FinTrack: Innovating Orca Conservation Through Technology

A Comprehensive Proposal for the Development of an Orca Identification and Tracking Application

Images provided via AI generation by Microsoft Bing

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Executive Summary

The proposed project aims to develop an app for the global identification and tracking of orcas (*Orcinus orca*) based on the unique morphology of their dorsal fins. Orca fins are like fingerprints, each is unique to an individual. This initiative is designed for wildlife photographers, marine researchers, and the general public interested in marine life conservation.

Currently, there are many methods employed in various ways amongst individual groups and organizations to track orcas. This leads to tracking data being collected — which is useful to the organization gathering the data — but incompatible with effectively sharing outside of that organization. This app seeks to bring continuity and provide a comprehensive and user-friendly tool for monitoring and studying orca populations globally in one app. The app will enable the collection and analysis of data pertaining to individual orcas, their pods, migratory patterns, and ecological impact. This project stands out due to its integration of technology with marine biology and universal usability amongst organizations which promotes both advancing scientific research and increases the opportunity for public engagement in conservation efforts.

Around the globe are marine researchers, wildlife photographers, and conservationists watch and keep track of their orca sightings. Unfortunately, most of these groups are independent from one another and do not work together to share information. This app will work to bring together these groups to form a community around the globe — collecting and storing their information in one platform — creating a detailed database on orcas. This is accomplished through the use of artificial intelligence (AI) to analyze photos and identify individual orcas based on their fin characteristics — including fin size, shape, and coloring. The AI will have the ability to form an understanding of migration patterns based on the various locations where an orca or the associated pod has been spotted and predict where to get the next best photos.

Any user will be able to upload photos to the FinTrack, and the app tells the user which orca they have just spotted. From there the user will be asked if they would like to share the photo they took to a public board, where they can present what to the rest of the community what they spotted.

FinTrack will go through various stages of development to ensure proper functionality. The Alpha stage of development will be the prototype, with a simple capture and upload feature on the home page of the app. This is where the AI is trained with Machine Learning (ML) to analyze photos of Orca fins, learning to recognize the individual differences between their fins.

To train the AI it will be given photos from researchers who are familiar and have catagorized the orca or pod is in the photo. The researchers will feed the AI this information so it can create a large enough database to start analyzing photos on its own.

In the Beta stage of development, researchers will take the app out to sea to test the ability of FinTrack. This will train the AI for real life use when fully launched. The researcher will take photos of spotted orcas out at sea and let the AI analyze the photo. From there, the AI will give it's best guess as to which orca it believes it has spotted. An educated guess will be presented based on the previous training from the Alpha stage, and collected data from researchers of known orca sightings.

In order to let the AI know if it is correct or not, the researchers will share preliminary information, such as satellite data and known orca locations. If the AI is correct, the researcher that uploaded the photo will let the AI know so it can add the photo and information to the database. If the AI is incorrect, the

researcher will let the AI know it is wrong so it can try again. Reasearchers will continue to train the AI until it can correctly determine the orca that was spotted with minimum of 95% confidence.

When fully launched FinTrack will be completely functional and can correctly guess which orcas have been spotted on its own. It will have a fully functioning app design with an interactive front-end design, and a optimized back-end design, to ensure the app stays operational and runs quick and smoothly. The user interface (UI) will have a homepage where the user can capture photos and upload them while they are out at sea, or when they're connected to internet at home. There will also be a built in social media page where users can post their sightings to a board so they can share what they've seen, communicate where they spotted the orca, chat with the community, and share why they love orcas! There will be weekly lessons uploaded to encourage continued use of the app for those who have a strong interest in this field of science.

Our team is proposing a budget of $10,000, using every dollar to ensure the app functions through design and testing, along with implementing marketing strategies with social media.

With 40% of the budget ($4000) dedicated to be used for software development to create a functioning UI, train the AI, and optimize the back-end for the best performance. This portion will also be allocated for quality assurance testing to ensure the app runs correctly, either after a update or for addressing bugs reported by users.

An initial 25% of the budget ($2500) will be applied to research, working with different institutions to gather their collected data of orca spottings. There will also be research on user interface design to create a visually appealing display that makes it easy and fun for users to interact with. Another 25% of the budget ($2500) will be used for marketing strategies, such as social media advertising and app store optimization (ASO). This is where the app gets promoted through webinars and social media pages on instagram. Having app store optimization is important because it allows a potential user to find FinTrack with fewer search attempts in the app store.

The remaining 10% of the budget ($1000) will be used for administrative purposes. This will be for legal fees, unexpected costs, registering the app, and internet usage. Once the initial budget is used, FinTrack will continued to be funded through the community of users.

There will be options for long term memberships giving the user a few extra perks, like where to get the best orca sightings based on recent uploads. There will be crowdfunding options incorporated where any user can donate an amount of money they feel is satisfactory given their experience with the app. Additionally, it will be funded through social media pages, where information about the app is continually updated. Social media pages encourage the user to join FinTrack, ask if they would like to make any donations, and give the developers feedback.

FinTrack is feasible with current technology. Dedicated and casual orca trackers have the ability to track individuals based on geo-tagging, satellite locations, or recording whale noises over periods of time [1]. Using the power of AI, and the previously mentioned technologies, the app will have the ability to pin-point and track orcas through triangulation via GPS. It will use all the information collected — uploaded photo captures, satellite locations through geo-tagging, the distance various orca pods can be heard through the noise recordings, and migration patterns — to calculate where the whale was last spotted and where it will be in the future based on predictions.

With FinTrack being an innovative combination of marine research and computer science, it can bring together people to form a global community dedicated to the common interest of orca conservation — or persuade casual enthusiasts to become active conservationists of these majestic creatures.

Abstract

This document outlines a proposal for creating an orca identification and tracking app. The app will utilize photo uploads and advanced analysis to identify individual orcas and track their movements via geo-tagging through the metadata contained in the photo, and the location where the app is used to upload the photo. It aims to fill a critical gap in marine conservation by providing a global collaborative platform for data collection and public education about orcas and their migration patterns. This project combines wildlife and computer sciences, offering an innovative approach to studying and conserving these apex marine predators.

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1. Introduction

Background: Information on orcas and their different ecotypes

Orcas (Orcinus orca) are scientifically known as *keystone specie*s – species that have a disproportional impact on their surrounding environment. There are many different types of orcas, each of which occupies a specific niche within their respective environments. There are currently ten identified different ecotypes of orcas split between the Northern and Southern hemispheres. Within the Northern Hemisphere, five distinct ecotypes can be found split between the northern Pacific Ocean and the northern Atlantic Ocean. The Resident, Bigg's (Transient), and Offshore ecotypes can be found in the Northern Pacific, while the Type 1 Eastern North Atlantic and the Type 2 Eastern North Atlantic ecotypes reside within the Northern Atlantic, as the name suggests. The other five ecotypes are found in the Antarctic. They include Antarctic Type A (Antarctic), Antarctic Type B1 (pack ice), Antarctic Type B2 (Gerlache), Antarctic Type C (Ross Sea), and Antarctic Type D (Sub-Antarctic)[2].

