversation and Speculation of Adaption

As theme parks around the world are beginning to open their doors to guests, industry experts are taking note of the success and hindrances at hand. Operations and design are being explored with a different approach.

Contactless solutions are being expanded upon, such as transactions in retail or menu distribution. The industry is mindful that guests and employees both need to limit contact to practice safe hygiene (Coates, 2020). Surveyed guests of Six Flags have communicated the want to return to location-based attractions, so the market has not been lost. Adaptability will be critical upon welcoming back guests (Banecker, 2020).

2.3 Touchless Technology in Theme Parks

When implementing any new technology within theme parks the narrative and immersion must be prioritized. Storytelling is what sets theme parks apart from the regular carnival or amusement park. The industry thrives on suspending the disbelief of guests and removing people from reality (Younger, 2016). Interactivity is the start of giving guests the power to find their way into these worlds and digital media can bring these stories to life in a new way. Stimulating guests in a multi-sensory way can create social communication, extension of a story, and overall positive feeling (Bartoli, Corradi, Garzotto, & Valoriani, 2013).

One example of touchless interactive media currently available are the commercialized wands in the Wizarding World of Harry Potter in Universal Parks and Resorts. By using infra-red sensors, the wands are able to interact with various elements around the land area. Whether the guest is levitating a pot or making a plant grow, the effect inspired a widely read mass media review and acclaim (Acuna, 2014). Giving guests the perception of agency and control of their environment can produce positive feelings towards the experience (Younger, 2016).

Walt Disney World is utilizing interactivity in queues with rides like Peter Pan's Flight in the Magic Kingdom. This queue projects "shadows" of the guests in the queue so they can interact with fabricated "shadows" like bells on the ceiling or butterflies (Andersson, 2015). This is an attraction with a normal wait time of above an hour on most days, so integrating more interactivity for guests to pass the time is necessary for guest satisfaction.

The technology for these types of interactions already exist but can be elevated to a new degree by developing the story even further and giving guests a reason as to why this action is happening.

Now, with COVID-19 affecting the world, there must also be forward thinking of the next challenge to maintaining public health and safety. By taking preventive measures now and integrating them into the realm of theme parks, many in this industry will be ready to think more intentionally about the guest experience.

2.4 Summary

Queues are an important a part of the theme park experience. Many methods have been implemented by using different queue designs and interactive elements, but with the emergence of COVID-19, there is a need to provide a queue that is safe by enhancing social distancing practices but not losing the immersion or story. Activities in queues mitigate the perception of waiting and people have been conditioned to consider interactive elements superior to passive entertainment effects. With touchless technology, these interactive elements can be effective in not only engagement but also safety guidelines.

This MRP will explore the use of one design featuring interactive elements designed to reward adequate separation in the queue. The next chapter describes the prototype and testing of such a device.

3. Design Process

3.1 Initial Design Candidate

When first analyzing the question of how to keep groups of guests to maintain a distance of six feet apart, there was an idea to create a system that included multiple interactive elements as well as a camera sensor system, similar a Microsoft Kinect device, to be placed around the open queue area. This camera system would monitor the total number of guests in the queue area as well as keep track of individual groups and their placement and proximity to one another. This would allow the system to detect when groups were too close and invoke an outside stimulus to move certain groups away from one another and to empty interactive elements within the queue area.

It was decided that to create, prototype, and test a system of this caliber would be outside of the scope of time and comprehension. This system and its design would also focus very heavily on the overall operations of an interactive queue rather than enhance the storytelling or narrative of the attraction.

3.2 Design Objectives

The intention of the proposed prototype is to promote physical distancing within queues while maintaining or enhancing interaction, immersion, and guest engagement. Building a device to serve the intention calls for updated objectives and requirements. Upon ideation, the principles stated in section 2.1.2 were considered, with mainly focusing on points [1] and [2]. With that, I added additional design objectives to said principles, as follows:

Interactive Queue Design Objectives	
1	Queue must ensure safety through physical distancing and limited contact with elements in public proximity
2	Interactive elements must be consistent with the narrative of the attraction
3	Interactive elements must accommodate guests of varying abilities
4	Interactive elements must facilitate interaction and storytelling through technology
5	Interactive elements must be durable and without the risk of vandalism or theft
6	Interactive elements must be able to be updated

Table 2: Additional queue design objectives

The solution of using touchless interactivity within a queue element met the needs of scope, capability, and new design objectives. For the first objective, application of an Ultrasonic sensor and Arduino was explored but to avoid the missing criteria of the initial candidate and to meet objective [2], the interactive element must be built aligned with the narrative of the attraction, in this case, Discover Atlantis. The idea of an interactive element within the queue space was inspired by the examples found in section 2.3. By integrating Ledbetter's guidelines with the new objectives, the proposed prototype was created (Fig. 3). The build and functionality will be explained in the next chapter.

