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Human Computer Interaction Design

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Student Name: Tran Duy Hung

Student ID: GCS210483/ 001358096

Tutor name: Vo Thanh Duy

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COMP-1649 Human Computer Interaction and Design (2023-2024)

1 Introduction

In the dynamic world of diving, modern technology and underwater exploration have ushered in new possibilities for enthusiasts. This report aims to develop and present an advanced interactive product specifically tailored for snorkelers and amateur scuba divers. The objective is to address the increasing demand to capture and relive underwater moments by creating a versatile mobile application. This application serves not only as a tool for documenting photos and videos underwater but also for providing users with a comprehensive overview of their diving activities. The aim is to integrate functionalities for both underwater and on-land interactions, delivering a user-friendly and appealing product that adds an innovative touch to the diving experience.

2 Background literature

2.1 HCI Research

Research main purpose is to enhancing Underwater User Interface Visibility: A Comprehensive Study on Luminance and Display Illumination for Diver-Friendly Interaction this will ads in choosing front type and size, colour base on the luminance when underwater.

Luminance

Luminance plays a pivotal role in ensuring effective visibility of screens. Despite established standards for various light conditions in the air, the underwater environment has not received adequate attention. The underwater operational setting is inherently darker than the air, with incident light at 10 msw in clear water being only 20% of that on the surface. In deep and turbid conditions, ambient light is significantly low, resembling the darkness of a night or blackout scenario in the air. For displays intended for dark environments in the air, it is recommended to use low luminance red light (0.07-0.35 candela/m²) to enhance screen visibility (Mil Std., 1999). In situations requiring night vision compatibility, the spectral output of light emitted from or illuminating a display should not exceed 600 nm in wavelength, and the luminance should be continuously adjustable. The two options for illuminating a display are external illumination and self-illumination. Self-illumination emerges as a superior choice for the underwater operational environment due to its self-contained nature, allowing control by the diver and automatic adjustments. The optimal luminance range for the underwater

environment remains unknown, as light absorption by water and particulate matter can affect the perceived luminance of the display for divers. In the context of these experiments, divers were provided with adjustable luminance for the head-down display.

Front size and Front type

In the context of screen visibility, luminance plays a pivotal role, yet standards for various light conditions often neglect underwater environments. The underwater operational setting, inherently darker than its terrestrial counterpart, presents unique challenges. Even in clear water at 10 meters, incident light is only 20% of that on the surface, comparable to a dark night or blackout conditions in air. For dark environments in the air, low luminance red light is recommended. When night vision compatibility is needed underwater, light emission from a display should not exceed 600 nm in wavelength, with adjustable luminance. Self-illumination is favored in the underwater operational environment, offering control and adaptability. However, the ideal luminance range for underwater conditions remains unknown due to light absorption by water and particulate matter.

Color and Contrast

Color and contrast considerations are integral to designing an effective underwater display. Contrast, which delineates the difference between light and dark objects, encompasses two types: color contrast and brightness contrast. The perceptual aspects of a light stimulus—hue (color), saturation (color purity), and brightness (intensity)—are interconnected with its spectrum. Hue signifies the color associated with the largest wavelength component, while saturation denotes color purity, and brightness relates to light intensity. Color contrast pertains to the ratio of hue and saturation, emphasizing the distinction between foreground and background on the display screen and between the screen and surrounding water. Brightness contrast, crucial for text legibility, focuses on perceived differences in luminance compared to the background. (James Barbour Morrison and Zander, 2021)

2.2 HCI Theory

Icon Colors and Icon Symbols on Menu Item Selection for Smartphone

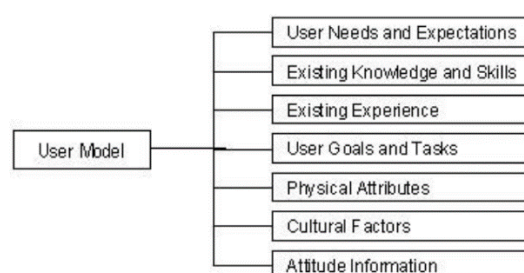
Icon Colors and Symbols Influence Menu Item Selection on Smartphones, providing access to application or device functions and facilitating selection among alternatives. Menus exhibit a spectrum, ranging from simple and concise choices to intricate information systems. The core objective of menus is to furnish users with an intelligible,

comprehensible, memorable, and convenient organizational structure tailored to their tasks. The effectiveness of menus lies in offering cues for recognition, eliminating the need for users to recall command line syntax from memory. Consequently, uncomplicated menus prove effective for users with minimal training or those unfamiliar with technical terminology. Transitioning from desktops to mobile devices has introduced challenges in menu design due to the limited screen size of smartphones, imposing constraints on the amount of information displayed at once. Currently, several menu patterns have been designed and implemented for smartphones, including springboards (also known as launchpads or grid menus), cards, list menus (or hierarchical navigation), dashboards, gallery, and skeuomorphic menus. However, there has been limited experimental research on the efficiency of smartphone menu patterns. (Lumpapun Punchoojit and Nuttanont Hongwarittorn, 2018)

