

Web Application for Surf Journaling

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Table of Contents

Table of Contents	2
Abstract	4
Introduction	5
Motivation	5
Stakeholders	5
Project Goals	6
Project Deliverables	6
Background	6
Formal Project Definition	8
Customer Requirements	8
Design	9
Architecture	9
Data sourcing	11
Database structure	12
Results	13
Fulfilled Customer Requirements	13
#1: Users can create accounts, login, and logout	14

#2: Users can create, edit, and delete custom Surf Spots	16
#3: User can create, edit, and delete Surf Sessions	20
#5: User can view all Surf Sessions in a scrolling feed interface	27
#6: User can view all Surf Sessions in a sortable table interface	28
#7: User can filter Surf Sessions by Surf Spot	28
Future work	30
Reflection	31
Bibliography	33

Abstract

Before deciding whether to surf, many surfers consult surf forecast services. Current surf forecasting offerings provide general information such as predicted surf height and a condition rating, but these predictions are often misleading, as widely varying swell conditions can receive the same forecast. Additionally, these existing services do not incorporate user feedback into their predictions, which requires users to keep a mental mapping of trends between forecast information and real-life conditions.

This report describes the design and implementation of a web application where users can record the surf conditions and assign ratings to recorded surf sessions. With historical surf conditions and rating information at their disposal, users can compare current conditions to past recorded sessions in order to more accurately predict today's wave conditions. This increased forecast confidence will help users to choose the optimal locations and times to surf.

Introduction

Motivation

Surf conditions are hard to predict, and each surf spot responds uniquely to meteorological conditions.

Further, the preferred wave heights and behaviors of surfers vary greatly depending on skill level and board choice. This application enables users to hone in on the ideal conditions for their surf activities.

The application is a convenient alternative to the traditional use of paper journals or spreadsheets, and the digitalization of surf data allows for ease of analysis. In addition, the digitalization of this information allows for access from any internet connection—removing the need to carry a physical journal to surf outings.

Stakeholders

The primary stakeholder for this project is myself. This project arose from a personal desire to enhance my surf forecasting abilities and to use my limited free time for surfing most effectively. After attempting to use a pen and paper surf journal, I found the process cumbersome and ineffective.

Drawing from my experiences enabled me to prioritize features that would be most immediately useful for users of the web application.

Another stakeholder of this project is my advisor, Professor James Mealy. Between professorial duties and personal responsibilities, finding time for surfing is a challenge. Through use of this tool, Professor Mealy will be able to determine opportune surf windows in his busy schedule more effectively.

Finally, other stakeholders include surfers, bodyboarders, bodysurfers, and fishermen. As I worked on the web application, I ensured that it remained flexible enough for multiple use cases—not just board surfing. Though designed primarily for surfers, sea fishermen could use this application to examine relationships between ocean conditions and fish caught. While this application is accessible to all wave sport enthusiasts of all ability and knowledge levels, it will be of increased utility to those with knowledge of surf condition metrics and their effects on wave conditions.

Project Goals

The goal of this project is to deploy a fully functioning web application that facilitates the recording of ocean conditions and journaling of ocean experiences.

Project Deliverables

The deliverable for this project is a hosted web application, accessible at surfapp-v2.herokuapp.com

Background

Most surf forecasts include the following data points: Swell Height, Swell Direction, Swell Period, Tide Height, Tide Direction, Wind Speed, and Wind Direction (Peterson). An understanding of these metrics and their effects on wave conditions is important to comprehending surf forecasts.

Swell Height: The height of a wave from the trough to the crest. Units: feet, meters. This metric is generally positively correlated with observed surf wave height. Wave power (wave energy flux) is proportional to the square of significant swell height (*Waves in Ocean Engineering* 35).

Swell Direction: The direction that waves are coming from. Units: Degrees (0-360). Swell direction can significantly affect the swell energy received at a given location—bays, peninsulas, and offshore islands can weaken or completely block swells depending on the direction.

Swell Period: The time in between waves. Units: Seconds. Period is related to wave power and wave diffraction— longer period swells (period > 14s) will have more power and tend to retain more energy as they diffract than short period swells (period < 14s). Wave power (wave energy flux) is proportional to the swell period (*Waves in Ocean Engineering* 35).

Tide Height: Measurement of sea level in relation to tidal fluctuations. Tidal fluctuations are caused by combined effects of the Moon, the Sun and the rotation of the Earth. Units: feet, meters. A higher tide means that the water level is higher and makes the exposed beach smaller. Tide height matters because it affects how waves interact with the ocean floor. The effect is very spot-dependent: Some surf spots will only break at high, others only at low, while others will break on all tides.

Tide Direction: The direction that the tide is moving, i.e. Rising or Falling. Though not backed by research, many surfers report stronger waves when the tide is rising, presumably because the tide and waves are pushing in a common direction.

Wind Speed and Direction: Self-explanatory. Wind direction is measured like swell direction, i.e. the angle describes where the wind is coming from. Wind speed Units: knots. Wind Direction Units: Degrees (0-360). Wind speed and direction affect surface texture and wave shape. Strong winds can “blow out” conditions, causing surface chop and inferior wave shape (Peterson). Wave conditions are generally most favorable with light wind blowing in an offshore direction.

Formal Project Definition

Customer Requirements

When creating a formal project definition, I considered the shortcomings of existing surf forecasting services and identified potential pain points for users. A central focus of these requirements is ease of use. In order for this tool to be used most effectively, users must record as many surf sessions as possible. The process to record a surf session must be simple and streamlined. I identified the following requirements as essential for an MVP product

#	Customer Requirements
1	Users can create accounts, login, and logout
2	Users can create, edit, and delete custom Surf Spots
3	User can create, edit, and delete Surf Sessions
4	User can record a Surf Session without manually entering surf condition data
5	User can view all Surf Sessions in a scrolling feed interface
6	User can view all Surf Sessions in a sortable table interface
7	User can filter Surf Sessions by Surf Spot

Figure 1: Customer Requirements

Design

Architecture

The web application is composed of two parts: A Ruby on Rails backend and a React.js frontend. The decoupling of data logic and display logic allows for more focused codebases and better extensibility. Application data (users, surf spots, recorded surf forecasts) is persisted in the backend in a database. The React.js frontend is a Single Page Application (SPA) that displays application data in the web browser and allows users to interact with and modify application data. The frontend fetches application data from the backend through a JSON API.