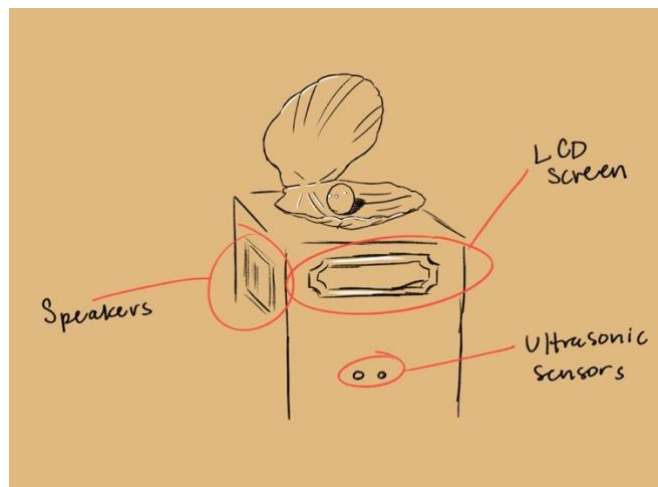


Figure 3: Initial sketch of interactive element

4. Proposed Prototype (The Curse of Nemo)

4.1 Overview

To further display the impact of interactive elements within a themed space and how to encourage social distancing within a post-COVID environment, I will use the example of the Curse of Nemo, an interactive, contactless narrative activity. This project used a conceptual design to apply the proposed prototype. Testing was applied once the prototype was in its initial form. This chapter reports on the process and specification of the prototype, design and fabrication, and the functional and usability testing.

4.2 Interactive Touchless Prototype

4.2.1 Context – Discover Atlantis

Discover Atlantis is a hypothetical ride themed around the story of 20,000 Leagues Under the Sea (Lê et al., 2020). Upon entering the space, guests will start in the preshow area leading to the interactive queue (Fig. 4) After their allotted time in that space, groups will be split into various ride pods to experience the ride itself.

For this research, I will be focusing on the queue area, a space we developed to be interactive. Within this space there are various activities for guests to experience, to keep them preoccupied during their wait. Specifically, I will be expanding upon the Curse of Nemo, a touchless experience to encourage social distancing within the space. The Curse of Nemo meets the new objectives proposed in section 3.2 and will be explored throughout this chapter.

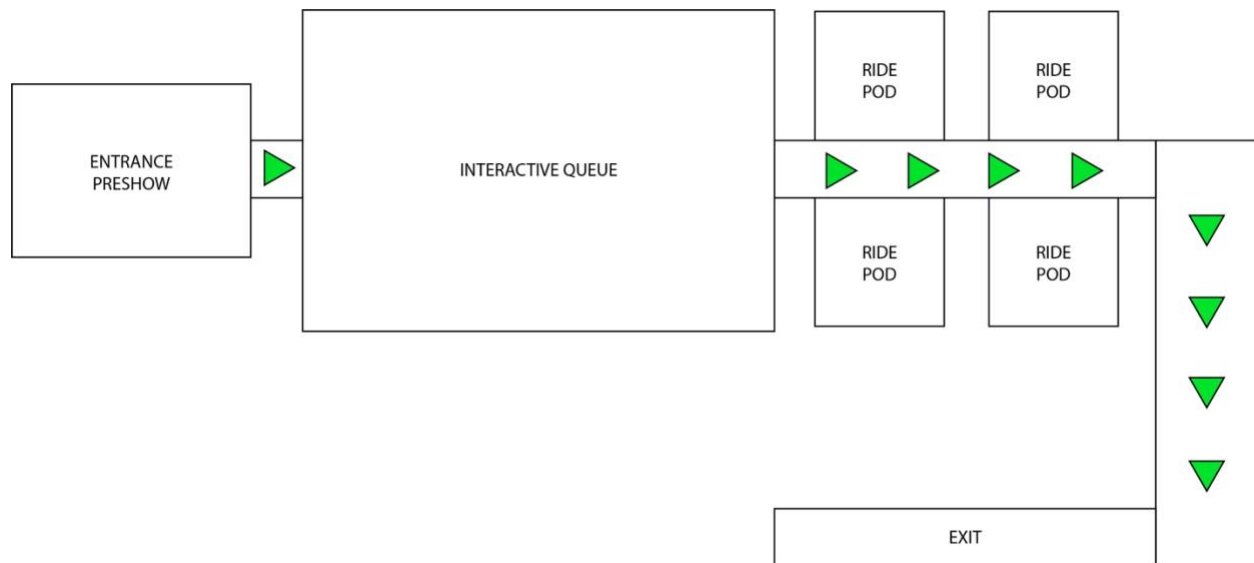


Figure 4: Conceptual layout of the Discover Atlantis show building.

4.2.2 Interactive Activity – The Curse of Nemo

The following is the narrative of the interactive activity, The Curse of Nemo:

“Many decades ago, Captain Nemo and his crew crashed their famed submarine, the Nautilus, on the bottom of the ocean floor. Search and rescue tried to find their bodies but ultimately pronounced the entire crew dead. What they did not know was that the magic from the city of Atlantis saved the sailors and trapped them in a curse deep below the sea. Now you must unlock the secrets that this mystical city holds.

Within Captain Nemo’s quarters many beautiful shells were found fully intact and unscathed by the wreckage. The Nemo Foundation has now displayed the shell in their lab as a reminder of their ultimate goal of researching and uncovering the truths of what really happened all those years ago. It is said, if those deemed worthy are near the shell, it might reveal some secrets of the unknown.”

4.2.3 Application and Performance Requirements

As discussed in section 2.1.2 queues have several purposes in themed entertainment and section 2.2.1 identified current conditions that impose new constraints. In order to meet the design objectives outlined in section 3.2 a prototype was constructed using Arduino and Ultrasonic Sensors (Fig. 5), a proximity sensor that relays information depending on the distance and actions of the subject. For example, the LCD screen will display different information if someone is standing still, six feet away from the sensors or if they are moving, three feet closer. The beta testing used a 16x2 LCD screen to read the messages cued by the Ultrasonic Sensors.