The diet of each ecotype differs significantly, and each has evolved to only prey on specific organisms within their range. In the Northern Hemisphere the Resident ecotype preys primarily on Pacific salmon, the Transient ecotype preys primarily on marine mammals, and the offshore ecotype preys exclusively on sharks. The Type 1 Eastern North Atlantic ecotype feeds mostly on herring and mackerel, but will occasionally eat Atlantic salmon when the opportunity arises. The Type 2 Eastern North Atlantic ecotype, however, primarily hunts other cetaceans (dolphins and whales) as its main source of prey, with it most notably favoring Minke whales [3]. In the Southern Hemisphere, The Antarctic Type A ecotype feeds primarily on Minke whales and Southern Elephant seals [2]. The Antarctic Type B1 ecotype mainly hunts Weddell seals by creating waves to wash their prey off ice flows and into the water where they can chase them down. The Antarctic Type B2, which is very similar to their larger counterparts, prefers to hunt penguins rather than seals. The Antarctic Type C ecotype is the fish-eaters of the southern hemisphere, primarily eating Antarctic toothfish [2]. Not much is known about the elusive Antarctic Type D ecotype. However, they have been observed eating Patagonian Toothfish caught on commercial fishing lines [2].

Orcas live in matrilineal familial units called pods, led by the oldest female member of the group. The life span of orcas can range anywhere from 50-90 years in the wild [4]. Family members do not often leave the pod and all members will stay within their mother's pod for their entire life. However, because of the decline of individuals within pods, there has been an increase in recorded instances of inbreeding within pods in both the northern and southern hemispheres. The most notable of this phenomenon can be seen within the Type D ecotype, which has been found to have the highest recorded level of any mammal. This decline of individuals affected all ecotypes, however none more than the Southern Resedents off the cost of the Pacific Northwest with only 75 individuals, and the AT1 pod of South Central Alaska with only 7 members remaining after the Exxon-Valdez oil spill in 1989 and no births since 1986. Both of which are under federal protection by the U.S. government [5].

Context: Current methods of orca tracking and their limitations.

Current methods for tracking orcas and orca pods range from amateur photo submissions [6][7] along with self-reported times and locations of sightings to researcher-led satellite tracking through specialized tags applied to the fins of the individual orcas [8]. These methods provide tracking information that ranges from generalized sightings with potentially unhelpful photo submissions to exact tracking of individuals and their associated pods through verifiable satellite data.

While amateur submissions are helpful for researchers to gain a general understanding of the locations of pods, the lack of reliable fin photographs and sometimes approximated times and locations can result in pods and individuals not being identified properly. Conversely, satellite tracking is very reliable because it is applied by qualified researchers and teams that can accurately catalog or identify an individual at the time of tagging along with the pod to which it belongs. Satellite tracking devices have serious limitations. They are expensive and are designed to be temporarily attached and naturally corrode and fall off to not cause harm to the individual tagged [8]. To maintain a high level of accuracy for tracking, tags would need to be reapplied regularly to a member or two of a pod. This is both cost-prohibitive and reliant on the pod being available when researchers are located nearby to be able to apply the tags.

Gap Identification: Highlighting the absence of a globally accessible orca identification and tracking tool.

Given the number of localized amateur groups devoted to tracking orcas and the number of non-profit organizations keeping track of their own individual data in their respective proprietary formats, it can be difficult to compile the data into one easily referenced resource. Additionally, some research groups may have limitations imposed for funding or institutional reasons as to how their collected data may be shared with the general public and with other researchers not within their group. Thus, there is a lot of data disparately collected and maintained, but usable only to those who collect and maintain it.

Purpose: Explaining how the proposed app will address these gaps and contribute to marine conservation.

With FinTrack, key data points are standardized and cataloged the same way each time a submission is made. Tracking and referencing these submissions is simple and requires very little training for the user. The data is publicly accessible through the app with no limitations on access. This open approach allows for more accurate community submissions. It engages public involvement in conservation efforts while giving professional and academic researchers access to more reliable data without requiring rigorous proprietary collection controls to be in place.

Structure: Outlining the contents of the proposal.

This proposal takes the reader through the needs of robust orca identification with conservation efforts. It starts by explaining the gap in globalization of orca tracking research, and why it is needed to create a more universal data collection. Then it explains how FinTrack will work using photo uploads or image capture, using Artificial intelligence (AI) and Machine Learning (ML) to learn and understand how to identify orca fins and pods. Followed by a timetable breaking down the development of the app and the research needed to create it, explaining how the apps will work at different stages of development. Then will be the budget breakdown needed for the development of the app, such as initial development, and the following updates needed to keep the app functional. After that the writers of the proposal then introduce themselves and why they are qualified for this project. Finally, we'll discuss the feasibility of the app with current technology, and how the app will be sustained in the long term. Lastly, the conclusion, wrapping up final thoughts and thanking the reader for their support.

2. Need for Orca Identification and Tracking:

Introduction to Orcas: Discuss the biological and ecological significance of orcas, including their role as apex predators and their impact on marine ecosystems.

As discussed in the Introduction, orcas are a keystone spieces within their specific ecosystems, giving researchers and scientists an overall idea of the health and sustainability of the environment around them. Not only do they help indicate the overall health of the ecosystem, orcas are also the natural solution to the population control of prey items. For example, If there are too many seals within a specific population then the orcas will have more prey items to hunt, in turn lowering the seal population and returning the ecossysten to a balanced and sustainable state. There are ten different ecotypes split evenly between the Northern and Southern hemispheres, with each ecotype inhabiting a specific ecological niche within their environment. This occupation of a specific niche is what scientists refer to as specilization, and helps to disperse predation habits to specific prey items, like seal specialists versus fish specialists, so that there is no competition between ecotypes for the same food source.

Current Challenges in Orca Research: Explore the difficulties faced by researchers in tracking and studying orca populations, such as limited access to remote habitats and the need for non-invasive research methods.

Currently, there is no global network or database of all known individuals and pods available to the public. There are regional catalogs that document each local pod and individual, however many of them have not been updated in some time and are often not an accurate way for tourists, photographers, and researchers to identify and track orcas. Some databases can be used offline as well as online, rather than a printed copy of local catalogs, which can be used when a cellular device is out of service. The current methods for locating orcas include a radio chain between boat captains as to their last seen location, Facebook groups dedicated to whale sightings, and other less accurate ways.

Conservation Concerns: Address threats to orca populations like habitat destruction, pollution, and climate change, emphasizing the importance of monitoring for conservation efforts.

