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1 INTRODUCTION

The underwater exploration with the ever-changing science of Human-Computer Interaction. The objective of this programme is to create an interactive product for snorkelers and amateur scuba divers. Our users want a device that photographs stunning marine views and keeps them safe and informed when they dive deep into the ocean. The comprehensive report will lead users through this innovative product's meticulous creation. Starting with HCI research, the paper explores underwater users' demands and restrictions. The theoretical foundations of HCI provide context and informed design techniques. In the last stage, we design the interactive marvel. Next, a physical prototype with imagined elements gives a sense of the creation. A comprehensive evaluation of the prototype's efficacy, usability, and user attractiveness concludes.

2 BACKGROUND LITERATURE

2.1 HCI Research

Underwater photography and videography play a significant role in several scientific research, as well as being utilised by snorkelers and amateur scuba divers to document and preserve their experiences and memories (Borda Cristin, 2014).

Underwater photography has a long history. Many reports credit English photographer William Thompson with the first underwater photo in 1856 (Adam, 1993). In 1893, marine engineer Louis Boutan designed a housing for a 9 X 12 cm glass plate "detective" box camera and took the first underwater photograph (Rebikoff, 1967). In the early 60s, Plexiglas housing was introduced to allow cameras to work underwater (Shortis M., 2007).

The 21st century has seen significant technological advancements, including mobile cameras that facilitate snorkelers' and divers' photography and videography. To render smartphones compatible with underwater usage, certain companies have developed specialised housings, such as the SeaLife SportDiver Underwater Smartphone Housing (SeaLife, 2023) and Krakensports Universal Smartphone Housing (Kraken, 2023).

Waterproof underwater housing uses flat and dome lens ports. Figure 1 shows attractive, professional, and consumer-grade waterproof digital camera housings. Low-cost consumer housings like Figure 1b,c may not be suited for photogrammetric collecting due to their non-rigid materials. Port-camera relative shifts are likely as pressure, temperature, and diver abilities change. Uncontrolled relative movements can cause optical aberrations that are hard to define (Menna, et al., 2016).