3 Design Process

3.1 Conceptual Design

The user interface design relies on user models and insights obtained from studies involving individuals. A user model serves as a representation of information and assumptions regarding users and can be approached from three perspectives: modelling user knowledge, modelling user plans, and modelling user preferences. The modelling of user knowledge involves accurately estimating users' background knowledge, skills, and experience. The modelling of user plans aims to explore the sequence of tasks users undertake to achieve their goals. (Sisira Adikari and McDonald, 2007)



Focusing on users' information needs and preferences, the modelling of user preferences is integral. Our observations indicate that user model attributes are context-dependent, varying across application domains. However, specific user attributes remain crucial to a user model. Figure above illustrates our proposed user model, comprising eight key user attributes.

3.2 Design principles

Design principles are fundamental guidelines and concepts that guide the creation of user interfaces and interactions to enhance the user experience. These principles' goal is to improve the usability, accessibility, and overall effectiveness of interactive systems.

- **Visibility**

Users should quickly grasp their options just by looking at the interface. In mobile apps, where screen space is limited, it's crucial to include only necessary options. For instance, a login screen should focus solely on login or signup info, avoiding unnecessary clutter.

- **Feedback**

Users need feedback after each action to confirm success. For example, changing the tab icon to a spinner indicates a webpage is loading.

- **Affordance**

Design should intuitively guide users. Like a coffee mug's obvious grip, digital interfaces should enable users to access information just by looking at the design.

- **Mapping**

Controls should closely resemble their effects. A vertical scroll bar, for instance, indicates your position, and the page moves accordingly. This aligns with a modern stovetop, where knob arrangement corresponds to burner order.

- **Constraints**

Constraints prevent overwhelming user choices. An example is an online form that restricts entering letters into a phone number field.

- **Consistency**

Users learn better through recognized patterns. Consistency is vital; if similar elements don't produce similar outcomes, user frustration may arise. For instance, a website's buttons, if designed as protruding boxes with labels, should maintain that consistent look. Similarly, a backward arrow should consistently denote the back button.

4 Prototype

Overview

The underwater mid prototype serves as an intermediate stage in the development of the interactive product designed for snorkelers and amateur scuba divers. It marks a crucial point where the initial concept is translated into a tangible and interactive representation, allowing for a more refined understanding of the product's functionalities and user interactions.