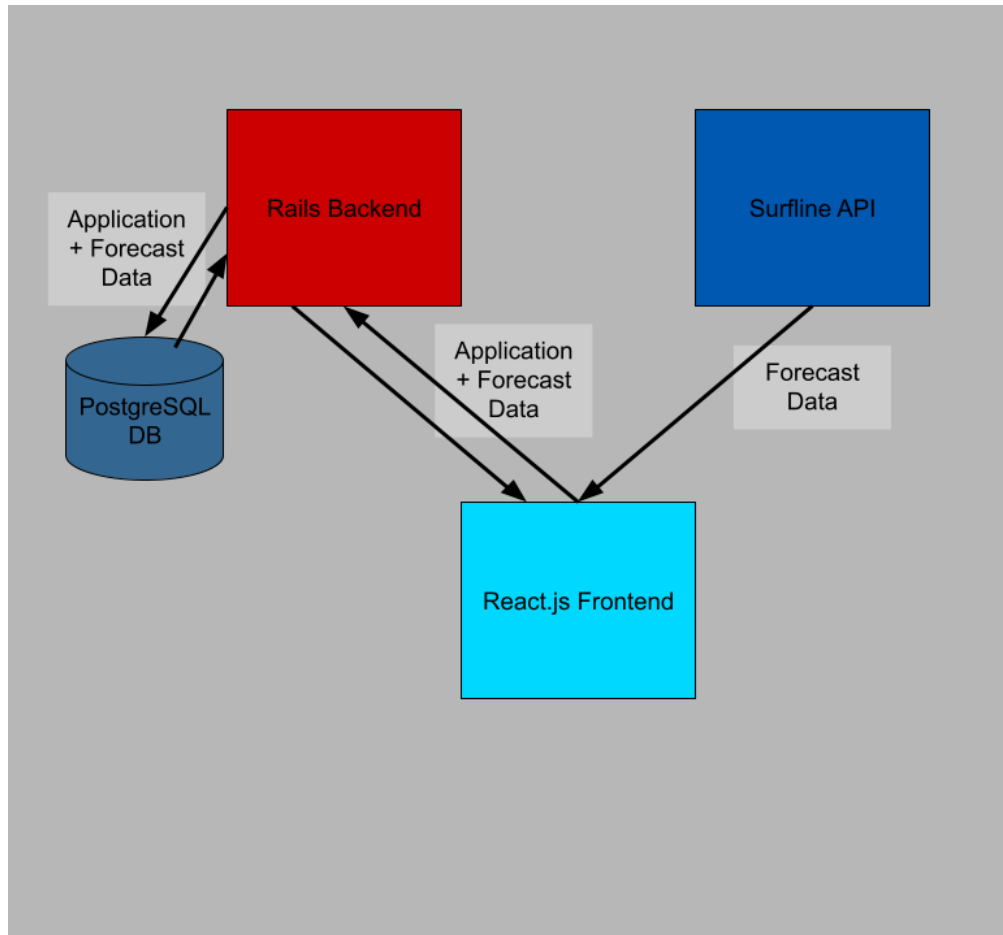


Figure 2 Application Architecture Diagram

One advantage of this application architecture is improved user experience. In a traditional server-rendered web application, each page load makes a request to the server “to fetch a static HTML page” (Khalifa 1). “Any action that is done on the browser, say a button click, will make a request to the server to retrieve a whole new static HTML page” (Khalifa 1). In contrast, a Single Page Application loads all UI resources (HTML, CSS, JavaScript) on the initial page load. On subsequent page loads, only application data is sent from the server, reducing bandwidth needs and decreasing page load times. Client-side caching further improves this experience—cached data for a recently loaded page can be rendered without any network requests.

An additional benefit of a decoupled backend and frontend is reduced startup costs for the development of a mobile or desktop application. Because multiple clients can use the same server backend, creating a client for a new domain (desktop or mobile) only requires development effort for the client application.

The frameworks used for the application (Ruby on Rails for backend and React.js for frontend) were selected because they are modern, promote security and developer experience, and because their popularity has led to the creation of many tutorials and resources. Additionally, I have become familiar with these frameworks through internships and hobby projects, allowing for accelerated development of this application.

Data sourcing

The primary data source for this project is Surfline.com's publicly-accessible forecast API. This API provides swell, tide, and wind forecasts for surf spots around the world. In addition to being easily accessible and containing a large collection of surf spots, Surfline forecasts are some of the most popular, receiving an Alexa ranking of 4,747, better than competitors like surf-forecast.com (49,833) and surfer.com (103,767) ("Surfline.com Competitive Analysis, Marketing Mix and Traffic"). Because of their popularity, many users will have a familiarity Surfline's forecasts, reducing cognitive overhead for new users.

There are three API endpoints used in this application: swell forecasts, tide forecasts, and spot search. The search endpoint is used to aid users in associating data sources to surf spots. In order to fetch forecast data for a user's surf spot, it must be associated with a Surfline spot. The forecast and tide endpoints use a 24-digit hash to identify the surf spot, a value that is cumbersome for humans to remember. The application keeps track of the association between alias and id for the user, allowing

them to avoid direct use of the hash. The search API responds to a user query (i.e. “Pismo Beach”) and returns a list of spot records, each detailing its unique id and human friendly name.

The swell forecast endpoint returns a list of JSON objects containing a timestamp and an array of six individual swells for the current day at a specific spot. Each element of the swells array contains the height, direction, and period of the swell.

The tide forecast endpoint response is similarly structured to the swell forecast response. It returns a list of JSON objects containing a timestamp, the corresponding tide height, and whether that height is at low (minimum), high (maximum), or in between extrema.

Database structure

This application uses a PostgreSQL database to persist application data.

The following diagram represents the structure of the database in an Entity Relationship Diagram