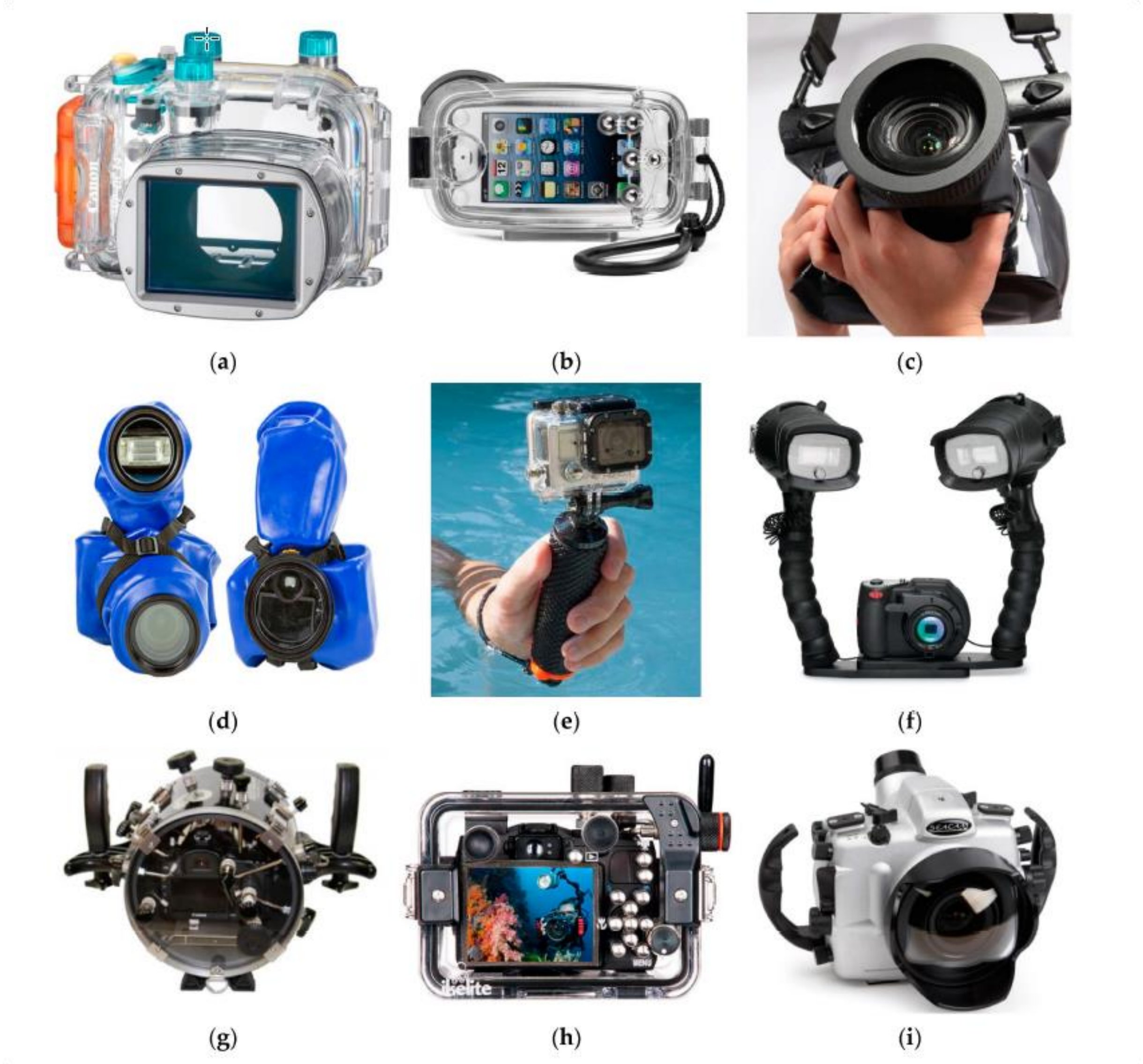


Image Source: (Menna, et al., 2016).

Figure 1: Waterproof digital camera and flash housings: (a) Canon with flat port for compact cameras; (b) Watershot iPhone housing; (c) TteooBL waterproof bag; (d) Outex; (e) GoPro Hero 3 with waterproof case (Christography); (f) Sealife with twin-flash (Hunteroc); (g) Equinox housings for DSLR Nikon; (h) Ikelite for Canon; (i) Seacam with dome port.

The following part compares this product, its problems, target audience, and goals.

2.1.1 Product Comparison

Detailed examination of underwater photography and videography products' characteristics, features, and integrated components will be used to evaluate and compare them. This detailed comparison shows how each device meets different underwater imaging needs by highlighting its unique features and functions. A comprehensive comparison chart that highlights these significant distinctions will help users assess each product's fit for their underwater photography needs and preferences.

The structured comparison table exhibited in ***Appendix A***

2.1.2 Problems

One prevalent issue encountered by amateur scuba divers is their lack of familiarity with various **underwater signals** (K. Hussein, 2019). When submerged in water, smartphone touchscreens become less responsive or unresponsive, especially at depth (Huawei, 2023). It can be difficult to use the device when diving. It is imperative for scuba divers to diligently observe and assess their depth, air supply, and immediate environment. The inclusion of smartphone engagement has the potential to augment cognitive load, hence posing a potential **threat to safety**. (L. Ozdemir, 2013).

Scuba divers also face **physical constraints** when using smartphones, which require hand dexterity. Diving gloves or cold weather impair finger agility, making interaction harder (Dimmock & Wilson, 2011). **Visibility concerns** arise from water refraction changing object appearances. Divers may misinterpret smartphone material due to this distortion (Prachi S. Shete, 2016). The majority of smartphone **user interfaces** (UIs) are not designed for underwater usage. Underwater vision for scuba divers could potentially be improved through the incorporation of larger buttons, simplified menus, or specialised colour contrasts. However, it is worth noting that these enhancements may not be readily accessible within ordinary user interfaces (H. Koike, 2013).