4.1 Login Page

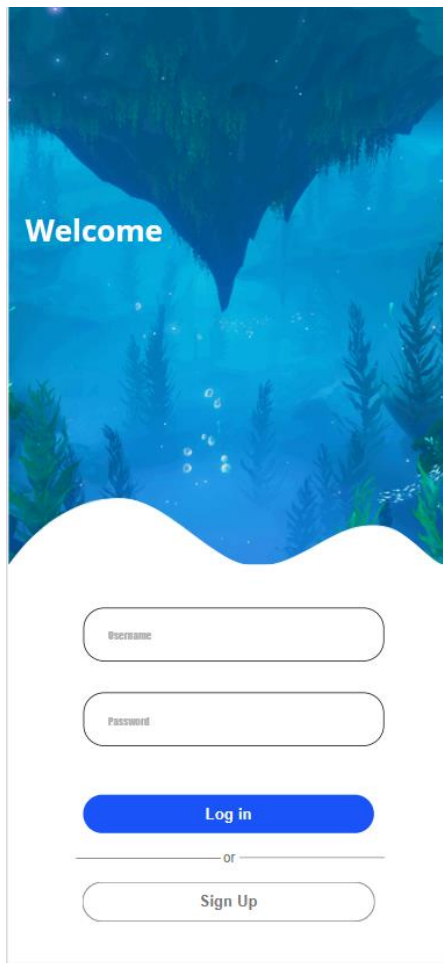


Figure 1: Login Page

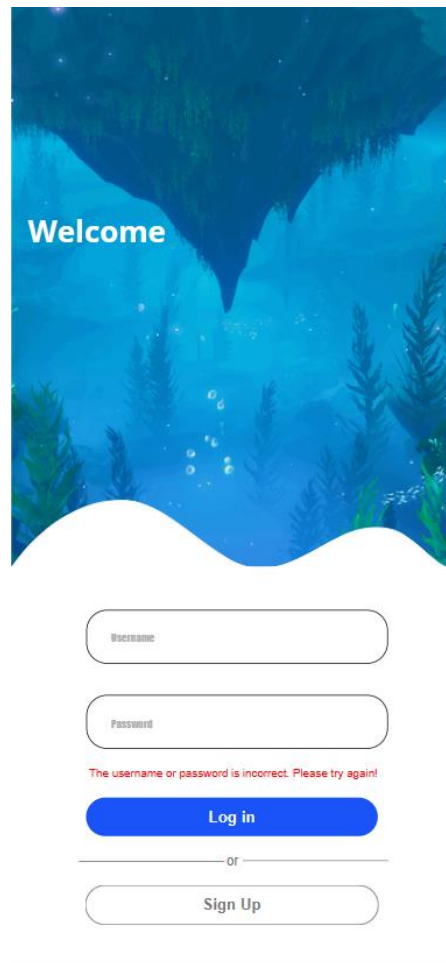
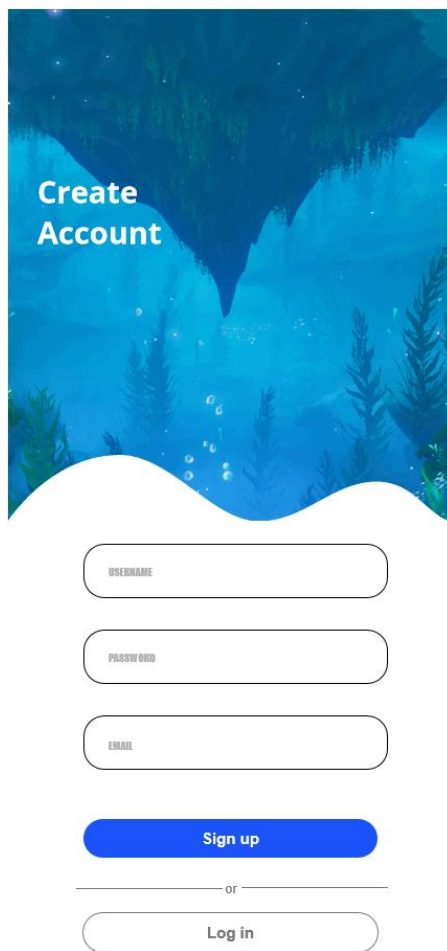


Figure 2: Login Error

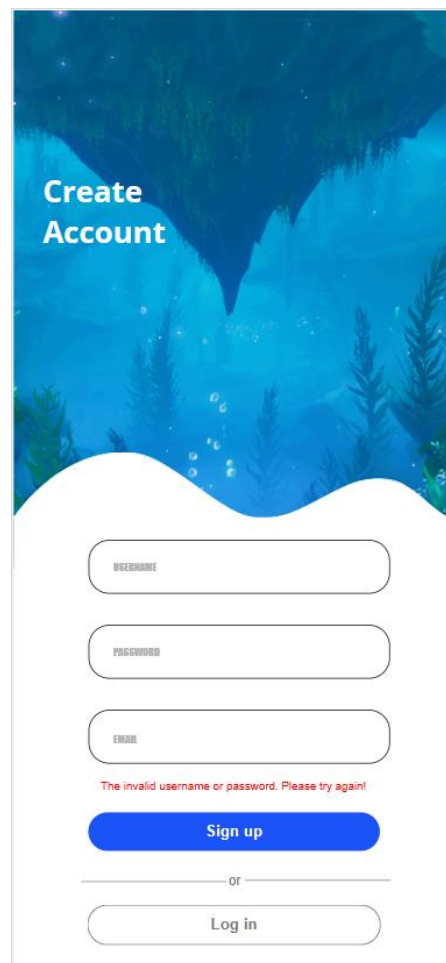
The login process require user to have an account to log in, and new users can sign up to create one. If the entered account information is correct, the app redirects the user to the main menu page. In case of incorrect information, a message appears, notifying the user of the error.

4.2 Register Page



The Register Page features a blue header with the text "Create Account" in white. Below the header is a white form area with three input fields labeled "USERNAME", "PASSWORD", and "EMAIL". A blue "Sign up" button is positioned below the input fields. Below the button is a horizontal line with the text "or" in the center. Below the line is a white "Log in" button.

Figure 3: Register Page



The Register Error page features a blue header with the text "Create Account" in white. Below the header is a white form area with three input fields labeled "USERNAME", "PASSWORD", and "EMAIL". A red error message "The invalid username or password. Please try again!" is displayed below the input fields. A blue "Sign up" button is positioned below the error message. Below the button is a horizontal line with the text "or" in the center. Below the line is a white "Log in" button.

Figure 4: Register Error

The registration process for the app requires users to create an account. New users can sign up to establish their account. Upon successful entry of the required information, the app will proceed to the main menu. Conversely, if there are errors in the registration details, a notification will appear, indicating that the information provided is incorrect.