There are multiple threats to orcas, such as harrasments by boats, climate change, and inhuman capture and captivity. Due to climate change and polar caps melting, orcas are having to migrate to new areas that have the right temperature for their survival. This unfortunately puts strain on orcas, as moving to new a location puts strain on "predated species, which risks harming the ecosystem, including prey availability, and therefore orcas" [9]. There also boats who go out to sea trying to find orcas for capture and captivity. This is inhumane as the unfortunate orca that gets capture can be mistreated or even killed for meat [9]. Even those who do not capture orcas will tend to get close to them and "harass" them. This is dangerous because if they get too close it causes noise pollution, and boat motors has been known to slice the fins on orcas. Based on these dangers for orcas, is it very important that conservation is taken seriously, as they are a apex predator in their ecosystem and have a huge impact on the population of prey. "The data on the endangered species act list states that killer whales are endangered. They are on Appendix II of the CITES site, which means they are not threatened by extinction, but conservation efforts must be employed to help keep them from moving closer to extinction" [10]. Using FinTrack, there is hope in creating better conservation efforts and protection for these creatures. Having better knowledge of individual locations of pods, conservationists are able to keep a close watch on what pods might be threatened by poachers or others who wish harm on these majestic creatures.

Benefits of Monitoring: Explain how tracking individual orcas can provide insights into their health, behavior, social structures, and migration patterns, which are crucial for effective conservation strategies.

Global tracking databases, like *FinTrack*, would allow for the continuous monitoring of both individuals and pods at any given moment. This information could be especially useful when studying Southern Hemisphere ecotypes, of which little is known, or the endangered pods of the Northern Hemisphere. This monitoring would possibly allow scientists to identify the reason for the abnormally high rate of inbreeding within Type D orcas, or allow researchers to closely monitor the lasting harmful effects of the Exxon-Valdez oil spill on the AT1 pod. A global database of all known orca locations would also help to track normal pod migratory patterns and compare those movements with patterns observed to be induced by self preservation- either from climate change, human hunting and trapping, or harrassment.

Global Importance: Highlight the significance of a global tracking system in fostering international collaboration and standardizing research methodologies.

A global database for the identification and tracking of orcas would allow for a better understanding of different ecotypes in different regions, as well as a unification of information that is easily accessible to anyone seeking it. Not only would *FinTrack* allow for a greater range of information to be shared, but it would also allow for the collaboration of multiple research teams to discuss findings. It opens the door for global eco-tourism as well and allows avid whale watchers to keep track of the individuals they spot.

3. Novelty and Innovation of the App

Existing Solutions and Their Limitations: Review current methods and tools used for orca tracking and identify their shortcomings.

Current orca and orca pod tracking methods range from accurate but expensive short-term researcher-applied satellite tracking devices to amateur enthusiast photo submissions which may not contain clear images or come with inaccurate time and location reports.

Innovative Approach: Detail the innovative aspects of the app, such as the unique algorithm for dorsal fin recognition and the integration of geo-tagging data.

With FinTrack, accurate fin identification is made possible through the application of algorithmic photo analysis and automatically collected time and location information.

Technological Integration: Discuss the use of advanced technologies like machine learning (ML), AI, and data analytics in the app.

With the modern advantages of machine learning (ML) and artificial intelligence (AI) integration, the accuracy of the photographed orca fin image identification becomes more reliable and accessible to the intended audience of researchers and amateur marine biology enthusiasts. Artificial intelligence is leveraged to assist with accurate and fast recognition of the fins of orca individuals without requiring time-consuming human interactions for most of the process. In the event of a low confidence recognition by the AI, an alert will be sent to a real live person who will then examine the uploaded image to better identify the orca captured. Machine learning will work alongside the AI to help speed up the process for future image recognition and will incorporate feedback from the human reviews of low-confidence images to better enable the AI to recognize orca individuals without requiring as much future human attention.

User Experience Design: Explain how the app is designed to be user-friendly for a diverse audience, including non-experts and the general public.

The simple point-and-shoot or tap-to-upload functionality of the FinTrack app ensures that anyone using the app can leverage their level of technology prowess to contribute to the community as a whole. A user with a general sense of how to use a camera application native to their device would be very comfortable with capturing an image directly from within the application itself. There will be a simple user interface with the ability to select the same zoom and camera functions available natively to the device in use. After capture, the user will have the option to upload or discard the image and a copy will be placed in the local device photos storage, should the user allow access. If it is preferred by the user to use their native camera application or another application designed to work with their device camera, uploading will consist of three taps. First tap to select upload from within the app, second tap to to select the picture from their camera roll, and third tap to confirm upload to the collection. This feature is also dependent on the application receiving permission to access the camera roll.

Long-term Impact: Project the potential long-term impacts of the app on marine research and conservation.

The potential long-term impacts of this application and the data it collects cannot be understated. With the availability of one source for live tracking of orcas and orca pods, researchers can gain a more complete picture of the population and the migration habits of these apex marine predators. This has the potential to drive more focused conservation efforts.

4. Methodology: Photo Upload, Identification, and Geo-Tagging

Photo Upload Mechanism: Describe the process for users to upload orca fin photos, including any required formats or guidelines.

Users of FinTrack can contribute to the data collection in one of two ways. The first is to grant the application access to the device camera to allow for photos to be captured and uploaded directly from within the app. The second is to upload pre-existing photos containing metadata from a user's camera roll.

Identification Process: Explain in detail how the app analyzes and identifies individual orcas based on dorsal fin morphology.

With either method, the metadata and geolocation data can be collected and analyzed. This data includes the timestamp, geolocation, device type, camera type, camera mode, zoom level, and other pertinent data. With this data, the algorithm can determine the distance from the orca photographed and the position at the time the photo was taken. If an image is unusable, the user is immediately notified and provided tips on how to obtain a usable image. This may include sharing lighting tips, camera focus tips, or camera mode tips.

Geo-Tagging Functionality: Discuss how the app uses location data to track orca movements and how this information is visualized for users.

Geolocation and time data are then cataloged along with the image. If the image is of good enough quality to identify the individual photographed, then that data is immediately attributed to a known and cataloged individual. If the image is unrecognizable or of a new individual not yet cataloged, it can be reviewed by researchers in hopes of properly identifying or naming the subject.

Data Accuracy and Privacy: Address how the app ensures the accuracy of the data collected and maintains the privacy and security of user-contributed information.

At the time of initial sign-up, the user is discouraged from using their real name and location publicly. Instead, they will select a pseudonym for use in the app and are presented with a privacy policy and the option to opt in for more personal information sharing. The user is alerted to the default data collected and assured that no personally identifiable data will ever be stored or shared without the user's consent. The default data will include the metadata used to identify the photo characteristics, including device type, geolocation, and time taken. This policy will reappear for the user to make changes with each major iteration of the application with future updates to ensure consistent privacy is maintained or give the option to share more or less information.