Additionally, seawater **corrosion and salinity** are corrosive (K. Zakowski, 2014). Even with a waterproof casing, a smartphone's ports and connectors may still come into touch with salt residues after being removed from the water, causing corrosion. User interface (UI) constraints underwater may make it difficult or impossible to access some **features and functionalities** that are easy to use on land (Jan Čejka, 2020). Smartphone user interfaces (UIs) may not be tuned to deliver emergency **alerts and notifications** quickly and effectively. Current smartphone UIs may not provide clear and immediate diver safety indicators such as fast depth changes or proximity warnings (Motamedi, et al., 2015).

The existing product mixes two things, such as housing and smartphone, which is a concern. Because present apps don't combine photography and videography with activity tracking on one screen. Divers don't check their depth, oxygen level, etc. There are professional cameras like GoPro and DSLR that only take photos or videos and are too expensive for amateur divers (uwcamerastore, 2023). that do not meet both criteria.

2.1.3 Target Audience

Amateur divers and snorkelers are the product's target market. This product can also log data and capture journeys for experienced divers. This product can also be used by dive instructors and institutions. (Sharma, 2007). Scuba and snorkelling attract a varied audience with different backgrounds, interests, and goals. The table below shows audience demographics.

Table 1: *Target audience demographic table.*

Demographic	**Narrations**
Age Range	Under 20 years old, 21 to 30 years, 31 to 40 years, 41 to 50, 50 years and above
Gender	Male, Female, Others
Nation of Origin	Europe, West Asia, East Asia, Southeast Asia, South Asia, South America, And others
Profession	Student, Private sector workers, Entrepreneur / Trader, Self-employed, Public-sector workers, Retired, Housewife, And others

Table data source: (Buzzacott1, et al., 2019).

Annual count of snorkel and Scuba dives at locations across the globe in ***Appendix B****.*

2.1.4 Persona

Product research relies on personas for user insights. Figures 2's snorkelers and Figure 3's amateur scuba divers personas show different preferences and needs, guiding user-centric product and feature development.

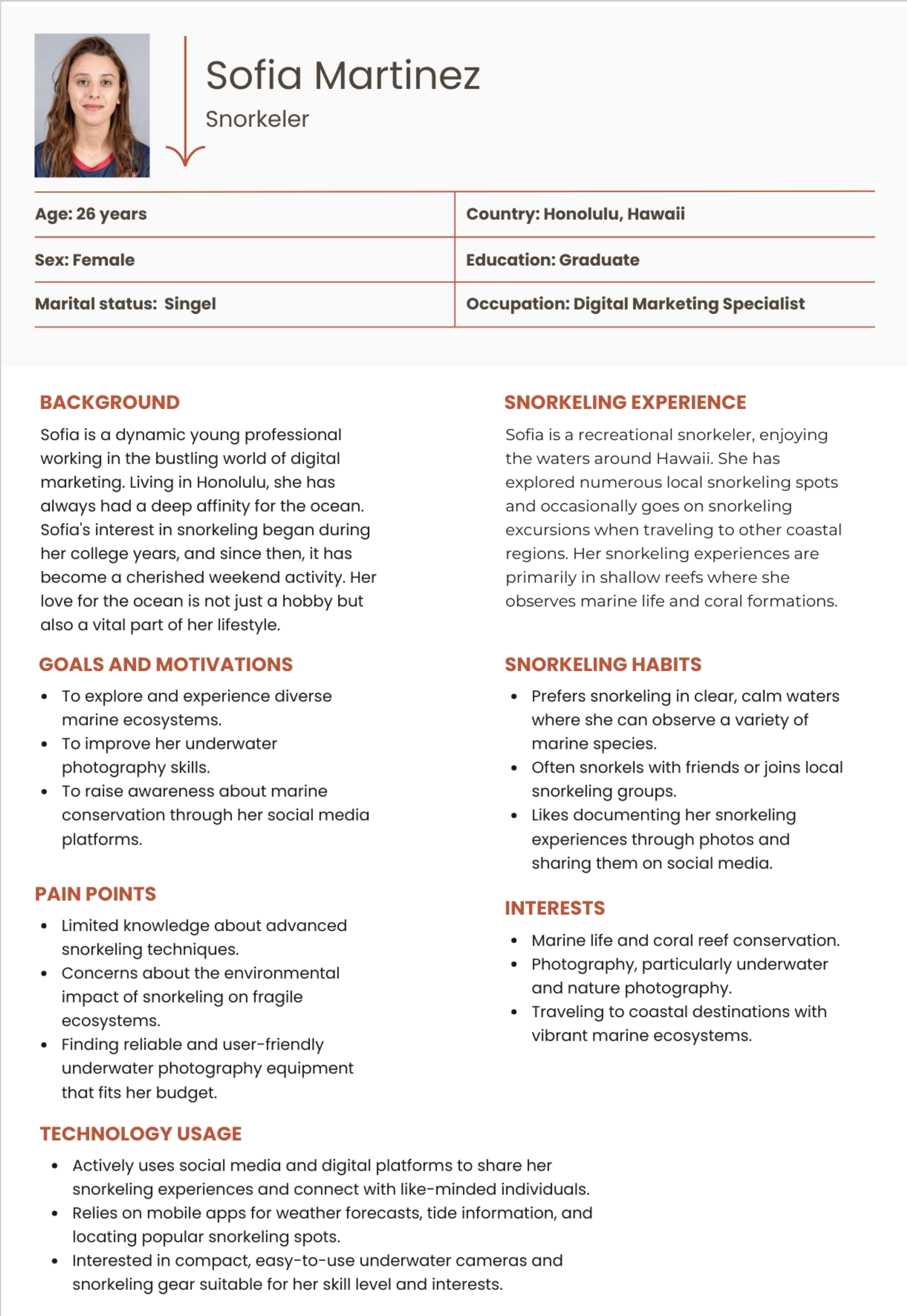
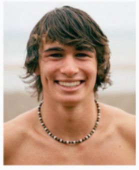