4.3 Main Page

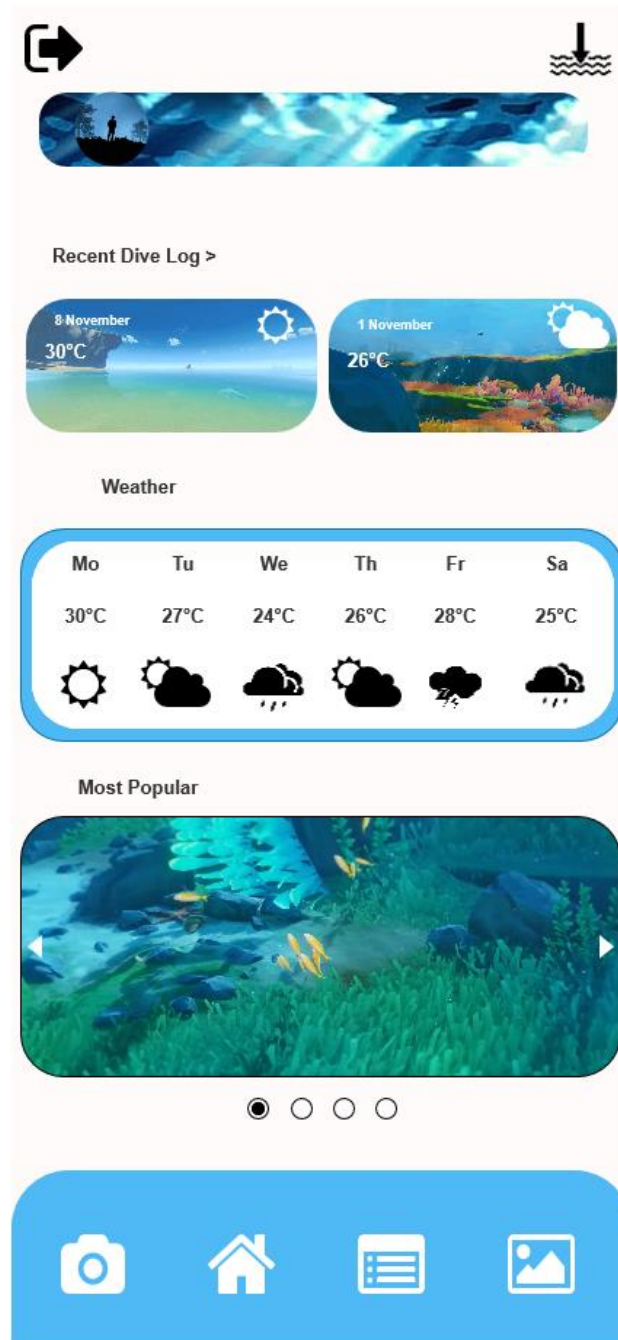


Figure 4: Main Menu Page

The Main Menu layout is user-friendly experience by placing quick access buttons like Log Out and Profile and Underwater monitoring at the top for easy navigation. Below a Time and Date bar, users can access their recent diving activities and check weather conditions. An engaging Image Slider showcases popular dive sites, offering an immersive preview of underwater landscapes. The task bar at the bottom facilitates easy access to essential features.