Community Contribution and Collaboration: Elaborate on how the app facilitates global collaboration and community involvement in orca tracking.

With FinTrack, the conservation community can grow exponentially by becoming more accessible to a wider amateur community of conservation-minded individuals while providing more accurate data for academic and professional researchers.

5. Timeline for Development

Initial Research and Planning: Outline the phases of preliminary research, including feasibility studies and consultations with marine biologists and technology experts.

Tasks	Team Member:	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9
Research tracking orcas	Mackenzie Wharton	█								
Research identifying orcas	Mackenzie Wharton		█							
Research on patterns of life	Mackenzie Wharton			█						
Research on technology feasibility	Adam Spivak	█	█							
Research on AI training	Daniel Spencer		█	█						
Create marketing strategy	Charles Caldwell	█								
Communicate with investors	Charles Caldwell		█							
Create and finalize budget	Daniel Spencer	█	█	█						
Prototype	Adam Spivak				█	█				
Beta testing	Team						█	█		
Final product	Team								█	█

App Design and Development Phases: Break down the development of the app into distinct phases, including prototype design, beta testing, and final product launch

Prototype: The prototype of FinTrack will have a simple UI, where a testing user can upload photos of orcas, knowing what the orca is, to train an AI in analyzing photos. The AI will take all the information from the photo, such as the photo itself, and the metadata (such as time, location, and zoom strength), and sort it into a database. Doing this, it learns the variety of the orcas, how to match and track locations, and how to get the precise location based on the zoom strength.

Beta Testing: In Beta Testing, a few researchers take the app out to sea to capture images of spotted orcas. Using its information, the AI will give its best-educated guess as to what kind of orca has been spotted, and where, to return its conclusion of what orca it spotted. Then, from satellite data, geo-tagging [1], and researcher knowledge, the user (the researcher at Sea) will compare its info to the AI. If the information from the AI matches the information from the research, then the AI spots the correct orca, and it will record it as a correct answer. If it is not the right orca, and the information does not match, the user will tell the AI if it's wrong, and the AI will make another educated guess, and learn from the mistake.

Final Product: When the app is completely developed, it will have the power to recognize oras on its own based on the extensive training it went through. It will be able to track all the information to understand patterns of migration, what orcas have been spotted, and who uploaded them. The app will have a post page, where any user (researcher, conservationist, or public user), can upload photos and make comments as to what they saw, and to who they are. This is where the community starts to form, as everyone can interact with different posts from all over the world. There will even be a map page where the AI generates a map of known orca spottings, so everyone around the world can get live updates on orca sightings.

Testing Procudures and Quality Assurance
Alpha Testing:
- Conducted internally by the development team to ensure basic functionality, catch major bugs, and verify compliance with initial design specifications.
- Focus on core features like photo upload, dorsal fin recognition, geo-tagging, and user interface elements.

Beta Testing:
- Open to a select group of external users, including marine researchers, wildlife enthusiasts, and technology experts.
- Real-world testing to identify usability issues, gather feedback on user experience, and assess the app's performance under varied conditions.
- Utilization of feedback forms and in-app reporting tools to collect detailed user experiences and issues.
- Performance Testing
- Stress tests to evaluate the app's stability and responsiveness under high-load conditions.
- Testing for scalability, ensuring the app remains functional as user numbers grow.

Security and Privacy Testing
- Rigorous checks to safeguard user data, including penetration testing and vulnerability assessments.
- Ensuring compliance with data protection regulations like GDPR.

Accessibility Testing
- Ensuring the app is accessible to a diverse range of users, including those with disabilities.
- Compliance with ADA and WCAG guidelines.

Continuous Monitoring
- Post-launch, continuous monitoring tools to track app performance, and user engagement, and identify any emerging issues.
- Launch and Initial Feedback
- Launch Strategy

Soft Launch
- Initial release to a limited audience to gauge response and make necessary adjustments before a full-scale launch.
- Leveraging partnerships with conservation organizations and educational institutions for initial exposure.

Full Launch
- Roll out across major app stores with comprehensive marketing campaigns, including social media promotion, press releases, and collaborations with influencers in the conservation and technology spheres.
- Hosting launch events or webinars to introduce the app and its features to a broader audience.
- Incorporating User Feedback in each update.

Feedback Channels
In-app feedback forms, social media, and dedicated email for user reports and suggestions.
Encouraging user reviews on app stores.

Response Mechanism
A dedicated team to analyze feedback, categorize issues, and prioritize them for resolution.
Regular updates to the user community about the feedback received and actions taken.
Agile development approach to quickly implement changes based on user feedback.
Continuous iteration of the app based on user needs and experiences.

Future Updates and Improvements

Regular Feature Updates

There will be regular bi-weekly updates to FinTrack to ensure the app continues to stay functional. These updates will include performance improvements, fixing bugs that were reported by the user, keeping the tracking AI up to date with the newest advancements in photo recognition, and adding new content for weekly lessons.

Scheduled updates for new features, enhancements to existing features, and user interface improvements.

When FinTrack is first released there will the standard photo capture and upload to community board. After some time when all the initial bugs are fixed and the app has proven to perform well, a weekly lesson option will be added. This is where users will have the opportunity to learn more about Orca whales and inspire those who are interested in conservation.

Incorporating advancements in AI and ML for improved dorsal fin recognition and tracking algorithms.

Partnering with companies like OpenAI, our team will have the opportunity to work with the best professionals in the field. With their help, the FinTrack AI will stay up to date with the latest advancements in pattern recognition. This will improve the recognition of fins on Orcas with greater accuracy and confidence, decreasing the time it takes to analyze each photo to increase photo capture count. Taking more photos leads way to creating a better tracking algorithm. Having more photos means more locations to plot and track with the migration predictor.

Performance and Security Enhancements

In the background there will be many functions operating to record the speed and handling of FinTrack to analyze the performance for future updates. For example, when a user takes a photo of a spotted Orca whale, the app will record how long it takes for the AI to anaylze each photo. Or, whenever the app is overwhelmed and crashes, it will send a report to the database recording what happen and what caused the crash. These two features will allow the developers to understand how the app has run with other users, and what process is happening in the background that needs to be redirected in order to improve the speed of image analysis and how the app can take a different path so it doesn't crash.
For security enhancements, there will be developers on the team who can create encryptions on personal data to protect the users, like location or who the user is. This is important because it allows the user protection and rights to what sightings they have uploaded to the app, so no one else can take credit for their work.

Ongoing improvements in app performance, speed, and reliability.

As stated before there will be continuous updates to the app to improve performance and reliability by measuring data in the background of performance speeds and bug reports, all used to used to understand processes have ran and what can to decrease the time of computational processes.