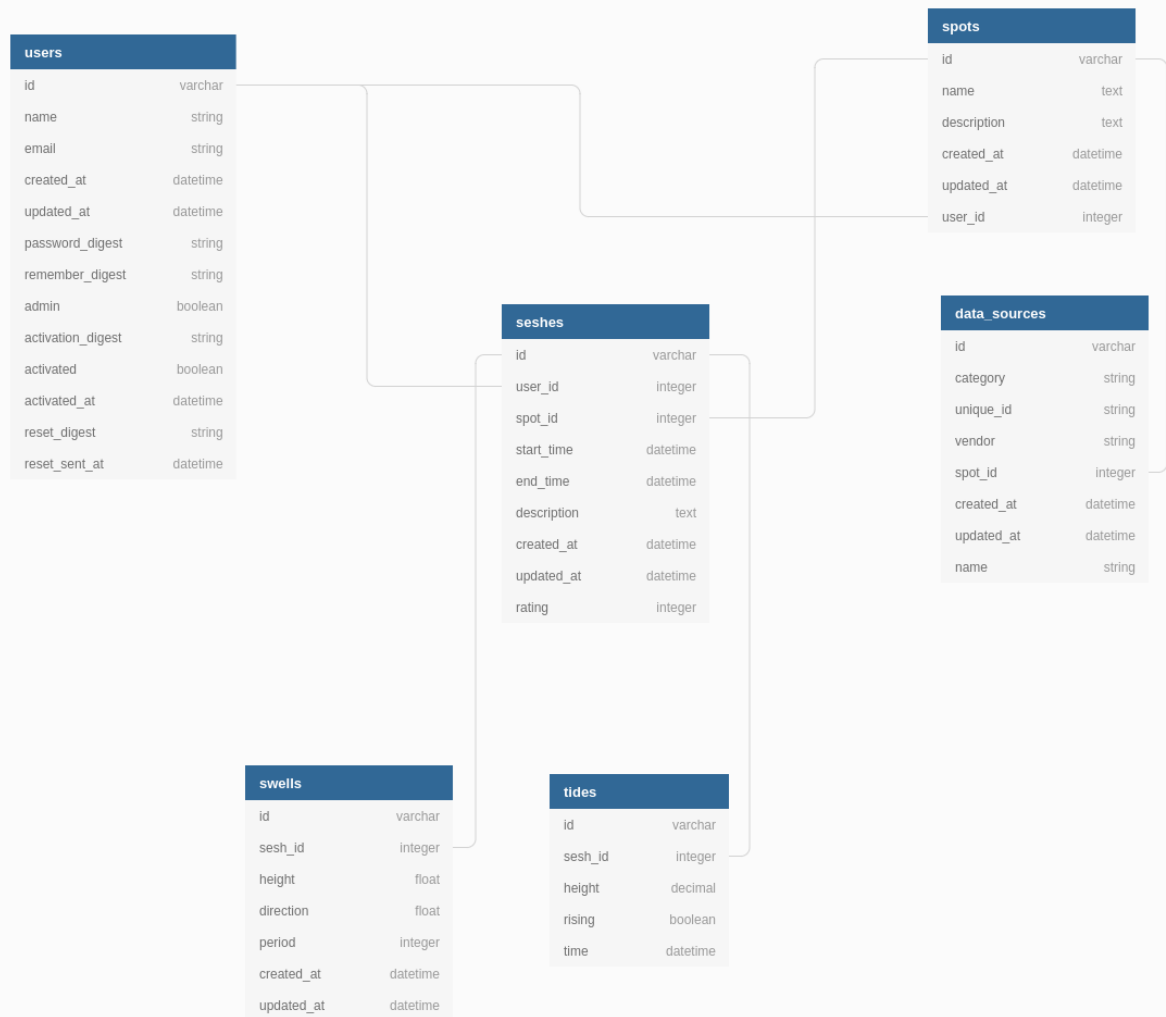


Figure 3: Entity-Relationship Diagram of Backend DB

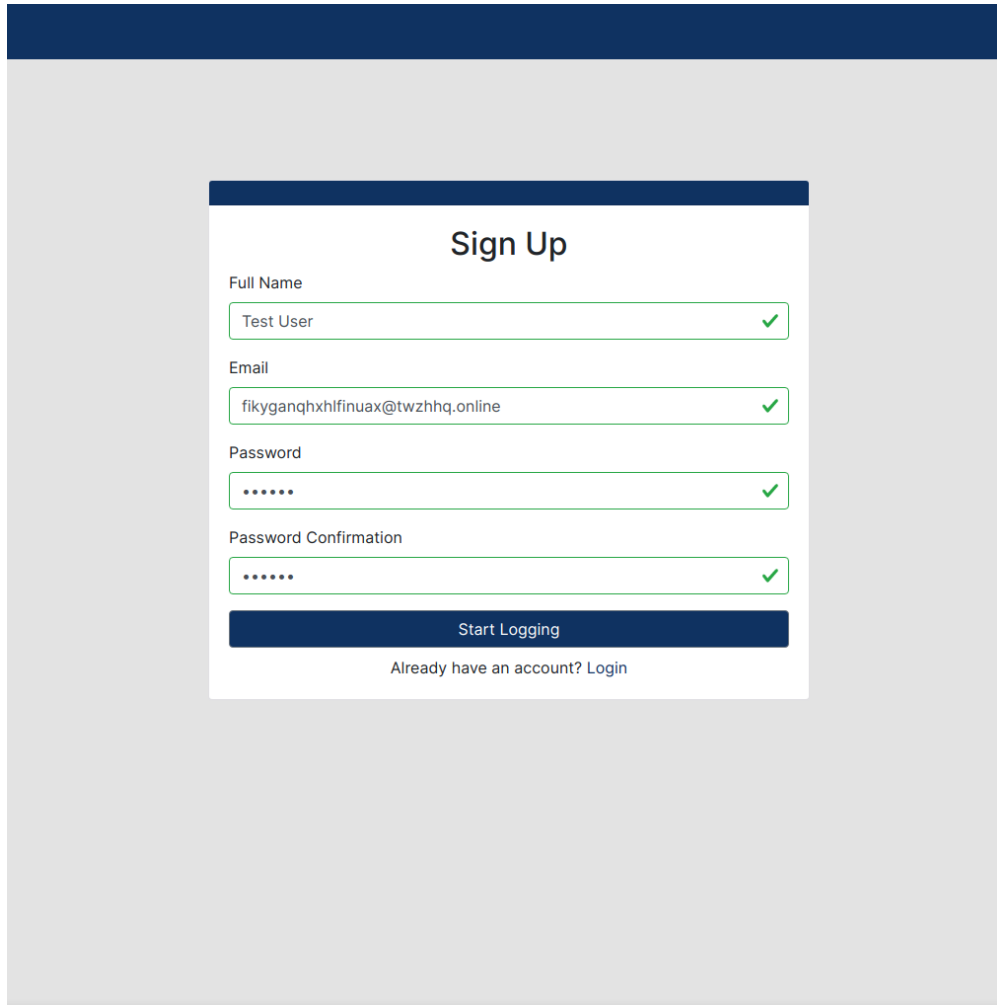
Results

Fulfilled Customer Requirements

The following customer requirements have been implemented:

#1: Users can create accounts, login, and logout

In order to use this web application, users must first create an account.



The image shows a 'Sign Up' form with a dark blue header bar. The form is centered on a light gray background. It contains four input fields, each with a green checkmark on the right side, indicating they are valid. The fields are: 'Full Name' with the value 'Test User', 'Email' with the value 'fikyganqhxhlfinuax@twzhq.online', 'Password' with six dots, and 'Password Confirmation' with six dots. Below the fields is a dark blue button labeled 'Start Logging'. At the bottom of the form, there is a link that says 'Already have an account? Login'.

Figure 4: User Signup page

Users will receive a confirmation email with a link to activate the account.