4.4 Dive List Page

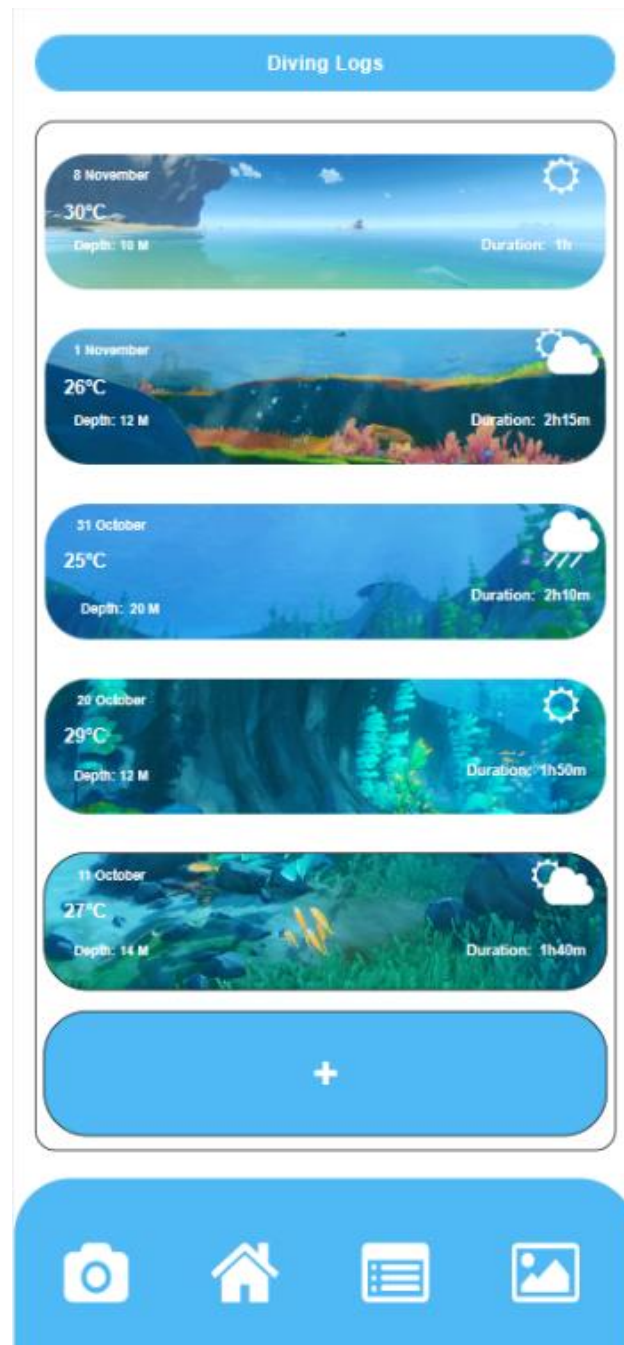
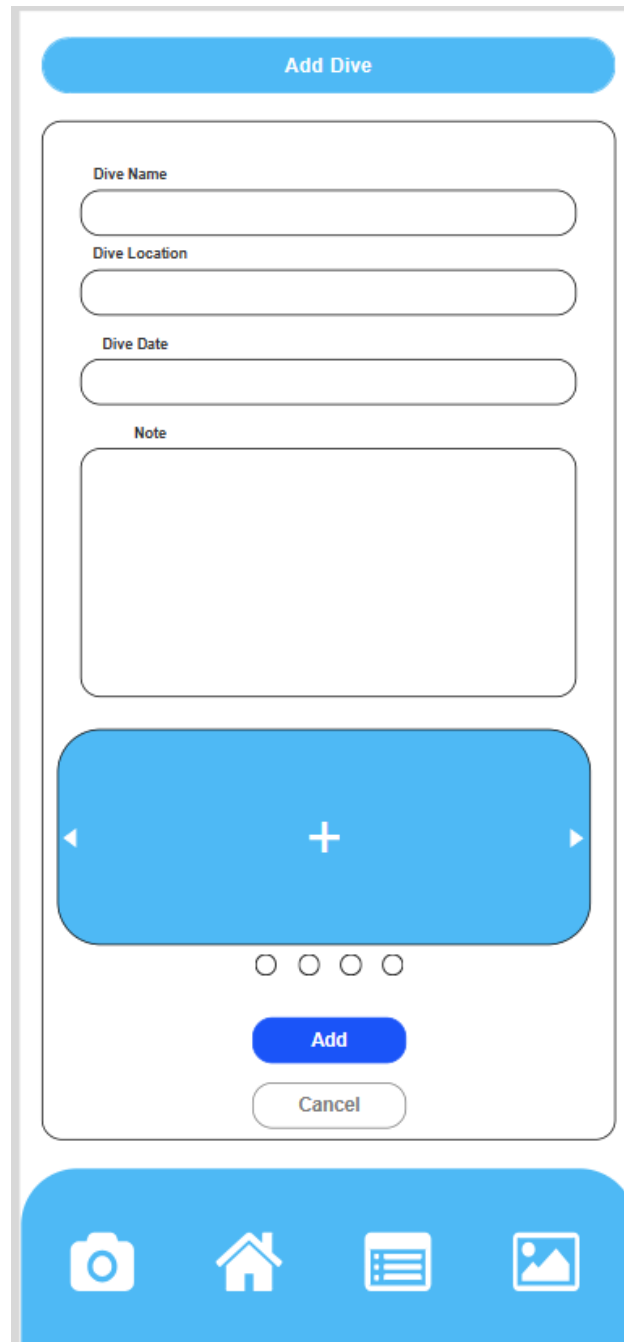


Figure 5: List Recent Dives Page

The Dive List feature provides users with an overview of their underwater adventures, offering a detailed log of each dive. Users can easily access this feature from the Main Menu, allowing them to track and manage their diving experiences effectively. The Dive List includes essential information such as dive location, date, depth, duration, and additional notes.