In Figure 6 and Figure 7, the flow of the main software loop can be seen. Within the “check differences” the sensor will read the distance of the subject in front and depending on the subject’s movement, the LCD screen will read different messages. The measurements used in initial testing are fit in varied distances, optimized for the quality of sensor used. To ensure the smallest amount for margins of error the measurements are in centimeters. These measurements are able to be rescaled for a larger room with more capacity and an improved sensor.

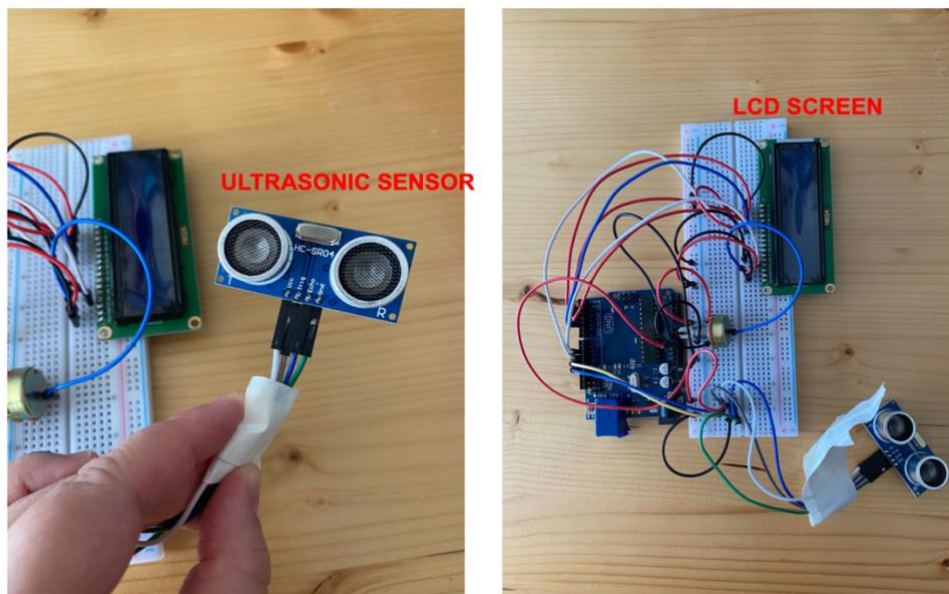