Figure 2: Persona of snorkeler.



Jordan Smith

Amateur Scuba Diver

Age: 29 years	**Country: Seattle, Washington**
Sex: Male	**Education: Graduate**
Marital status Married	**Occupation: Software Engineer**

BACKGROUND

Jordan is a software engineer with a passion for adventure and the outdoors. After trying scuba diving on a vacation in Hawaii a few years ago, he was instantly hooked. Jordan enjoys the thrill of exploring new environments and the serenity of being underwater. He takes scuba diving trips a few times a year, typically combining them with his love for travel.

SCUBA DIVING EXPERIENCE

Jordan is an amateur scuba diver with an Open Water Diver certification. He has about 15 dives under his belt and is always eager to learn and experience more. His diving experiences are mostly during holidays in tropical destinations like Mexico and Thailand.

GOALS AND MOTIVATIONS

- To gain more diving experience and obtain Advanced Open Water Diver certification.
- To explore more challenging dive sites and learn new diving skills.
- To document his dives and underwater discoveries through photography.

DIVING HABITS

- Often rents diving gear at the dive destination.
- Prefers guided dives with a group or a dive buddy.
- Keeps a basic log of his dives, including location, depth, and interesting sightings.

PAIN POINTS

- Limited knowledge of advanced diving equipment and techniques.
- Balancing his busy work schedule with his passion for diving.
- Finding reliable and beginner-friendly underwater photography equipment.

INTERESTS

- Exploring underwater life and shipwrecks.
- Photography, with a growing interest in underwater photography.
- Traveling to different countries with renowned diving sites.

TECHNOLOGY USAGE

- Uses dive planning apps and online resources for dive education.
- Active in online communities for diving enthusiasts.
- Interested in simple and intuitive technology that can enhance his diving experience, especially for tracking and photography.

Figure 3: Persona of scuba diver.

2.1.5 Goals

This research is dedicated to creating a product for amateur divers and snorkelers, incorporating essential features to enhance their underwater experience. Focused on usability, reliability, and performance, the design aims to meet users' needs while adhering to operating standards, thus improving diving and snorkeling safety and satisfaction. A methodical, user-centred approach guides the development process. Initial stages involve in-depth analysis of target users' needs, informed by market analysis, user feedback, and scholarly research, leading to the generation of multiple design concepts prioritizing usability and innovation. These concepts undergo rigorous evaluation to select the most user-friendly options for prototyping. Each prototype iteration refines the design, ensuring quality and performance through careful selection of materials and technology. The resulting prototype will undergo extensive real-world testing to gather feedback for continuous improvement. This meticulous process aims to establish a new benchmark in amateur diving and snorkeling equipment, focusing on exceptional quality, functionality, and enhancing user experience.