4.5 Add Dive Page

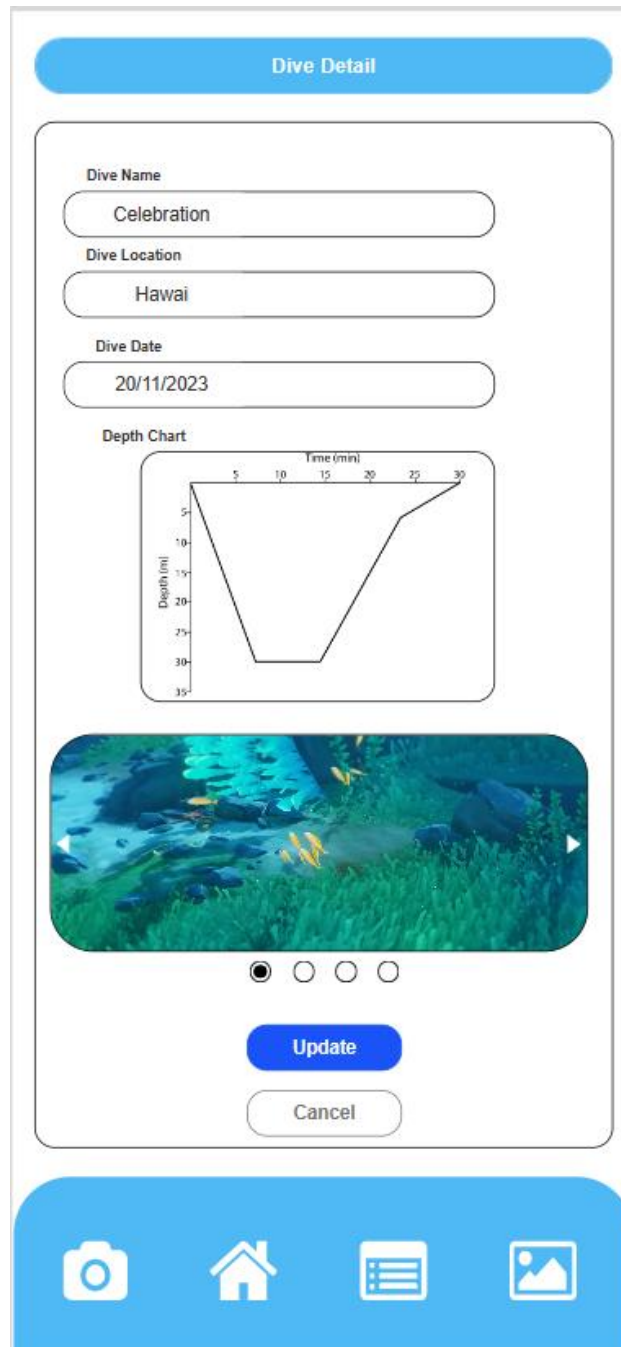


The image shows a mobile app interface for adding a new dive. At the top is a blue header bar with the text "Add Dive". Below this is a form with four input fields: "Dive Name", "Dive Location", "Dive Date", and "Note". The "Note" field is a larger text area. Below the form is a large blue button with a white "+" icon and left/right arrow icons. Underneath this button are four small white circles. At the bottom of the form are two buttons: "Add" (blue) and "Cancel" (white with a grey border). At the very bottom of the screen is a blue navigation bar with four white icons: a camera, a house, a list, and a photo gallery.

Figure 6: Add Dive Page

Users can add a dive by accessing this feature from the Dive List. The page requires users to input key information such as dive location, date, note, and the images captured during the dive if the user have taken them. Users can document and catalogue their diving experiences in a detailed and organized.

4.6 Dive Detail Page



The image shows a mobile application interface for a 'Dive Detail' page. At the top is a blue header bar with the text 'Dive Detail'. Below this is a white container with rounded corners. Inside, there are three input fields: 'Dive Name' with the value 'Celebration', 'Dive Location' with the value 'Hawai', and 'Dive Date' with the value '20/11/2023'. Below these is a 'Depth Chart' section. The chart has 'Time (min)' on the x-axis (0 to 30) and 'Depth (m)' on the y-axis (0 to 35). The line graph shows a descent from 0m at 0min to 30m at 10min, a horizontal segment at 30m until 15min, and an ascent to 0m at 30min. Below the chart is a video player showing an underwater scene with fish and coral. Below the video are four circular indicators, with the first one filled. At the bottom of the white container are two buttons: 'Update' (blue) and 'Cancel' (white with a grey border). At the very bottom of the screen is a blue navigation bar with four white icons: a camera, a house, a list, and a picture.

Dive Detail

Dive Name
Celebration

Dive Location
Hawai

Dive Date
20/11/2023

Depth Chart

Time (min)

Depth (m)

Update

Cancel

Figure 7: Dive Detail Page

The Dive Detail page is where users can access the specifics dive from their log. By selecting a particular dive from the Dive List, users are directed to this detailed view. The page showcases information such as dive location, date, depth, images that was took when diving.

4.7 Gallery Page



Figure 8: Photographs organized by Year



Figure 9: Photographs organized by Months

The Gallery Page organized structure, categorizing photos into sections by Year, Month, Albums, and showcasing all photos collectively. This arrangement ensures that users can efficiently navigate through their underwater memories.