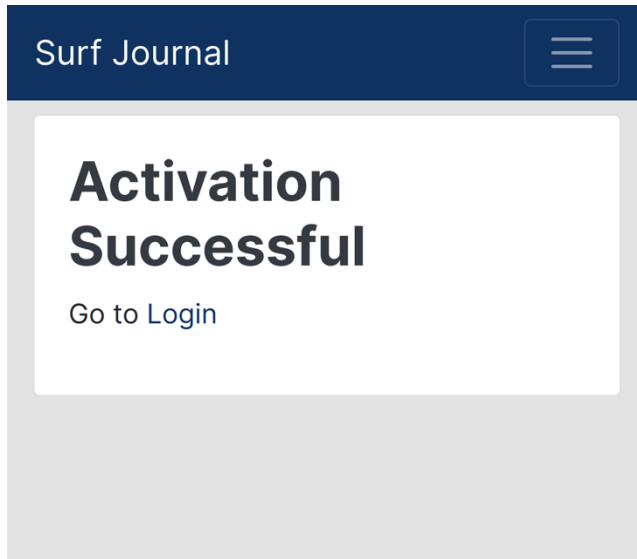


Figure 5: Successful Activation Page

Once activated, user use their email and password to login

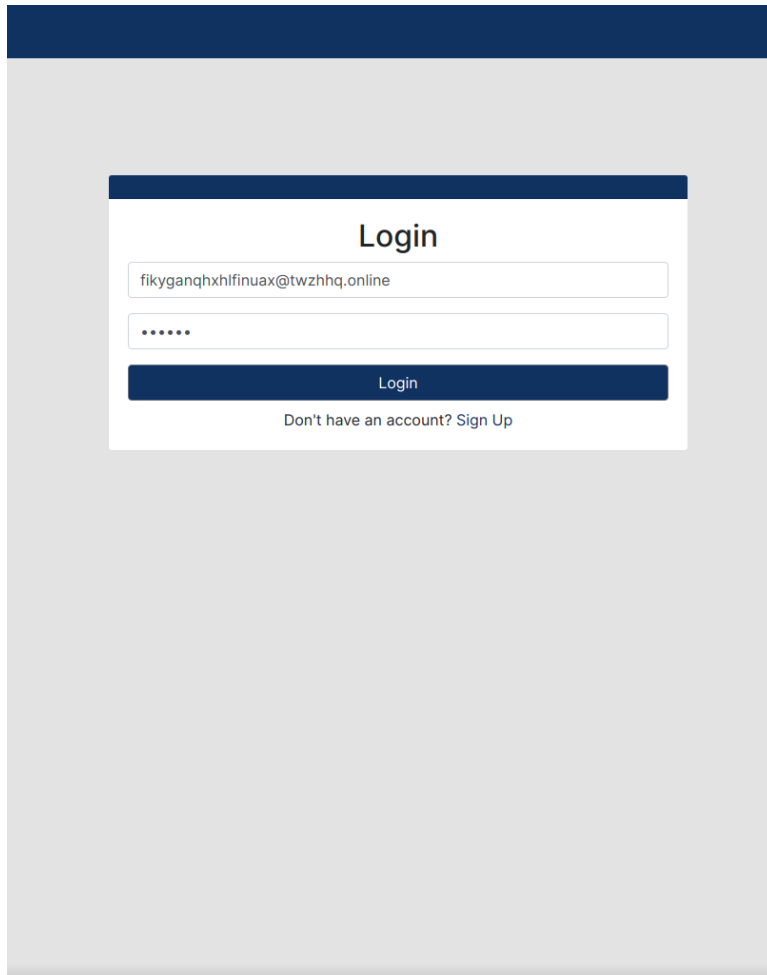


Figure 6: Login Page

Once logged in, users are presented with their home feed

#2: Users can create, edit, and delete custom Surf Spots

Before recording a surf session, a user must create the surf spot to be recorded. The following example walks through the creation of a spot for Pismo Beach.

First, a user fills in spot metadata.