Figure 5: Hardware and technology used during beta testing

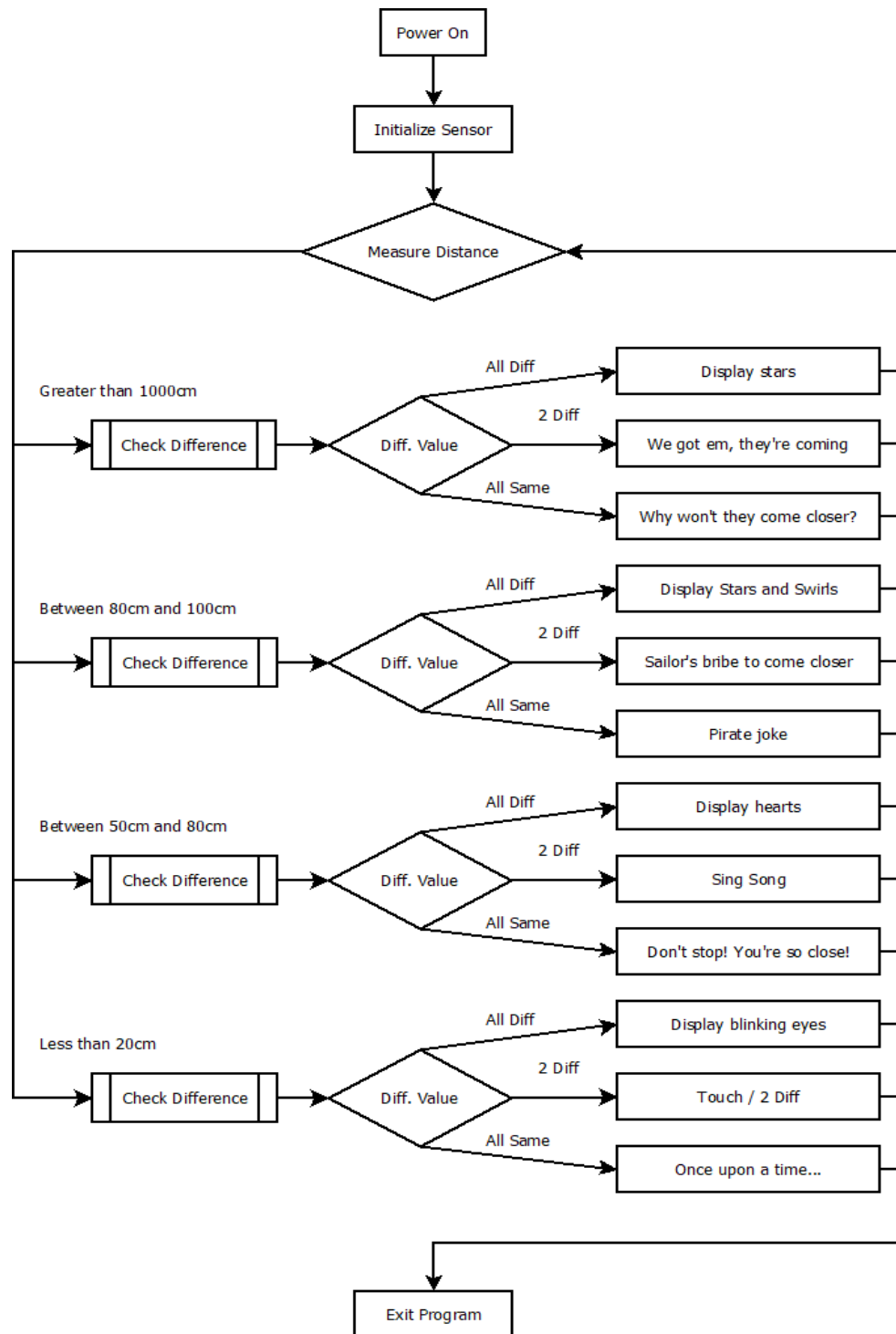


Figure 6: Main software loop

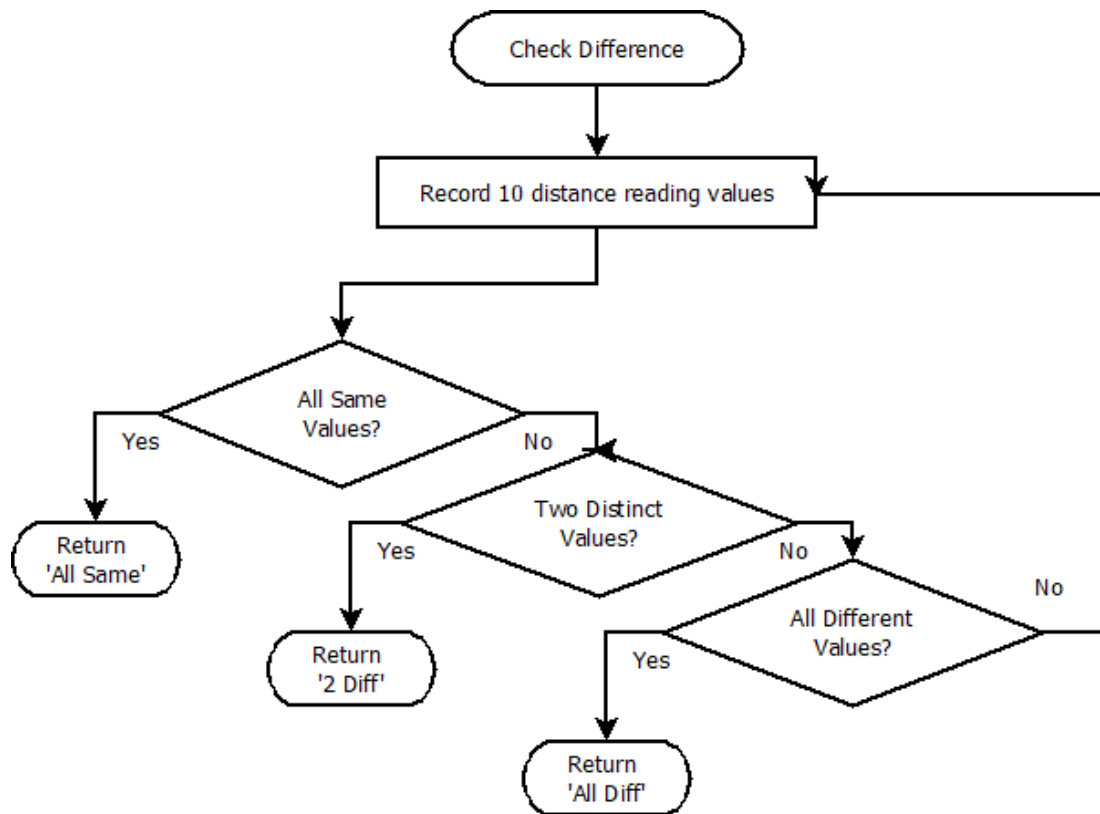


Figure 7: Check difference function for main software loop

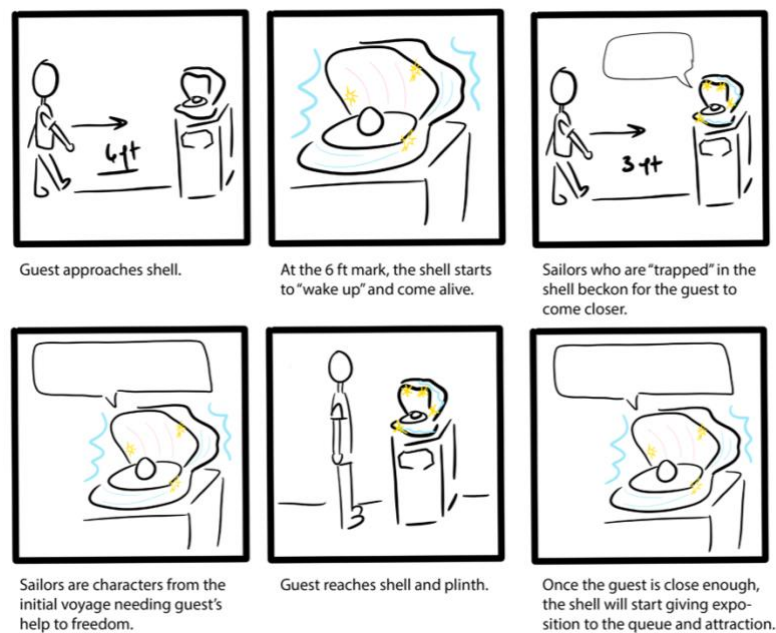


Figure 8: Storyboard of interactivity

Once the guest is close enough, “sailors” trapped within the shell will give more backstory to the attraction and the adventure they are about to embark on (Fig. 8). Within this script will be more clues and cues to head to the next interactive activity around the room so guests are able to stay engaged through the wait time.