Feedback-Driven Improvements and User Feedback Analysis

After FinTrack is released for full launch users will be able to report bugs on the app and give feedback on the performance of the app. On the app there will be a separate screen dedicated to the user experience where the user is able to communicate with the developers bugs and performance issues they have experienced. They will also be able to give suggestions of what they would like to see in the app, things that will enhance their experience. On the app store as well, users can leave ratings and comments for the potential users who have not downloaded the app to see. All of this feedback, from the users on the app and on the app store, will allow developers to take into account what needs to be added or improved on FinTrack in order to enhance the user experience.

Regular surveys and focus groups to gather in-depth user insights.

On the user experience page there will be surveys that the user questions directly from the developer, allowing for a little more precise feed back on what they can do to improve the app.

Sustainability and Conservation Impact

As long as the app receives funding through user donation and memberships, the app will be able to stay functional and receive updates. Since this is an computer program on the app store there will be practically no carbon footprint, allowing for longer-term sustainability with no enviromental impact. FinTrack will have a huge impact on conservation efforts because researchers in this field will have a globalized database for tracking Orcas, allowing the field of science and the community to come together to create better conservation regulations and advance the field light years ahead then previously before.

Evaluating the app's contribution to marine conservation and adapting strategies to maximize impact.
After the app has been released for some time, the development team will be communicate with conservationists and ask how they're enjoying the app and what they find needs to be added in order to improve their experience and make their work a little easier.

In conclusion, the approach to testing, launch, and future development of FinTrack is designed to ensure a robust, user-centric, and continuously evolving application. This strategy aims to establish FinTrack as a reliable, informative, and engaging tool in marine conservation efforts, driving both public engagement and scientific research.

6. Budget

Initial Budget Breakdown: Initial Budget Breakdown for FinTrack App Development
The initial investment of $10,000 will be allocated across various critical aspects of the FinTrack app development. The budget is meticulously planned to ensure efficient use of resources while maintaining high standards of quality in each phase of development. Below is a detailed breakdown:

<u>Software Development - $4,000 (40% of the budget)</u>
App Design and Interface: $1,500
UI/UX design for a user-friendly experience
Graphics and visual elements creation

App Development: $2,000
Coding and Programming
Implementing machine learning algorithms for dorsal fin recognition
Geo-tagging functionality integration

Testing and Debugging: $500
Beta testing with a selected user group
Bug fixing and optimization

<u>Research - $2,500 (25% of the budget)</u>
Orca Behavioral and Ecological Studies: $1,000
Collaborating with marine biologists for accurate content
Accessing existing databases and research materials

Technology Research and Integration: $1,000
Studying and integrating advanced technologies (AI, ML)
Research on data accuracy and privacy standards

User Experience Research: $500
Surveys and feedback collection from potential app users
Research on effective community engagement strategies

<u>Marketing and Outreach - $2,500 (25% of the budget)</u>
Digital Marketing: $1,200
Social media advertising
Creating promotional content (videos, articles, infographics)

Community Engagement and Public Relations: $800
Hosting webinars and online events
Collaborating with conservation organizations for promotion

App Store Optimization (ASO): $500
Ensuring high visibility in app stores
SEO strategies for the app's online presence

<u>Administrative and Miscellaneous Costs - $1,000 (10% of the budget)</u>
Licenses and Legal Fees: $400
App registration and legal consultations
Contingency Fund: $300
Reserved for unforeseen expenses

Miscellaneous Expenses: $300
Operational costs like internet, communication tools

Total: $10,000
This budget ensures that each phase of the FinTrack app development is adequately funded, from the initial software development to research and marketing efforts. It balances the technical requirements with the need for outreach and user engagement, setting a solid foundation for the successful launch and sustainability of the app.

Funding Model for FinTrack App

Basic Version: Free access to general features, fostering wide user engagement.
Premium Version: Monthly/Annual subscription for advanced features, such as detailed orca analytics, personalized notifications, and exclusive content.

Crowdfunding
Platforms like Kickstarter or Indiegogo to raise funds, especially during the initial stages.
Offering incentives like early access, app merchandise, or acknowledgment in the app credits.
Partnerships Collaborating with conservation organizations, marine research institutes, and eco-tourism companies.
In-kind support, financial backing, and mutual promotion can be part of these partnerships.

Grants
Applying for grants from governmental bodies, environmental foundations, and scientific research funds.
Focusing on grants that support wildlife conservation, technology for environmental purposes, and community engagement.

Long-term Financial Planning
Revenue from Premium Memberships: To sustain and continuously improve app features.
Regular Crowdfunding Campaigns: For specific projects like expanding the app's capabilities or research partnerships.
Ongoing Partnership Development: Strengthening ties with existing partners and seeking new collaborations.

Grant Applications:
Regularly applying for relevant grants, keeping abreast of new funding opportunities.

Risk Assessment and Mitigation
Market Saturation Risk: Mitigated by continuously updating app features and maintaining unique offerings like specialized orca tracking algorithms.
Dependency on External Funding: Diversifying funding sources to reduce reliance on a single stream.
Technology Obsolescence: Regular technological updates and adapting to new trends in app development.
User Engagement Fluctuation: Implementing engaging and educational content strategies to retain user interest.

Return on Investment (ROI)
Conservation Impact**:** Improved understanding and awareness of orca populations, leading to more informed conservation strategies.
Research Advancements*:* Valuable data collection contributing to marine biology research and ecosystem management.
Community Engagement: Fostering a global community of conservationists, researchers, and enthusiasts, promoting environmental stewardship.
Premium memberships and partnerships provide a steady revenue stream post-initial investment phase.

In summary, the funding model for FinTrack combines initial crowdfunding and memberships with ongoing support from partnerships and grants. This model not only ensures the financial sustainability of the app but also aligns with its mission of promoting orca conservation and engaging the public in marine biology research. The ROI is substantial in terms of both conservation impact and financial returns, ensuring the app's long-term success and contribution to marine ecology.

7. Qualifications and Expertise

Team Introduction: Introduce the team members, highlighting their qualifications and experience in wildlife science and computer science.

My name is Charles Caldwell and I am a Computer Science major. Before embarking on a path to a degree in technology, I have spent the better part of the last two decades as an IT consultant for small and medium-sized organizations along with multinational enterprise corporations. In my consulting role, I have worked with business leaders and key individuals to evaluate organizational needs and implement solutions for recognized technology requirements. The experience I have gained as a consultant coupled with the broad scope of industries I have worked with enables me to approach projects with a unique perspective and an open mind to reach the best possible outcome for each project and organization. With my role in the FinTrack app project, I bring my experience to an important conservation tool aimed at being user-friendly and accessible while meeting those goals and opening up the availability for community contributions to an important and fragile area of marine conservation. I look forward to working with your organization and I am excited for the results of our collaboration on this project.