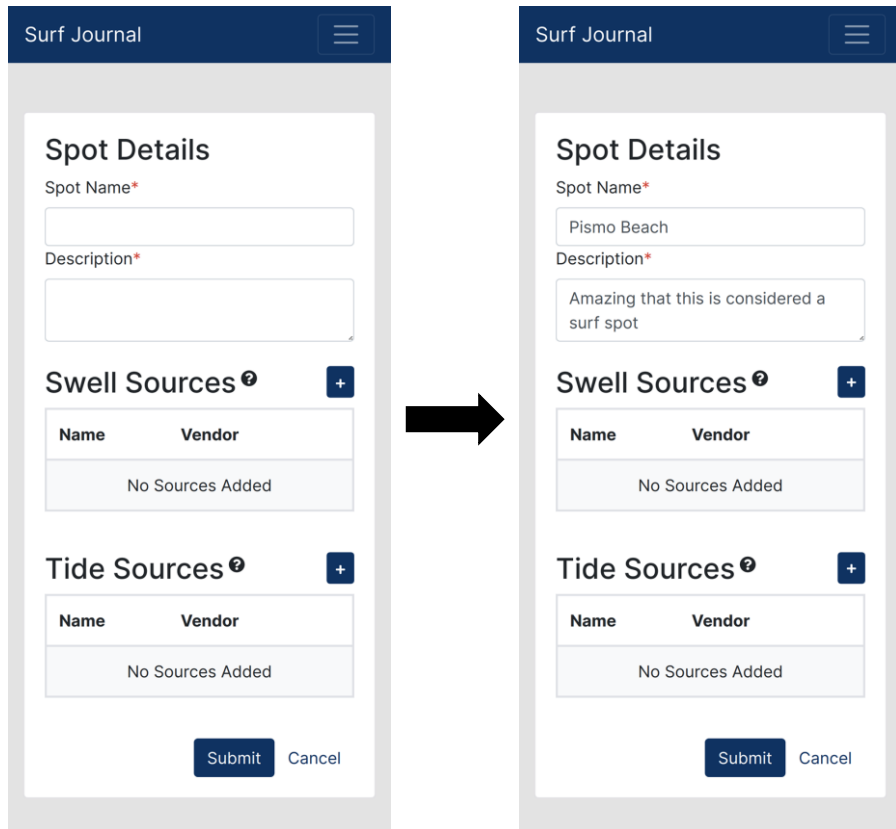


Figure 7: Entering Spot Metadata

Next, the user associates this spot with a swell source

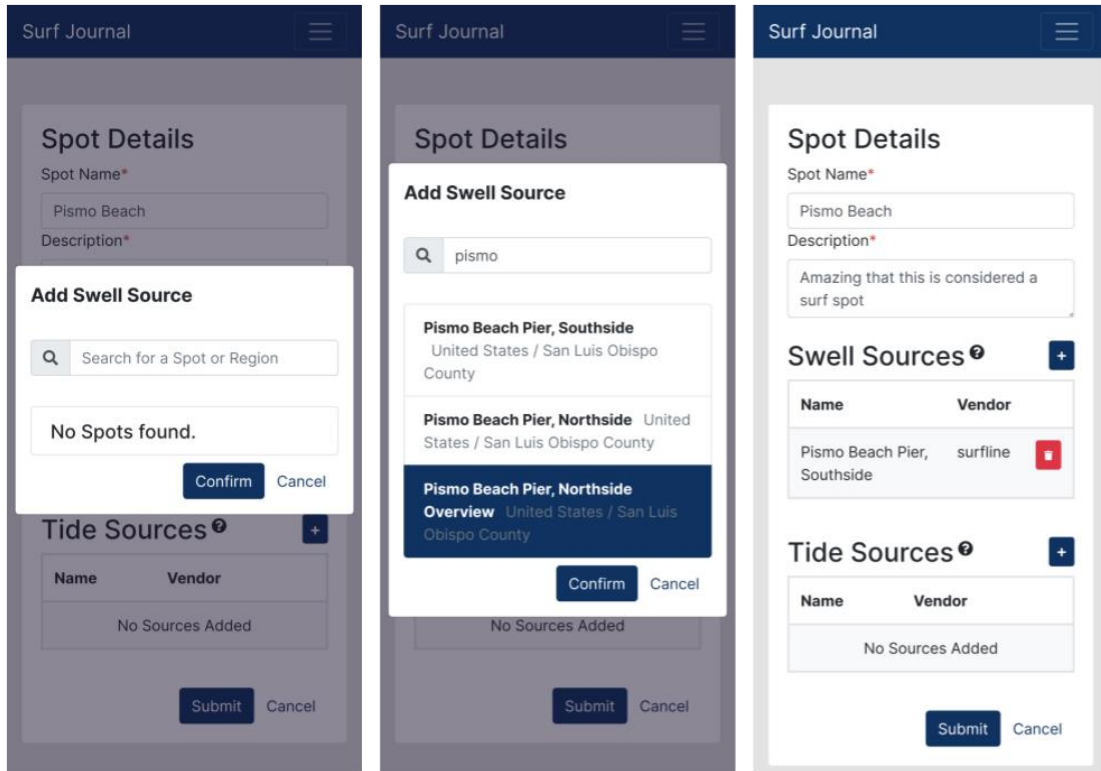


Figure 8: Adding a Swell Data Source

Next, in a similar fashion, the user associates this spot with a tide source

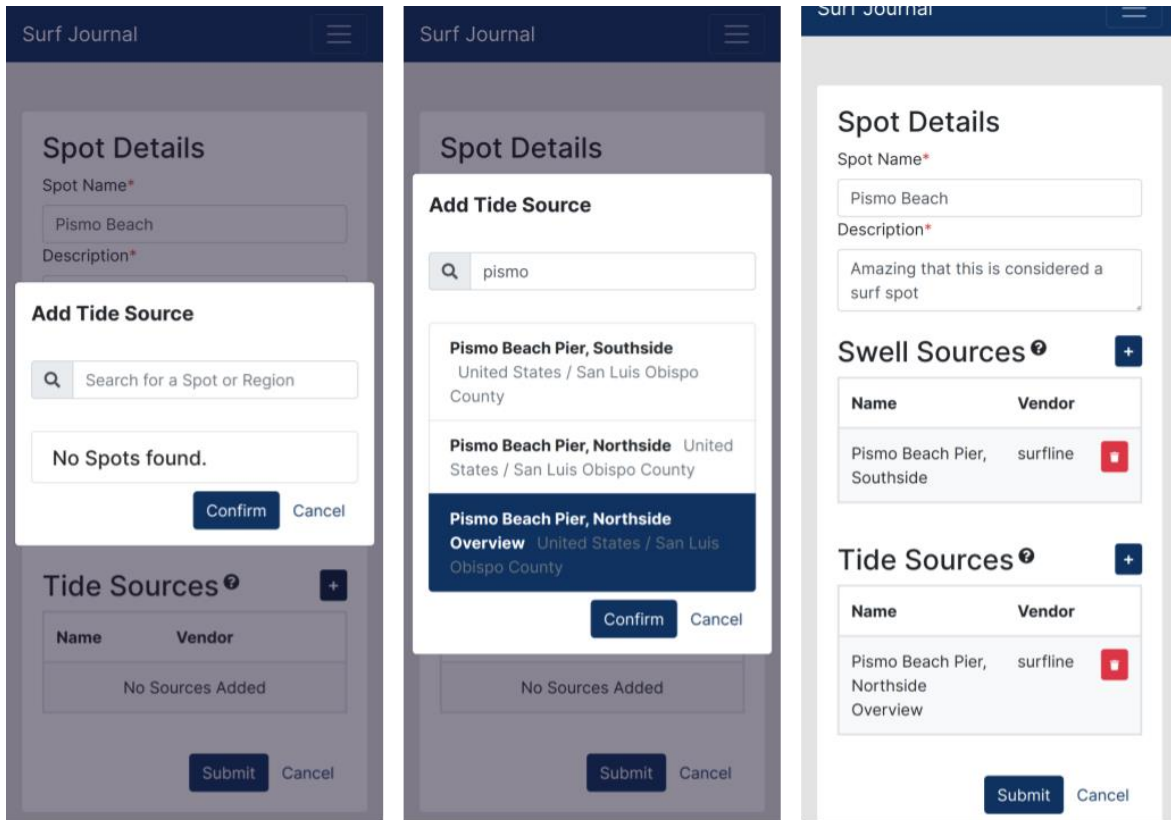


Figure 9: Adding a Tide Data Source

After submitting, the user is notified of success (Note: some information redacted for courtesy)

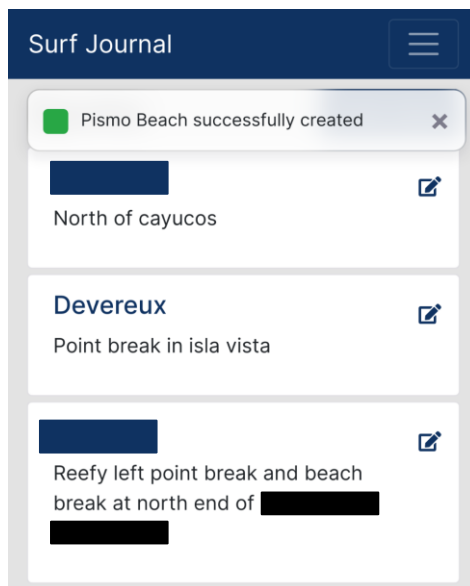


Figure 10: Success Notification upon creation

On the spot detail page, users can select from a dropdown to edit or delete the spot

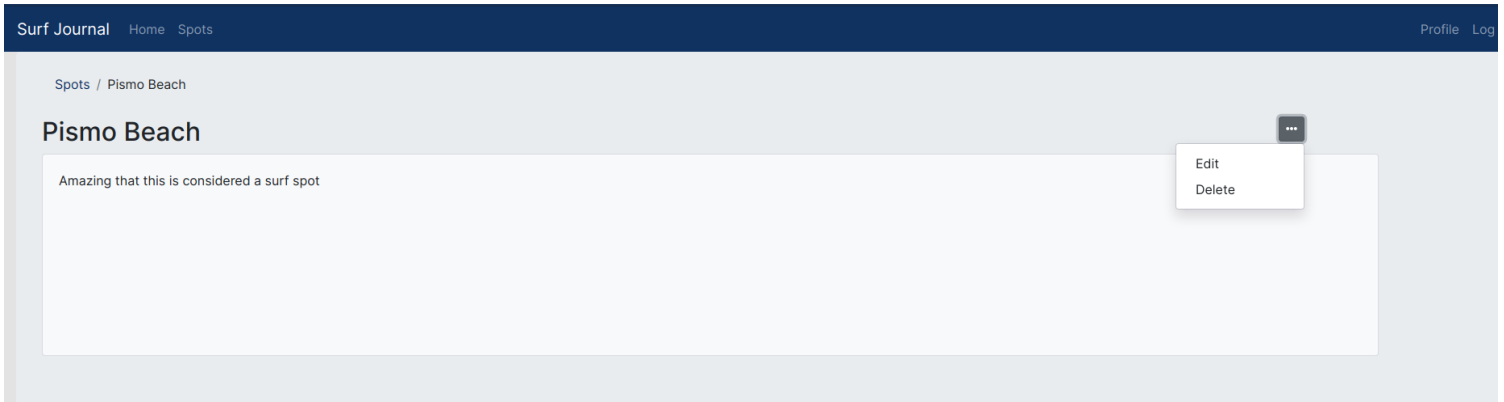


Figure 11: Spot Detail page with action dropdown selected

#3: User can create, edit, and delete Surf Sessions

Once a user has created a spot, they can start recording surf sessions. First session metadata is entered

Surf Journal

Sesh Info

Spot* Rating* ☆☆☆☆☆

Date*

Start Time* End Time*

Description

1.3ft at 12s WNW 296°

Sun, May 16th 2:00 pm

Surf Journal

Sesh Info

Spot* Rating* ★★☆☆☆

Date*

Start Time* End Time*

Description

1.3ft at 12s WNW 296°

Figure 12: Adding Session Metadata

Next, tide and swell information are fetched. This fulfills customer requirement #4. User can choose to edit or delete these values