This activity is enhancing the queue experience by giving purpose to the interaction and continuing the narrative of the attraction. It also encourages guests to stay in one spot for an allotted amount of time, rather than aimless wandering the room, thus, enforcing social distancing in an immersive way, meeting objectives [1] and [4]. This is one example of an activity that can be found within the queue itself. The space was written in a sequential way so the Curse of Nemo acts as the exposition to lead guests throughout the room to play through their wait time.

4.2.4 Accessibility

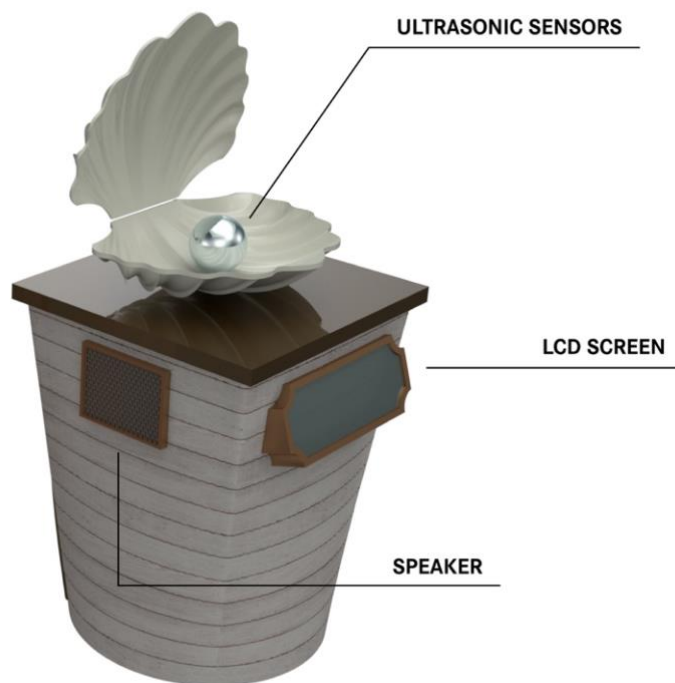


Figure 9: The Curse of Nemo interactive rendering

Each line of code displays different tactics the “sailors” use to bring the guest forward and closer to the shell. To meet objective [3] and ensure this interactive activity is optimized for guests of varying abilities many sensory elements have been implemented within the design (Fig. 9). The LCD screen is intended to read the characters’ script clearly for those who are hard of hearing or deaf. The shell, itself, also capable of omitting various coloured

lights using RGB LEDs to add to visual cues. There is a speaker located on the side of the plinth to enhance the auditory experience. Further assessment and the Americans with Disabilities Act (ADA) approval would be required for the final build and implementation of the element.

4.2.5 Testing

Testing was undertaken to validate the code worked as intended, and that users could successfully interact with it once placed into a space. The functional testing was done iteratively during coding, concluding when the code produced the intended outputs. The user-interaction testing was conducted by setting up the system within a space with the maximum distance of 1 metre allowing testers to circulate similar to the attraction queue (Fig. 10). Under pandemic quarantine conditions, my partner and I conducted three successful rounds of trials of each output to verify interaction performance. Attaching the Ultrasonic Sensor to a stable stand, my partner would perform each user action that had a coded case statement while I would monitor the LCD screen for the correct text output. I also verified that the correct distances were being read using the serial monitor included with the Arduino program.



Figure 10: Testing set up with marked distance

5. Results and Industry Evaluation

5.1 Results

During testing, there were a few instances of unexpected behavior. These were either caused by the subject moving in a pattern that was not accounted for or the sensor showing false values. Most errors were solved with extra logic statements until all possible user behavior was maintained (Table 3). The most consistent results came from when the subject was either standing still (All Same) or moving at a consistent pace (All Diff). To make sure that no narrative elements were being lost if outputs during the starting motion behaviours (2 Diff), the output was changed to be more transitional than characterized (i.e.: to ensure no story beats were lost, those outputs were changed to irrelevant, but still engaging outputs).

Fuzzy Logic Testing					
Case #	Distance	Code Logic	Subject Behaviour	Expected LCD Output	Output Correct (Y/N)
0	Touching (<20 cm)	All Same	Standing Still	Sailors start telling guests funny story	Y
1	Near (50 cm - 80 cm)	All Same	Standing Still	"Don't stop! You're so close!"	Y
2	Medium (80 cm - 100 cm)	All Same	Standing Still	Sailor jokes	Y
3	Far (>1 m)	All Same	Standing Still	Sailor bickering	Y
4	Touching (<20 cm)	2 Diff	Starting Motion	"Don't scare them off now!"	Y
5	Near (50 cm - 80 cm)	2 Diff	Starting Motion	Sailor songs	Y
6	Medium (80 cm - 100 cm)	2 Diff	Starting Motion	Sailors bribes	Y
7	Far (>1 m)	2 Diff	Starting Motion	"Ah yes, come closer..."	Y
8	Touching (<20 cm)	All Diff	Full Motion	Eyes opening	Y
9	Near (50 cm - 80 cm)	All Diff	Full Motion	Heart beats	Y
10	Medium (80 cm - 100 cm)	All Diff	Full Motion	Swirling stars	Y
11	Far (>1 m)	All Diff	Full Motion	Stars blinking	Y