My name is Mackenzie Wharton and I am a Fish and Wildlife Conservation Management major. The topic of our proposal is the tracking and identification of both individual orcas, as well as orca pods, on a global scale. I have experience with wildlife identification, not only with orcas but with Humpback whales, as well. Living in a marine-centric town in Alaska has allowed me the opportunity to become very familiar with both our resident orca pods and transient orca pods, in conjunction with other wildlife in our local national park. Before entering into conservation management, I was well-versed in equine health and training. A large component of equine training is a heightened awareness of the smallest changes within an individual. For example, a slight limp of one leg could mean a major ligament tear within or near a joint. This skill is useful in identifying individual orca features like when a new notch on their dorsal fin appears that is similar, but not the same, to a notch seen on another individual. I have also gained invaluable knowledge of the geography and specific locations within the Kenai Fjords National Park where orcas and other wildlife are most likely to frequent or be spotted. This is important because it helps to locate specific individuals and track them throughout their lifetime. I am confident that my skills and experience within this specific field, combined with the computer science skills of my teammates, that our proposal will be executed effectively and with the most accurate information we can find to create a database such as the one described in our proposal.

My name is Adam Spivak and I am a Computer Science major. Creating an app that allows for the globalization of tracking orcas can create new communities and bring together many people. I have experience with front-end development, creating applications that can be accessed through multiple platforms. Using programming languages such as React Native, I can create an application that easily converts into a web application, mobile website, or installable app depending on where it is being accessed. This allows anyone who is not able to download the app to access it another way, bringing access to more people. With experience in front-end development, comes knowledge of user experience (UX). I think critically about what features will be added to the app that will allow for successful interaction, such as bringing together a community by sharing posts of sightings people have seen. Including app features like weekly lessons about orcas and their diverse behavior, identification techniques, and even AI recognition of orca fins (like the name suggests) will keep users engaged consistently. I hope to create an application that will be revolutionary, something that has a significant impact on such a broad community — bringing together people from all over the world.

I am Daniel Spencer, an undergraduate majoring in computer science with a particular focus on cybersecurity. Our proposal concerns the development of an application that records and monitors orcas — employing photographs that have undergone photo-pattern recognition processing. By compiling this information into an app via user uploads, orca movements can be monitored and tracked. I have experience developing websites and applications. Presently, I assist in the development of applications and websites for California rental properties. An analytical approach is one of the most crucial components of administering these rental properties. This consists of examining key records, user clicks, and scrolls. This information gathering lends to the development of a more robust application or website. I am responsible for ticket management for each website or application requiring the upload and maintenance of new data and features. Streamlining and securing transactions is an element of administering rental accounts. Because the application is provided at no cost, it will require financial support through other means in addition to grants and investor contributions. The use of in-app purchases may serve as a viable way to generate revenue to cover app expenses. My skills are consistent with the backend labor required for the development and maintenance of the FinTrack application. By applying this knowledge, we can optimize the user experience and ensure that the application is intuitive and engaging, thereby facilitating the collection of data that aligns with our objective.

Roles and Responsibilities: Detail the specific roles and responsibilities of each team member in the project.
Mackenzie Wharton will be responsible for research on tracking and identifying orcas and their pods. She will be the main contributor to training the AI for analyzing and identifying orcas in uploaded photos. She will consolidate the information needed to understand the need for orca conservation, how they're an important part of the ecosystem, and why having a globalized tracking and identification system is important. Charles Caldwell, with the help of Mackenzie Wharton, will present FinTrack to potential investors. He will explain the necessity of FinTrack to research groups and educational institutions to grow a bigger network and gain support for the project. Daniel Spencer will help Adam Spivak with the development of the Front-end and Back-end of FinTrack. Adam Spivak will work on the user-facing portion of the app, designing the user interface (UI) and adding interactive features to bring it to life. Daniel Spencer will work on the back end optimizing the performance and training the AI using machine learning to aid in the recognition of orca fins.

Collaborations and Partnerships: Discuss any partnerships with research institutions, conservation organizations, or technology companies.
Our team will collaborate with orcas researchers, conservationists, and technology companies from across the northern and southern hemispheres to perfect FinnTrack. We will first work with independent research groups, such as the Southwest Fisheries Science Center [1], to showcase our idea for FinnTrack, and respectfully ask if we may have access to the information they have gathered on their own. We will work with them to understand their data such as what orca pods they have spotted, if they are tracking any pods using Satellite tracking and geo-tagging [1], and if they know anything about the pod size or ages of orcas in the pod. Then we will work with conservation organizations to better understand the need for orca conservation, and how we might relay that information to a Low-context audience for those using the app with no conservation experience. Finally, we will work with technology companies, such as OpenAI, to learn how we can train our AI to better match and identify orcas based on user uploads.

Expertise in Technology and Marine Biology: Showcase the team's expertise in the relevant fields, including previous projects or research.

Daniel Spencer has experience creating websites and applications for rental properties, as well as working on back-end management fixing bugs with each update using a ticketing system. With this experience, he can update FinnTrack and do quality assurance testing for each new feature that gets added. Mackenzie Wharton before becoming a Fish and Wildlife Conservation Management major has experience working with equine health and training. This is useful because she can identify the smallest changes within individuals, as she can spot the smallest differences between orcas and pods. This will be particularly useful when training the AI to spot the smaller differences between photos and individual orcas. Charles Caldwell has experience as an IT consultant, working with many companies to recognize and recommend technological requirements. With this skill brings knowledge of marketing, as he can promote our app to potential investors to gain their support. Adam Spivak has experience in front-end development with UI and UX design and has worked in the past to implement APIs to create responsive applications using React Native. With this skill, he can design the app to create an immersive experience for users, encouraging them to upload photos and learn more about the community.

Commitment to Conservation: Express the team's dedication to marine conservation and the broader implications of their work.

Our team is excited to work with an amazing field of science like orca conservation. We understand the need for orcas in such a large ecosystem and hope that creating this app allows for better protection of these majestic creatures. Having an app like this accessible app for everyone will not only inspire those who are already working in the field but also those in the general public who have an interest in orcas, creating a new generation of conservation enthusiasts who might want to pursue the field as a career.