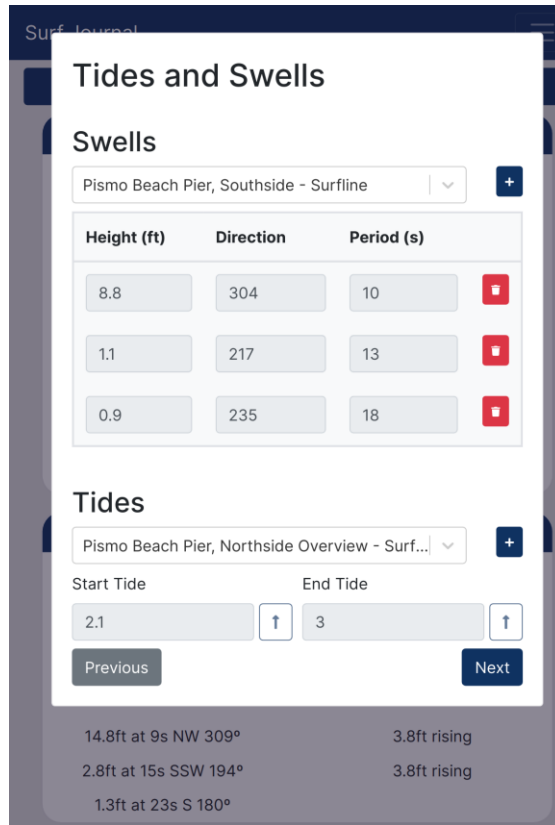


Figure 13: Fetching Swell and Tide data

Finally, all session information is displayed in one screen and the user can submit

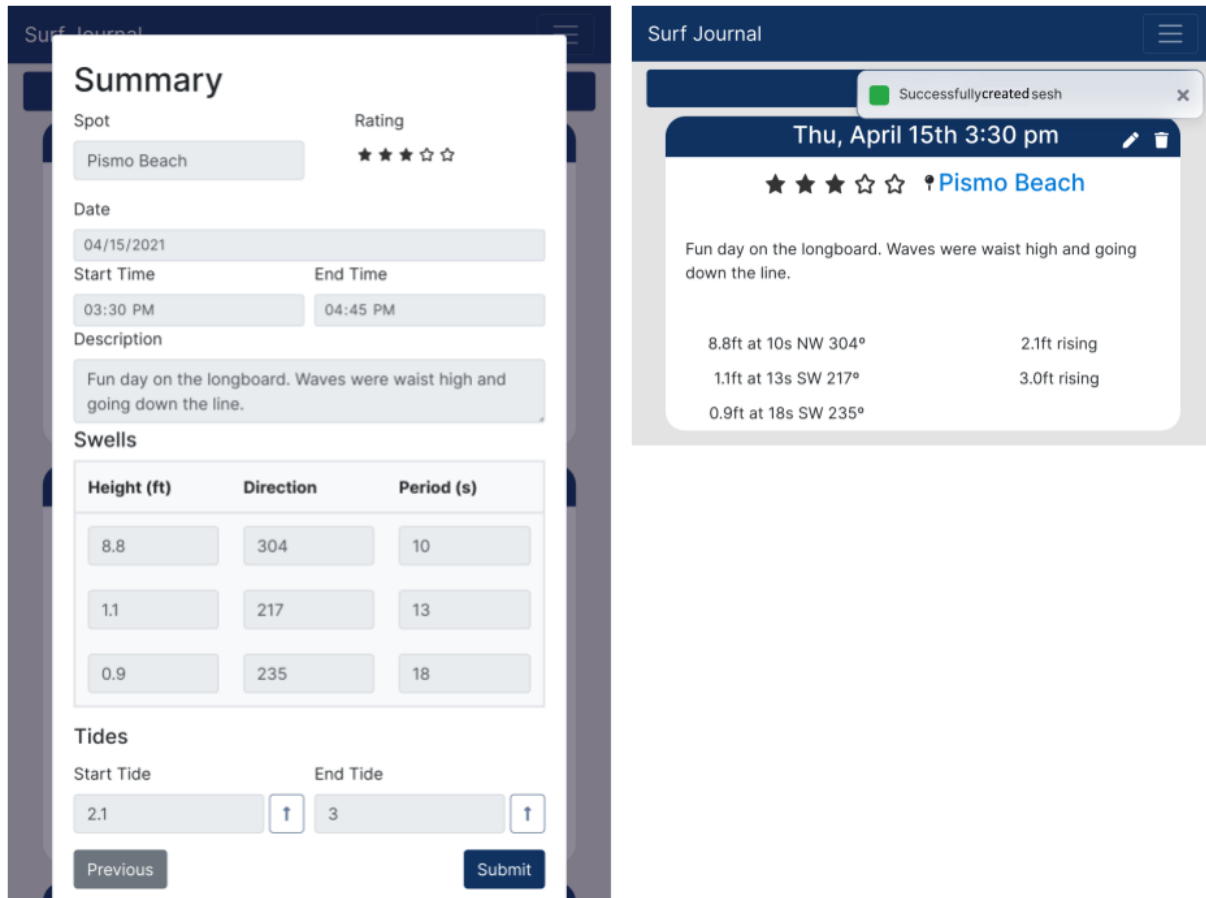





Figure 14: Session summary and creation notification

After being created, a session is displayed in the feed view. Users can click the pencil icon in the top right of each session card to edit the session.



Add a sesh

Wed, June 2nd 11:07 am  

★ ★ ★ ☆ ☆  Surf Spot

testing

5ft at 6s NW 305°	3.1ft rising
1.8ft at 13s S 190°	3.2ft falling
1.3ft at 13s SW 230°	