Table 3: Fuzzy Logic testing

5.2 Industry Feedback

5.2.1 Mini-Delphi Evaluation

I approached this project with a mini-Delphi evaluation. Upon finishing building out the beta version of the Curse of Nemo, I looked to industry professionals for review and feedback. Their insight would be rewarding toward the merit and need of touchless interactive elements in queues. In total, I interviewed five individuals with portfolios and professional work in the themed entertainment industry. The five individuals' work ranged in experience offering a range of expertise within the industry, from academic to professional. Each expert has derived professional knowledge based on thousands or millions of guest responses to themed entertainment design, potentially surpassing the insights obtainable from user testing in a laboratory. While Delphi methods are often used in multiple rounds of forecasting, this step used a minimized approach of one structured interview with each of five experts. Expert comments cited in this section are cross referenced by interview number 1 through 5 as tabulated in Appendix A. Within the interview I asked them questions about their personal endeavours with COVID-19 and their professional work which led me to show them a short presentation on the technology and story behind the Curse of Nemo, as well as a short video of how the interactive works. From there, they would offer overall feedback for the project.

5.2.2 COVID-19 Safety Precautions within Theme Parks

A large concern, with the current state of the industry was how to enforce social distancing in an immersive way all while keeping everyone safe. Interviewee 1, posed the question, "Even with virtual queues, where are we putting all these people? If you're congregating all these people indoors or outdoors, you're just creating another problem. Rise of the Resistance in Disney's Hollywood Studios is an example of that problem upon reopening. To

experience this attraction guests must reserve a spot using the My Disney Experience app. As the attraction's capacity fills, guests will be given a return time to start lining up for their turn to ride. In theory, this is a great way to mitigate crowds as well as cut down wait times in the queue itself. Unfortunately, upon reopening the park, there have been many technical difficulties with the attraction and guests are still experiencing long wait times within the queue. Therefore, counteracting the goal of the virtual queue. Only now, with COVID-19 still active, social distancing needs to be monitored within the space as well. So, in these queues there are large parties of guests at a standstill, in an enclosed space, for various amounts of during a pandemic (Mike, 2020).

Acknowledging this, he shared that the Curse of Nemo would be a great alternative to this dilemma. Instead of using traditional switchback queues, the space could be changed into a "holding-pen-style" such as rides like Race Through New York with Jimmy Fallon (RTNYJF) in Universal Orlando. In RTNYJF, their queue is essentially one large room with seating options and memorabilia from 30 Rock in New York City. There is also a mini soundstage in the front where, occasionally, entertainment such as a barber shop quartet, will perform, keeping guests preoccupied and distracted from their wait time. With this style of space, various interactive activities are able to be spaced out enough that groups can pass the time of waiting in line as well as stay six feet away from each other.

5.2.3 Pain Points with Interactive Elements

Another point discussed, was various attractions' current uses of interactive elements within queues and how to overcome their pain points. Big Thunder Mountain in the Magic Kingdom was brought up since they integrated an interactive queue in 2013 (Fickley-Baker, 2013). Interviewee 2 stated complaints that the interactivity added nothing to the value of the

attraction. In this queue, the interactive elements are installed for guests to be able to distract themselves from the longer wait times. Unfortunately, by being integrated within a traditional switchback queue and wait times always fluctuating, it causes more back-up and ultimately slows down the line [2]. Considering these constraints, her feedback for the Curse of Nemo was to make sure that the narrative of the attraction was consistent within the queue and engaged the guest with purposeful interactions. For example, giving more context to the ride, unlocking extra features of the ride experience, or even a take-home souvenir of sorts.

5.2.4 Maintaining Guest Interest

Finally, the last piece of feedback came from Interviewee 5. He focused on making sure that the interactive was engaging enough to keep the guest's attention. Especially, if the goal of the interaction was for social distancing and keeping CDC guidelines in mind. He posed the question, if a guest or party were to walk away because they got bored, how would the activity draw them back in [5]? This was an aspect I had not considered during the initial build and will be implanting during reconstruction.

6. Discussion

6.1 Feasibility and Build

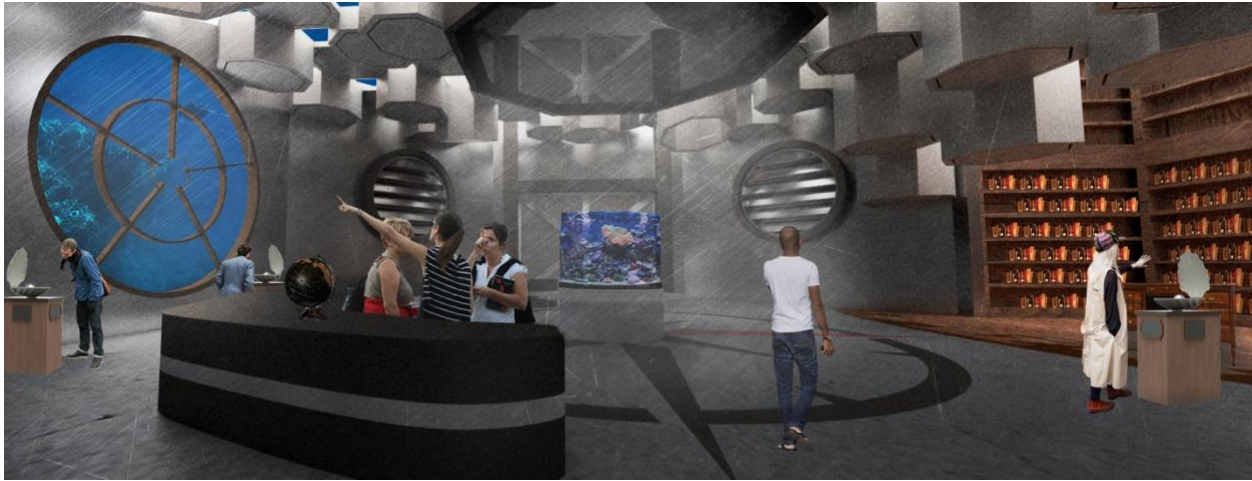


Figure 11: Early rendering of the Discover Atlantis interactive queue. Rendering by Keegan Toscano.