8. Feasibility and Sustainability

Technical Feasibility: Assess the technical feasibility of the app, considering current technology and resources

This application is very feasible with current technology. There are multiple ways to track whales, such as Satellite tracking, geo-tagging, or boats that go into the water to record whale noise [1]. With the ability to use metadata from captured images, we can find the exact location and time to find where the photo was taken. With all of these technologies combined, plus a little bit of AI that can keep track of and manage all that information, it will be easy to identify and track orca pods in seconds. Using the power of social media, we'd also be able to create a home page for sharing uploads of spotted orcas, fostering a community all around the world. This would work in a few steps:
1. Take and upload a photo.
2. Extract metadata from the photo, such as location, time, and zoom strength.
3. Calculate the exact location based on this information.
4. "Give" all of this information to the AI to analyze.
5. AI analyzes the photo and looks for unique patterns on the orca fin, such as bumps, skin texture, or colors.
6. Once the AI is done with its analysis, it decides if it is an orca that has been spotted before based on the metadata and predictive migration techniques. It will then store all that data in a database for analysis later, comparing it to new uploads.
    a. If it is a new orca the AI adds a special tag to "keep in mind" if that individual is spotted again, so it can focus on learning about that particular orca or its pod.
    b. If it is a previously spotted orca, it will just store the data in its database and update the tracking information on it.
7. The system will notify the user, and thank them for their contribution to the app. It will encourage them to upload their photo to a post where they can share with the community.

Sustainability Plan
Environmental Impact: FinTrack is designed to have a minimal environmental footprint. The digital nature of the app ensures that data collection and sharing are done virtually, reducing the need for physical resources and travel. The app will encourage sustainable practices among users, such as responsible wildlife observation and reporting.

Long-term Funding: To ensure financial sustainability, FinTrack will explore a mix of funding sources. This includes membership fees for advanced features, grants from conservation bodies, partnerships with research institutions, and crowdfunding campaigns. Regular updates and new features will be introduced to maintain user interest and encourage ongoing financial support.

User Engagement Strategies: The app will regularly update its features based on user feedback, keeping the interface user-friendly and the data relevant. Engaging with users through social media, hosting challenges, and creating educational content will keep the community active and involved. Collaboration with schools and conservation groups will help spread awareness and increase the user base.

Scalability
FinTrack's architecture will be designed for scalability, allowing it to adapt to track other marine species or for use in broader conservation projects. The app can be modified to include identification features for different marine species, expanding its scope beyond orcas. Collaborations with global conservation organizations can help adapt the app for specific regional needs or targeted species, making it a versatile tool for marine conservation worldwide.

Challenges and Solutions

Challenge - Data Accuracy and Reliability: Ensuring the accuracy of user-submitted data can be challenging.

Solution: Implement robust validation algorithms and engage a team of experts for data verification. Community moderation and reward systems for accurate reporting can also be employed to enhance data reliability.

Challenge - User Retention and Engagement: Keeping users consistently engaged with the app is crucial for long-term success.

Solution: Regularly update the app with new features, provide educational content, and engage users through gamification and community events. Collaboration with marine conservation influencers can also boost user interest.

Challenge - Technological Limitations: As technology evolves, the app must stay updated with the latest advancements.

Solution: Establish a dedicated team for R&D in emerging tech trends and plan for periodic updates to the app's technology stack.

Impact Assessment
Research Enhancement: FinTrack will significantly contribute to the understanding of orca behaviors, migration patterns, and population dynamics. By providing a centralized, global platform for data collection, it will enable more comprehensive and collaborative research efforts.

Conservation Efforts: The insights gained from the app will inform conservation policies and strategies. Understanding orcas' movement and behavior patterns is key to protecting their habitats and ensuring their survival.

Public Awareness and Education: By involving the general public in orca tracking, FinTrack will raise awareness about orca conservation issues. The app's educational content will help in spreading knowledge about marine ecosystems and the importance of conservation efforts.

Global Collaboration: The app's potential to connect researchers, conservationists, and enthusiasts worldwide will foster a global community focused on marine conservation, leading to more unified and effective conservation efforts.

9. Conclusion

Embracing the Future of Marine Conservation

Our proposal for FinTrack – an innovative orca identification and tracking application – represents a significant leap forward in marine conservation. By harnessing the power of technology, this app promises to unlock new possibilities in the study and protection of orcas. It provides a unique platform that bridges the gap between advanced scientific research and public engagement, inviting a global community to participate in crucial conservation efforts.

Impact on Marine Ecosystems

Orcas are apex predators and play a pivotal role in maintaining the balance of marine ecosystems. Understanding orca behavior, migration patterns, and population dynamics is not only vital for their preservation but also for the health of our oceans. "FinTrack" will generate valuable data that can inform policy decisions, and conservation strategies, and raise public awareness about the challenges facing these majestic creatures.

A Collaborative Effort

This project transcends individual efforts and calls for collective action. By bringing together marine biologists, technologists, conservationists, and citizen scientists, we are creating a synergistic approach to conservation. The collaborative nature of "FinTrack" will foster a stronger, more informed community dedicated to the well-being of orcas and the marine environment.

Sustainability and Evolution

The sustainability and adaptability of "FinTrack" are key to its long-term success. Our commitment to continuous improvement and adaptation to new scientific findings and technological advancements ensures that the app remains a relevant and effective tool for years to come. We envision "FinTrack" evolving into a comprehensive platform for studying various marine species, contributing broadly to oceanic research and conservation.

Call to Action and Final Thoughts

We stand at a crucial juncture in our relationship with the natural world. The development of "FinTrack" is more than a technological endeavor; it is a step towards deeper understanding and coexistence with the marine life that shares our planet. We invite you to join us in this pioneering venture. Your support, whether as researchers, funders, users, or advocates, is invaluable in turning this vision into a reality. Together, we can make a significant difference in the world of marine conservation. In conclusion, "FinTrack" is more than just an application; it's a beacon of hope for orcas and a testament to human ingenuity and commitment to conservation. As we embark on this journey, we are not just tracking orcas; we are charting a course toward a more informed, responsible, and sustainable interaction with our oceans. Let us seize this opportunity to make a lasting impact on marine conservation.

10. References

A comprehensive list of sources and research that support the proposal's arguments and claims.

[1] N. Fisheries, "Tracking technology: The Science of Finding Whales," NOAA, https://www.fisheries.noaa.gov/feature-story/tracking-technology-science-finding-whales (accessed Nov. 29, 2023).

[2] Prince of Whales. 2023, April 5. Killer whales of the world – the Southern Hemisphere. Available from https://princeofwhales.com/killer-whales-of-the-world-the-southern-hemisphere/ (accessed November 26, 2023).

[3] Meet the different types of Orcas. 2022, July 4. Available from https://us.whales.org/whales-dolphins/meet-the-different-types-of-orcas/ (accessed November 26, 2023).

[4] Orca 101. 2023, October 9. Available from https://orca.wa.gov/orca-101/ (accessed November 26, 2023).

[5] Fisheries N. 2023, May 31. Killer whale. Available from https://www.fisheries.noaa.gov/species/killer-whale#:~:text=Only%20one%20population%20of%20killer,under%20the%20ESA%20since%202005. (accessed November 26, 2023).

[6] "Become a Part of the Orca Network - Whale Sighting Network." *Orca Network*, www.orcanetwork.org/sightings-network. Accessed 14 Nov. 2023.