Tue, May 4th 4:03 pm  


★ ★ ☆ ☆ ☆  Surf Spot

Figure 15: Pencil Icon for session editing

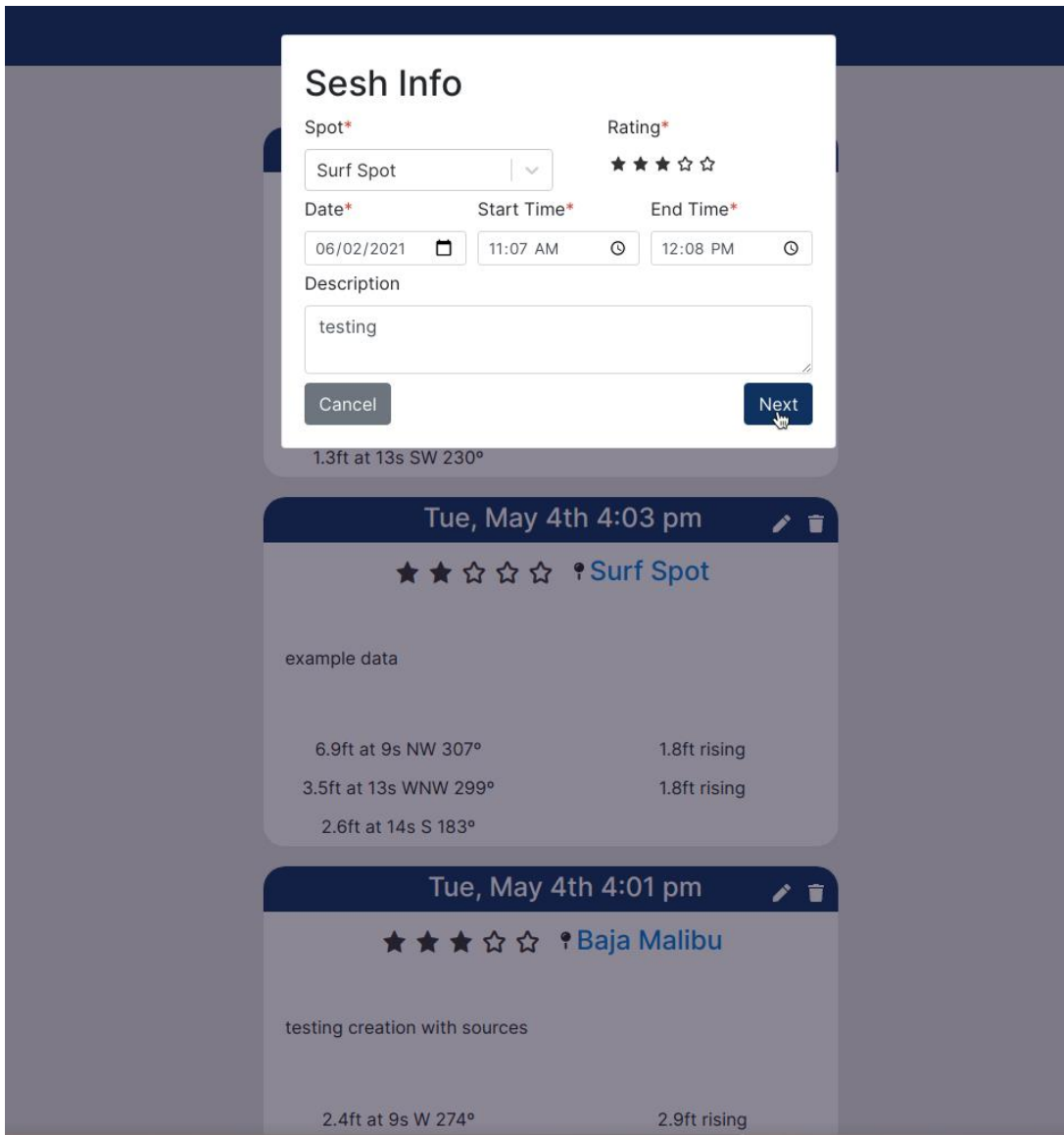


Figure 16: Editing a session

Users can the trashcan icon to delete the session.

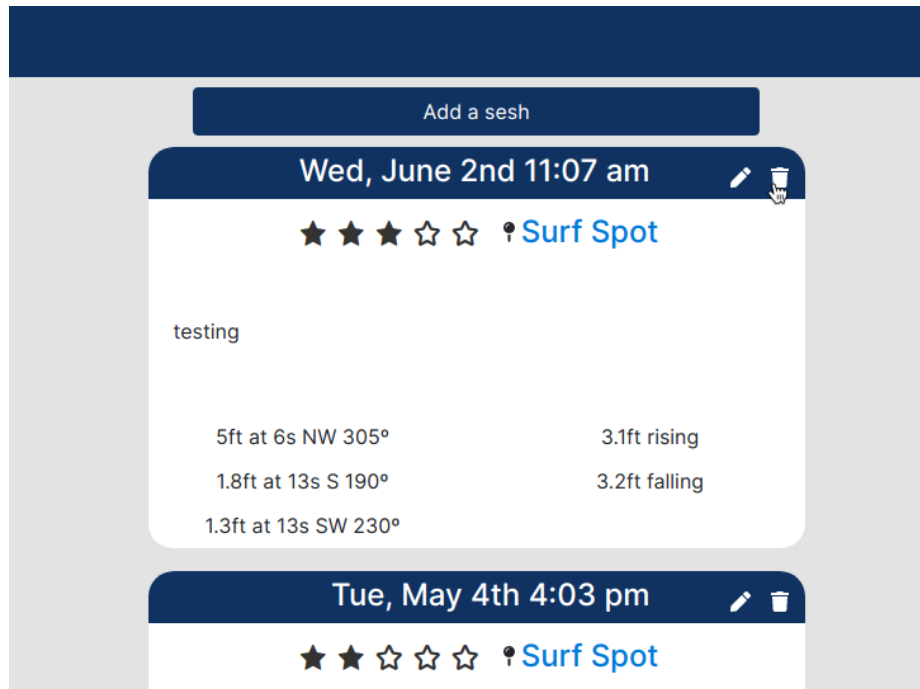


Figure 17: Trashcan Icon for session delete

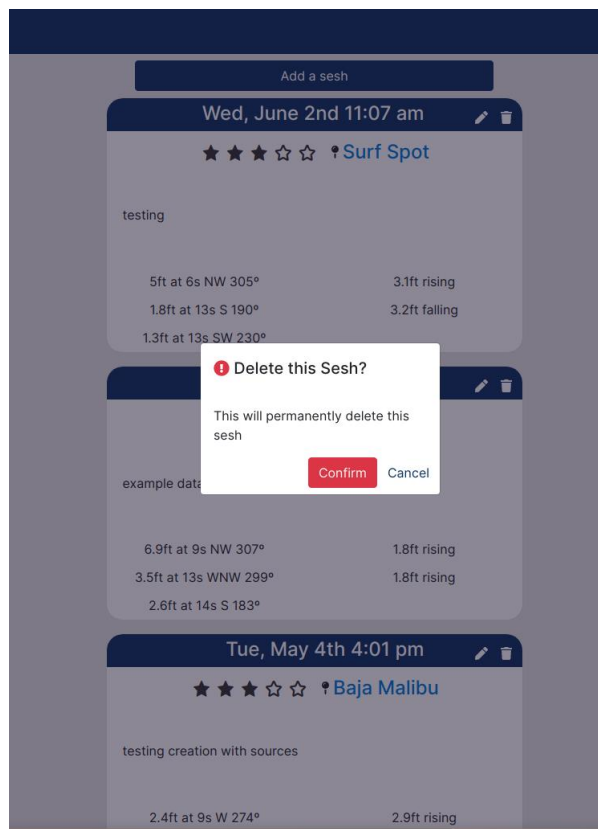


Figure 18: Session Delete confirmation

#5: User can view all Surf Sessions in a scrolling feed interface

Fulfilling customer requirement #5, users can view all of their surf sessions in an Instagram-like feed view. Sessions are listed in order of creation time. This view only fetches a few sessions at a time to avoid excessive loading times. When a user scrolls to the bottom of the page a “Load More” button appears, allowing them to view older sessions.

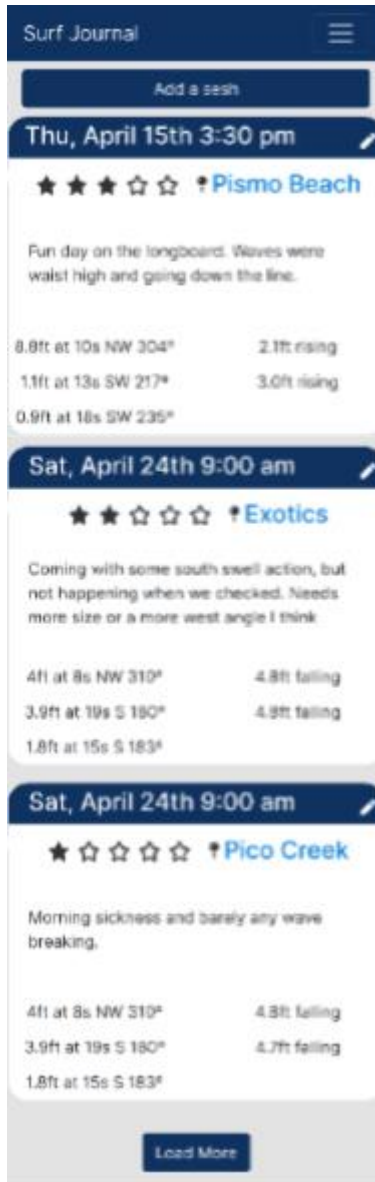


Figure 19: Session Feed View

#6: User can view all Surf Sessions in a sortable table interface

On the user profile page, all of a user's sessions appear in a table view. Users can sort by any field value.