After reviewing testing results and industry evaluation, conceptual changes would be made to the final application of the proposed prototype and operations guide.

Grouping of guests will be very important to adhere to CDC guidelines of social distancing. When building this interactive element into the queue holding room, it must be six feet away from any other activity that engages a guest. Employees must know to only send one group to each interactive element at a time. Within the interactive queue of Discover Atlantis there will be multiple interactive activities for guests to engage with, exemplified in Figure 12. The Curse of Nemo will be the spread throughout the room as a way for multiple

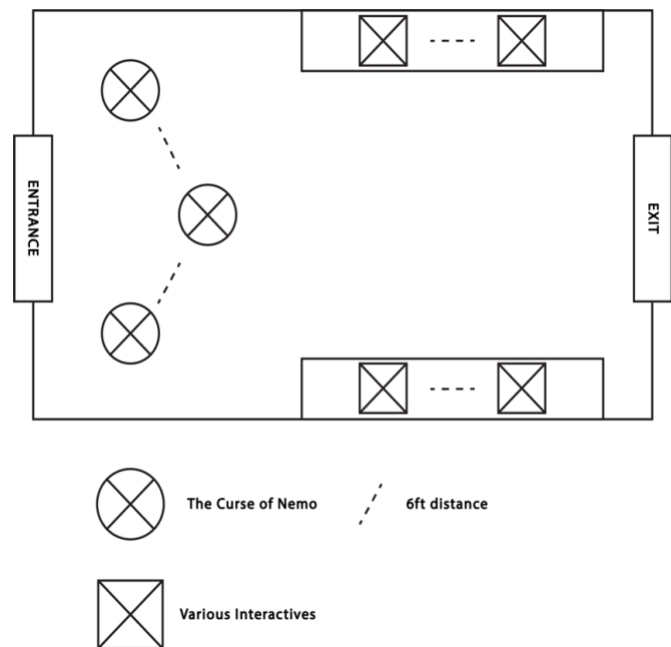


Figure 12: Layout of interactive queue with elements

groups of guests to have their time with the activity. Each plinth will be distanced and follow CDC guidelines.

The Curse of Nemo will hold the guests' attention and the Ultrasonic Sensor will know when a guest has moved further away than the recommended distance before the activity is over. Ensuring that guests stay in their designated areas for the full activity before moving onto the next interactive. Of course, humans have free will and even if a machine is telling someone to stay still guests may still roam, which is why it is imperative for employees to operate alongside the interactives. The Ultrasonic Sensor will also read when someone is too close and alarm the user, as well. In doing so, employees will be able to be notified of any suspicious behaviour, meeting objectives [5].



Figure 13: Front and back of the Curse of Nemo Shell, Renderings by Keegan Toscano.

Daily throughput and attendance must be acknowledged. The plinth is able to open, and employees can either turn the interactive completely off when wait times are low or change it to an alternative play-mode where the engagement does not last as long (Fig. 13). During these times, due to low capacity, the engagement is about how the guests interact with the activity rather than keeping them in one place due to social distancing (Fig. 14). These factors meet objective [6] of the new design objectives found in section 3.2. The shell should be sturdy and securely attached to the plinth, either as one whole fiberglass mold or through dowels and rods. This will help with objective [5].