The user requirements for the product, Multifunctional waterproof smartphone housing for amateur divers and snorkelers focuses on functionality, versatility, and user experience. Easy functionality, flexible and detachable components, user-friendly mobile app, multimedia dive log, additional components, durability and safety, compatibility and versatility.

*The identification of the requirement specifies in **Appendix C.***

2.2 HCI Theory

The HCI theory section will briefly describe the concepts and theories of the HCI field and how these are associated with the product. such as design framework, cognitive psychology, interaction design theory, different Modes of Interaction, types of interaction, and design principles and design patterns.

2.2.1 Design Interactions/ Frameworks

Design interactions or frameworks like User-Centered Design (UCD), Human-Centered Design (HCD), and Participatory Design (PD) play a critical role in developing products that meet users' needs effectively.

User-Centered Design (UCD) revolves around designing with the end-user's experience in mind, ensuring the product is intuitive and addresses the user's requirements (usability.gov, 2023). For the product designed for amateur divers and snorkelers, UCD guided the creation of an easy-to-use interface and features that enhance the underwater experience.

Image Source: (usability.gov, 2023).

Figure 4: User Cantered Design process.

The design framework particulars, implementation and justification specifies in ***Appendix D.***

2.2.2 Cognitive Phycology

2.2.2.1 Attention

The device's UI will be designed to engage consumers (Helen Sharp & Preece, 2019). To assist divers focus on critical metrics quickly, the display will decrease clutter and distractions. Visual hierarchies and colour coding highlight depth and oxygen levels even in high-stress or emergency situations.

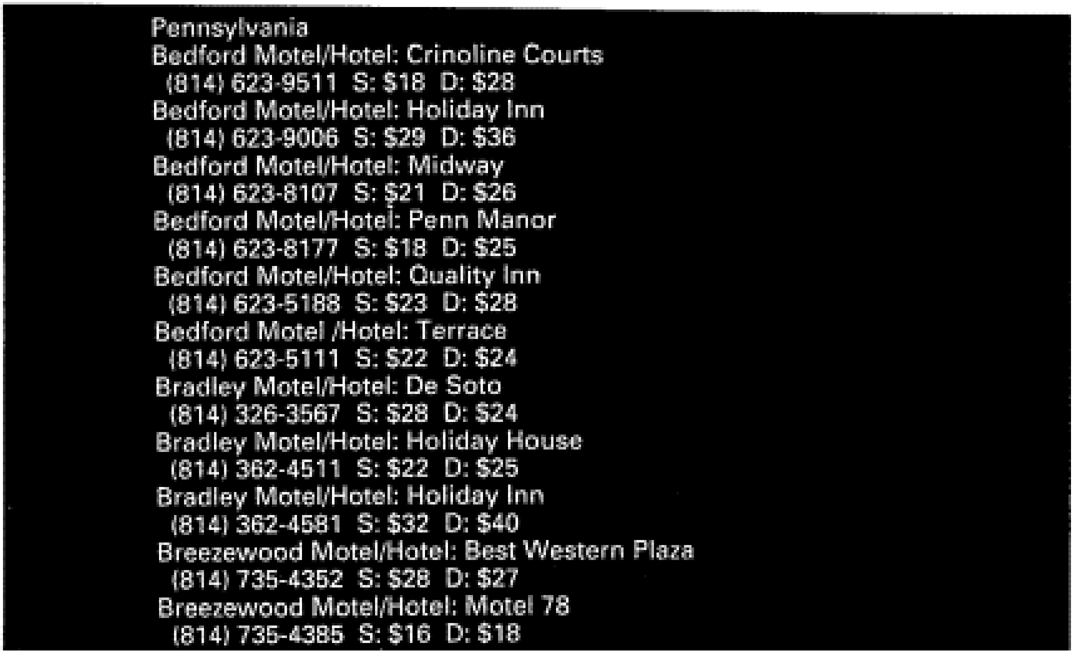


Image Source: (cs.uct.ac.za, 2010).