Surf Journal Home Spots Profile Log Out

Profile

More coming soon...

All Seshes (30)

Spot	Date ↓	Rating	Swell 1 Height	Swell 1 Dir	Swell 1 Period	Swell 2 Height	Swell 2 Dir	Swell 2 Period	Swell 3 Height	Swell 3 Dir	Swell 3 Period
sandspit	2021/05/11	4/5	1.2	225	19	3.7	301	12	2.8	200	16
Pismo Beach	2021/05/03	3/5	7	307	9	3.2	298	13	2.7	185	14
Pismo Beach	2021/04/30	2/5	5.3	304	7	2.6	298	11	2.4	205	16
exotics	2021/04/24	2/5	4	310	8	3.9	180	19	1.8	183	15
pico creek	2021/04/24	1/5	4	310	8	3.9	180	19	1.8	183	15
Pismo Beach	2021/04/15	3/5	8.8	304	10	1.1	217	13	0.9	235	18
morro bay	2021/04/14	4/5	7	305	9	2	301	12			
Pismo Beach	2021/04/14	2/5	7	306	9	2	301	12			
sandspit	2021/02/27	2/5	13.5	312	9	0.6	194	12	1.1	15	5
sandspit	2021/02/06	2/5	3.9	316	9	2.2	301	14	3.4	312	5
sands	2021/01/10	5/5	2.5	270	14	0.3	205	14	1.9	266	10

Rows per page: 100 1-30 of 30 < >

Figure 20: Table view of all sessions, sorted by date

#7: User can filter Surf Sessions by Surf Spot

Users can also apply filters to columns. Filtering by surf spot name fulfills requirement #7

Surf Journal Home Spots Profile Log Out

Profile

More coming soon...

All Seshes (30)

Spot	Date	Rating	Swell 1 Height	Swell 1 Dir	Swell 1 Period	Swell 2 Height	Swell 2 Dir	Swell 2 Period	Swell 3 Height	Swell 3 Dir	Swell 3 Period						
<div style="border: 1px solid #ccc; padding: 2px;"> <table border="1"> <thead> <tr> <th>Columns</th> <th>Operators</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Spot</td> <td>contains</td> <td>sandspit</td> </tr> </tbody> </table> </div>	Columns	Operators	Value	Spot	contains	sandspit		225	19	3.7	301	12	2.8	200	16		
Columns	Operators	Value															
Spot	contains	sandspit															
sandspit	2021/02/27	2/5	13.5	312	9	0.6	194	12	1.1	15	5						
sandspit	2021/02/06	2/5	3.9	316	9	2.2	301	14	3.4	312	5						
sandspit	2020/08/30	4/5	1.7	162	10	3.9	316	8	1.4	198	12						

Rows per page: 100 1-4 of 4

Figure 21: Table view of all sessions, filtered to a single spot

In its current state, this web application fulfills the MVP use cases. Users can create accounts, login, and logout. Users can create custom surf spots and link them to Surfline swell and tide sources. Users can record surf sessions at their spots, add a quantitative rating, and a qualitative description. Surf condition data is fetched for the user seamlessly—no need to manually gather data from other sites. Users can view all of their surf sessions in a scrollable feed and in a sortable table. Users are able to edit and delete surf spots and surf sessions.

#	Customer Requirement	Fulfilled?
1	Users can create accounts, login, and logout	Yes
2	Users can create, edit, and delete custom Surf Spots	Yes
3	User can create, edit, and delete Surf Sessions	Yes
4	User can record a Surf Session without manually entering surf condition data	Yes
5	User can view all Surf Sessions in a scrolling feed interface	Yes
6	User can view all Surf Sessions in a sortable table interface	Yes
7	User can filter Surf Sessions by Surf Spot	Yes

Figure 22: Customer Requirement Fulfillment

With this functionality implemented, this web application will provide value for a large swath of users. Surfers of all skill levels and surf forecasting ability will be able to improve

Future work

While the current product fulfills MVP requirements, there remains many quality-of-life enhancements and new features to be developed. One current limitation is that spots must use Surfline as a data source. While it presently is the most convenient data source, Surfline is a private company that may choose to modify or remove access to their APIs. Allowing users to link NOAA or NDBC weather buoys to spots would give users more options for data sources and will ensure long term access to data. Another benefit of linking NDBC buoys is the access to historical data. The Surfline APIs only report data for the current day, prohibiting users from recording sessions from previous days. With access to historical data, users could record sessions for previous dates, enabling more flexibility. Another limitation of the current app is the lack of analytical features. Users can view a table of all their sessions and sort by

rating or spot but cannot view simple statistical metrics such as average rating for a spot or highest rated spot. Analytical tools can be developed to allow this, as well tools for comparing today's surf forecast against previously recorded sessions. Additionally, the following new features could benefit the utility of the application:

- Spot and Session Sharing capabilities
- Social features (Friends, likes, comments)
- Notifications for upcoming swells that are similar to swells of high rated sessions
- Ability to record wind data

Reflection

After developing web applications in an agile team during a summer internship, I was excited to take on this project individually. Though there are tradeoffs, I found this individual mode of development flexible and empowering.

One benefit to working as an individual is complete creative control. I developed the idea for this web application, wrote every line of code, and designed the UI style. This creative freedom enabled me to prioritize features that were important to me. Additionally, I had full choice over technologies and frameworks. This freedom allowed me to use familiar technologies that increased my developer velocity. It was fulfilling to see my pitch come to fruition as a live web application.

One shortcoming of this individual process is the lack of support and collaborative brainstorming. Without other to bounce ideas off of, I sometimes struggled to make design decisions. Previously, I had only worked on existing web applications with established code style, project structure, and best

practices. Starting from scratch was a challenging endeavor, one that forced me to grow in my understanding of web applications.

Another aspect of team software development that was not present in my project were code reviews. In this practice, team members review and comment on code changes before they are deployed to the production. This extra review stage helps to catch software bugs and can lead to more efficient and readable code. Access to another software developer's expertise is a valuable tool, providing not only code review, but also assistance when stuck on a technical problem or design decision.

After my experiences in this project, I would develop web applications individually again. Total freedom from inception to implementation is a powerful and rewarding privilege. If I were to modify my development process, I would have spent more time in the design phase. Certain aspects of the project, like database structure and UI design, experienced multiple redesigns and reimplementations. Spending more time planning would have eliminated the need to restructure these aspects, saving time and frustration in the process.

This project has prepared me for my career in Software development. The experience gained in all aspects of web application development will benefit me in many Software domains. In contrast to my internship experiences where I worked on small, isolated portions of the codebase, this project required me to understand and design project architecture, UI design, task management, and website hosting. This breadth of experience will be valuable when working in cross disciplinary teams and improve my understanding of other roles in software development.

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