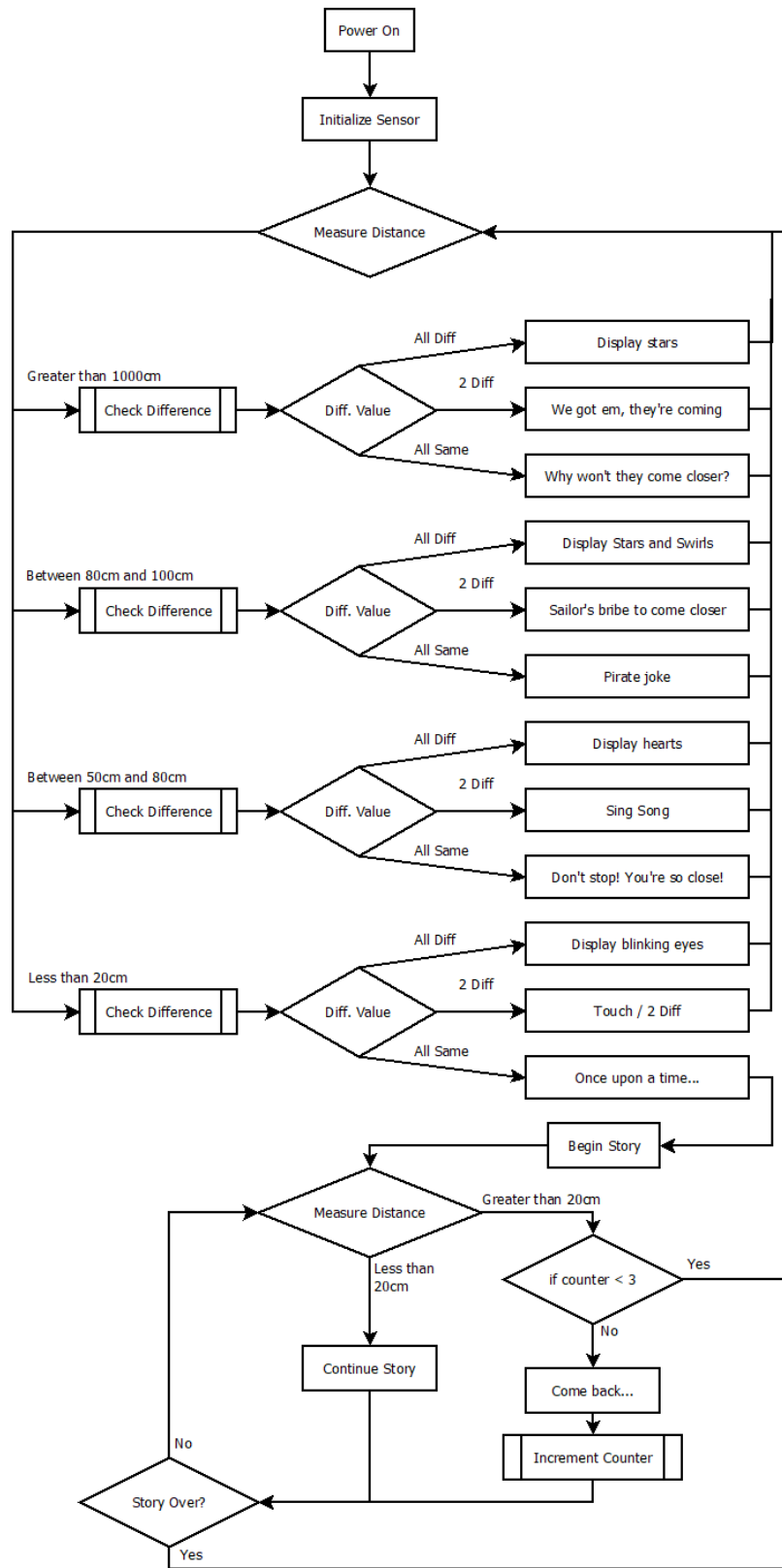


Figure 14: Main software loop, version 2

6.2 Limitations

This prototype also does not test whether or not narrative affects a user's interest within the interactivity. This is not to say, the interactive elements cannot be transferred to a different intellectual property, but this study was not designed to identify that specifically. This study also is focused on the elements and physical distancing within the queue and did not consider the situations in place before entering the space.

As discussed in section 4.2.4, the Curse of Nemo should be built with accessibility in mind. In that, the script was written in English and for guests where they are not fluent in English this activity may not engage them as intended.

6.3 Future Goals

For future iterations, the Curse of Nemo should be created in its stylized, decorated form for user testing with the intention of gathering quantitative data correlating a set wait time and guest satisfaction. With this data, various versions of the Curse of Nemo would offer more opportunity to expand the functions of the prototype.

The prototype that was fully built out to its capacity did succeed in my expectations of properly finding the function of a proximity reader within a themed experience. The Ultrasonic Sensor aligned with the intentions of creating an interactive, contactless activity themed to a specific narrative. Within user testing, it would have been beneficial to learn more about subject's reactions to the story and logic of the case statements as well as using a stronger proximity reader would be opportune to be able to measure larger distances to mock a larger scaled area. Using multiple sensors at once would also be opportune to test functionality and accuracy of the Arduino.

7. Conclusion

Even after a vaccine has been implemented and numbers of those affected by COVID-19 start to decline, there is no telling how people will respond to the “new normal”. Guests will be cautious for some time and creating new forms of immersive experiences that respond to these concerns will be the key to moving forward within theme parks. The Curse of Nemo is an example of how touchless and narrative-driven elements meet new objectives for interactive elements as stated in section 3.2 that address the challenges of operating a theme park during the middle of a pandemic and thereafter.

Although the Curse of Nemo is specifically themed to the Discover Atlantis attraction, the technology and principal of the interactive activity can be applied to various areas of a theme park. The Curse of Nemo, and interactive applications similar, enhance the guest experience at theme parks for a post-pandemic world by making the queue a safer area that provides additional context to the main attraction. Within the experts’ feedback, they identified different areas this touchless technology could be successfully implemented. For examples, entertainment departments could use it to create virtual meet and greets with characters around the property, so performers and guests are able to limit risk. Adding sensors and reactions like those from The Curse of Nemo could also enhance land play by keeping guests engaged while being safe. This could further be customized in the future with guest information to make a personalized experience for each and every guest.

Through testing and industry feedback The Curse of Nemo meets the interactive queue design objectives discovered during the design process. Touchless storytelling is just the beginning for themed entertainment and embracing life at six feet apart.

Appendix

Appendix A

Interviewee	Date	Interview Length	Description of Work
1	May 28, 2020	23:10	Artistic Director, theme park division
2	June 11, 2020	16:47	Intern, theme park division
3	June 11, 2020	8:34	MFA Themed Entertainment student
4	June 25, 2020	16:50	Graphic Designer, themed entertainment design
5	June 16, 2020	11:47	Assistant Director, theme park division

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