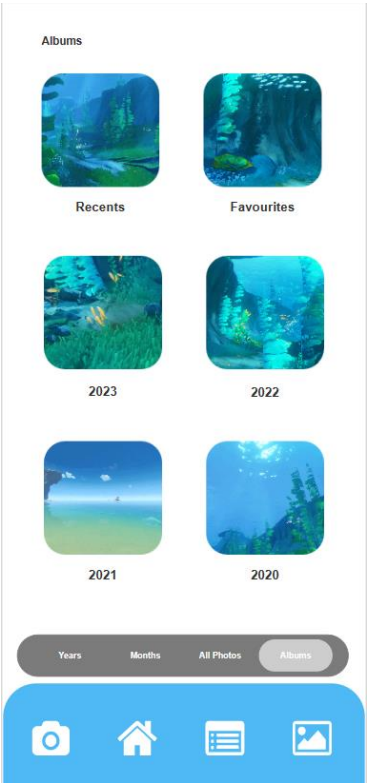


Figure 10: Albums



Figure 11: All Photos

4.8 Photo and Camera Page

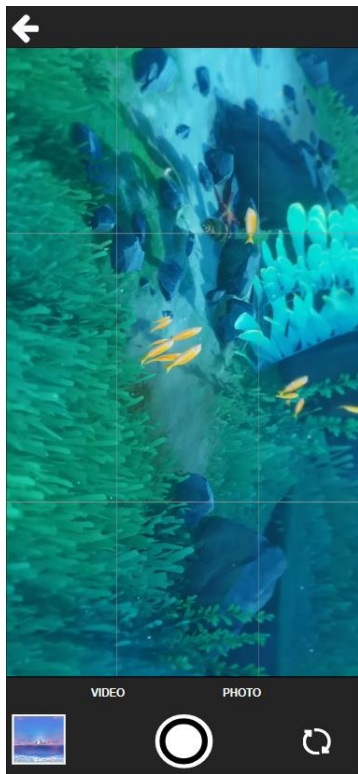


Figure 12: Camera



Figure 13: Video

The Camera function allow users to capture both photos and videos, providing a versatile tool for documenting their underwater experiences. Additionally, users can access the gallery directly from the Camera page, allowing for quick and convenient access to their previously captured photos.

4.9 Monitoring Dive Stats

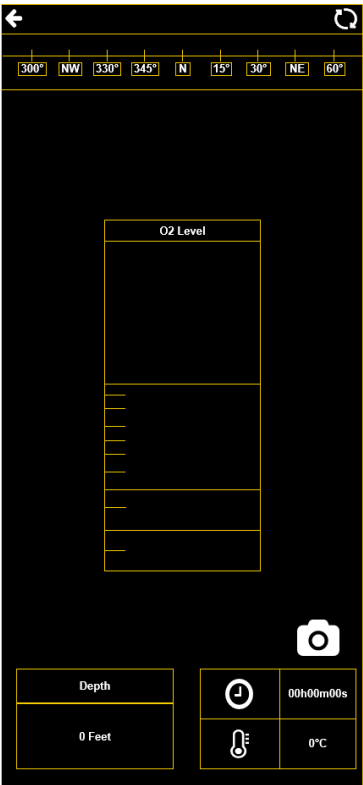


Figure 14: Vertical Monitor

The underwater monitoring interface allows users to switch between horizontal and vertical orientations. In the vertical layout, only essential information is displayed, optimizing the screen. At the mid-section, a bar visually represents the percentage of oxygen remaining in the tank, ensuring users can easily monitor their air supply. Information such as Depth, Temperature, and Duration will be displayed below the bar. Users can utilize the camera to take photos, or they have the option to return to the main page when resurfacing.

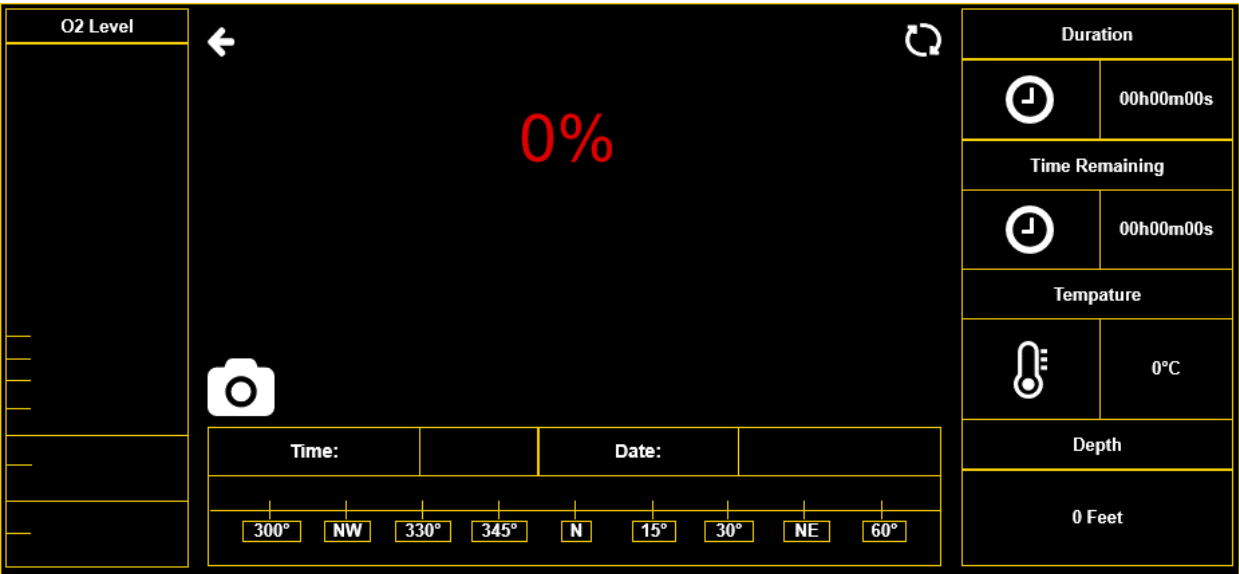


Figure 15: Horizontal Monitor

The reason why this UI is using Yellow, white, black, because of the Underwater environment require a high contrast colour and depending on the air left in the tank the O2 Level bar and percentage will have different colour:

- **High Contrast:** The combination of black, yellow, and white creates a high-contrast design, making it easier for users to discern information even in low-light conditions underwater.
- **Attention to Important Information:** Yellow outlines can draw attention to critical stats or information, acting as a visual cue for users to focus on specific details.
- **Readability:** White numbers and icons on a black background provide good readability, especially when using a high-contrast colour like white.
- **Visual Hierarchy:** The use of colour variation establishes a visual hierarchy, with yellow outlines emphasizing key elements and white indicating numerical values.

5 Research Study

Conducting this research is to ensure its success and effectiveness for the user. This research serves as an exploration for future app improvements. This research study aims to obtain insight into diver expectation, preferences, and behaviors when they are in underwater environments. This research will be employing a mix between quantitative and qualitative; I will be using survey question and usability testing. The research's main purpose is to find potential challenges when using it when they are underwater. This research will help the app adapt to diverse underwater situations. The research study will be foundational for creating a user friendly, and innovative app that meets expectations of scuba divers.

5.1 Research Participants

Participants of this research will be scuba divers from the age range from 18 to 60. All the divers should have one year's diving experience and be familiar with using mobile applications.

5.2 Research Method

For this underwater app research, I shall employ a mix between qualitative and quantitative techniques to comprehend the user experience in underwater applications. I shall conduct a survey question and usability testing.

5.3 Research Survey Question

These questions will gather valuable feedback and insights from divers when using the diving app. Each question will address specific aspects of the user experience and satisfaction with the app.

No.	Question	Answer
1.	How satisfied are users with the current interface and features of the underwater app?	Very Satisfied Satisfied Neutral Dissatisfied Very Dissatisfied
2.	Is the layout of the app when diving easy to use?	Very Easy Easy Neutral Difficult Very Difficult
3.	Is the layout of the app when on land easy to use?	Very Easy Easy Neutral Difficult Very Difficult
4.	On a scale from 1 to 5, how would you rate your satisfaction with the current app interface?	1 (Very Unsatisfied) 2 (Unsatisfied) 3 (Neutral) 4 (Satisfied) 5 (Very Satisfied)
5.	If there any improvements that you want to be add this app?	Short paragraph

6 Conclusion

The UI concept developed for scuba diver mobile application presents a user-friendly and intuitive design, focusing on providing easy access to key features for users both underwater and on land. The login main menu showcases Dive logs, Weather Forecast, and Popular Scenery, creating a visually appealing and informative entry point. The bottom navigation features four key icons: Dive List, Main Menu, Camera, and Gallery, streamlining navigation for a seamless user experience.

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Appendices

Survey questions

No.	Question	Answer
1.	How satisfied are users with the current interface and features of the underwater app?	Very Satisfied Satisfied Neutral Dissatisfied Very Dissatisfied
2.	Is the layout of the app when diving easy to use?	Very Easy Easy Neutral Difficult Very Difficult
3.	Is the layout of the app when on land easy to use?	Very Easy Easy Neutral Difficult Very Difficult
4.	On a scale from 1 to 5, how would you rate your satisfaction with the current app interface?	1 (Very Unsatisfied) 2 (Unsatisfied) 3 (Neutral) 4 (Satisfied) 5 (Very Satisfied)
5.	If there any improvements that you want to be add this app?	Short paragraph

Usability testing

Activity 1	Aim: Login with correct Password and Username
Steps	<ul style="list-style-type: none"> - Enter Username and Password - Press Login - if correct Username and Password redirect into main page - if not notify user incorrect Username or Password
Activity 2	Aim: Register information can't be empty
Steps	<ul style="list-style-type: none"> - Enter Username, Password, and Email - Press Sign In - if user fill out the necessary information redirect into main page - if not notify user invalid information
Activity 3	Aim: Popular sights can be slid to display different images
Steps	<ul style="list-style-type: none"> - Users interact with the image box swiping - If user swipe right shows the next image - if user swipe left shows the previous image
Activity 4	Aim: User can choose an image from the gallery to add to a Dive
Steps	<ul style="list-style-type: none"> - Users view dive list and press the dive that they want to add image - If there was already image in that dive - Users need to swipe to the right to show a add image box - Press the box it will redirect user the app gallery
Activity 5	Aim: View recent dive
Steps	<ul style="list-style-type: none"> - After user login the main menu - User can interact with recent dive or user can view the Dive that display in the main page

	- Redirect user the list dive page
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