[7] "Sightings Report." *Orca Conservancy*, www.orcaconservancy.org/sightings-report. Accessed 14 Nov. 2023.

[8] "Facts about Satellite Tagging Dolphins and Whales." *International Fund for Animal Welfare*, www.ifaw.org/journal/satellite-tags-dolphins-whales. Accessed 14 Nov. 2023.

[9] "Threats to orca," World Orca Day, https://www.worldorcaday.org/threats/ (accessed Dec. 8, 2023).

[10] E. Burnett, "Orcinus orca (killer whale)," Animal Diversity Web, https://animaldiversity.org/accounts/Orcinus_orca/#:~:text=Ecosystem%20Roles,sea%20lions%20in%20breeding%20areas. (accessed Dec. 8, 2023).

[11] Orca Network: "Become a Part of the Orca Network - Whale Sighting Network." Orca Network. Accessed November 14, 2023. www.orcanetwork.org/sightings-network.

[12] Orca Conservancy: "Sightings Report." Orca Conservancy. Accessed November 14, 2023. www.orcaconservancy.org/sightings-report. .

[13] International Fund for Animal Welfare: "Facts about Satellite Tagging Dolphins and Whales." International Fund for Animal Welfare. Accessed November 14, 2023. www.ifaw.org/journal/satellite-tags-dolphins-whales.

11. Appendix Sections

Appendix A: Technical Specifications of the FinTrack App

System Architecture

Front-End

Platform: Developed using React Native for cross-platform functionality, ensuring seamless operation on both iOS and Android systems. This approach allows for a shared codebase and simultaneous updates across platforms.

Languages: Utilizes JavaScript and JSX for dynamic interface elements, complemented by CSS for styling and animations. This combination offers a high level of interactivity and aesthetic appeal.

User Interface (UI): Designed with accessibility in mind, featuring high-contrast color schemes, scalable fonts, and intuitive iconography. The layout is optimized for various screen sizes, from smartphones to tablets.

User Experience (UX): Incorporates user feedback loops, personalized settings, and adaptive content presentation. Interactive elements like swiping gestures, dropdown menus, and modals enhance user engagement.

Back-End

Server: Employs cloud-based server architecture, providing robust, scalable, and secure data management. Leveraging services like AWS Lambda for serverless computing and EC2 for scalable computing capacity.

Database: MongoDB is chosen for its flexibility in handling diverse data types, such as images, user profiles, and location data. Its schema-less nature allows for easy modifications and scalability.

APIs: RESTful APIs facilitate efficient data transfer between the app and the server. They are designed for high availability and low latency to ensure a smooth user experience.
Data Processing and Analysis

AI and ML Algorithms: Custom-built convolutional neural networks (CNNs) and deep learning models are employed for accurate pattern recognition. These models are trained on a large dataset of orca fin images to ensure high accuracy.

Image Processing: Advanced algorithms for image enhancement include noise reduction, contrast adjustment, and edge detection, crucial for accurately analyzing fin patterns in varied lighting and weather conditions.

Geo-Tagging: Automated extraction of GPS data from image metadata, complemented by manual entry options. This system is integrated with a dynamic mapping interface for real-time tracking.

Photo Upload and Capture

Direct Capture: Features include grid overlay for composition, zoom functionality, and real-time tips based on lighting and focus settings. This aids users in capturing high-quality images suitable for analysis.

Photo Upload: Automatic extraction of EXIF data from uploaded images to gather accurate date, time, and location information. The app also supports batch uploads for efficiency.
Dorsal Fin Identification

Pattern Recognition: Utilizes edge detection and pattern matching algorithms, constantly updated with ML to improve accuracy. The system can differentiate between subtle variations in fin shapes and scars.

Individual Orca Identification: Incorporates a probabilistic model to match identified patterns against the database, providing confidence scores for each match. This helps in reducing false positives and improving identification accuracy.
Geo-Tagging and Movement Tracking

Location Data: Integrates real-time and historical GPS data for tracking orca movements. The system can filter data based on time frames, specific orca pods, or individual orcas.

Mapping Interface: Features interactive maps with custom layers, including satellite and terrain views. Users can view migration patterns, sighting hotspots, and individual orca tracks.
Data Collection and Reporting

Data Cataloging: The automated cataloging system tags each sighting with metadata and user-generated content. This includes environmental conditions, behavior observations, and additional notes.

Reporting Tools: Provides analytics on orca sightings, population trends, and habitat usage. Customizable report generation for research and educational purposes.
Community Features

Social Sharing: Integrated social media sharing options, including privacy-conscious settings. The app encourages community participation through gamified elements like badges and leaderboards.

Educational Content: Curated content updated regularly, including articles, videos, and interactive quizzes. The content is tailored to different user levels, from beginners to experts.
Security and Privacy

Data Encryption: Implements AES encryption for data at rest and TLS for data in transit. Regular security audits are conducted to ensure compliance with the latest security standards.

User Anonymity: Users can choose to share sightings anonymously. The app employs strict data minimization principles, collecting only essential data.
Compliance: Regularly updated to comply with evolving data protection laws like GDPR, CCPA, and others. Includes features for users to manage their data and consent preferences.
Performance and Scalability

Load Balancing: Uses auto-scaling groups to handle varying loads, ensuring consistent performance during peak times. The architecture is optimized for quick scalability in response to user growth.

Scalability: Designed with a microservices architecture, allowing for independent scaling of different app components. This facilitates easy integration of new features and services in the future.
Accessibility and Inclusivity

Language Support: Multilingual support with localization for different regions. The app includes community-sourced translations to broaden accessibility.

Accessibility Features: Adheres to Web Content Accessibility Guidelines (WCAG) for mobile apps, including voice-over support, screen magnification, and alternative text for images.

Maintenance and Support

Regular Updates: Scheduled updates for new features and improvements. The app employs a continuous integration and continuous deployment (CI/CD) pipeline for efficient rollout of updates.

User Support: Multichannel support system including in-app chat, email, and an extensive knowledge base. User feedback is actively solicited and incorporated into app development.
Sustainability Considerations

Minimal Environmental Impact: Emphasis on digital engagement to reduce the need for physical materials. Promotes eco-friendly practices among users.

Promotion of Conservation: Partnerships with conservation groups for shared initiatives and campaigns. A portion of revenue is allocated for conservation efforts.

Testing and Quality Assurance

Beta Testing: Involves diverse user groups for comprehensive testing under various scenarios. Feedback is systematically analyzed and used for improvements.

Continuous Monitoring: Implements real-time monitoring tools for app performance, user engagement, and error tracking. This enables proactive identification and resolution of issues.
The technical specifications of FinTrack demonstrate a commitment to excellence, user engagement, and conservation, ensuring it stands as a pioneering tool in marine wildlife research and public education.