Figure 5: The organisation of information and the directed allocation of attention.

2.2.2.2 Perception And Recognition

Familiar symbols, visuals, and words help quickly recognise and understand information (Helen Sharp & Preece, 2019). Clear, bright, and unambiguous graphics and language will be used to display remaining oxygen and ascent time data to improve perceptual salience and discernment. This method works well in underwater environments with changing visibility and lighting.

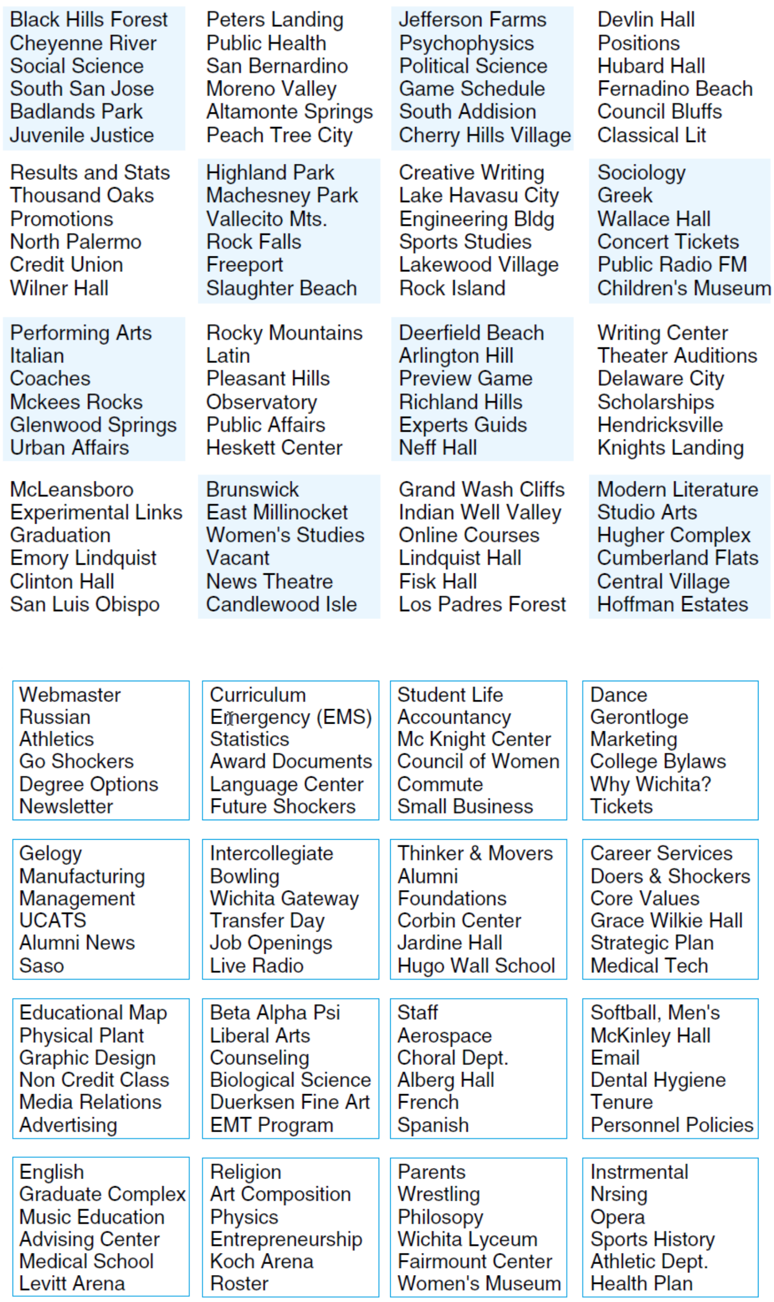


Image source (Sharp, et al., 2019).

Figure 6: There are two separate approaches for organising information on a web page.

2.2.2.3 Memory

The device will display information in manageable clusters to fit short-term memory. Regular tasks will be simplified, lowering cognitive pressure by minimising the number of steps or commands users must remember (Helen Sharp & Preece, 2019). Using familiar and readily remembered symbols and keeping uniformity among functionality will improve recall and reduce cognitive effort.

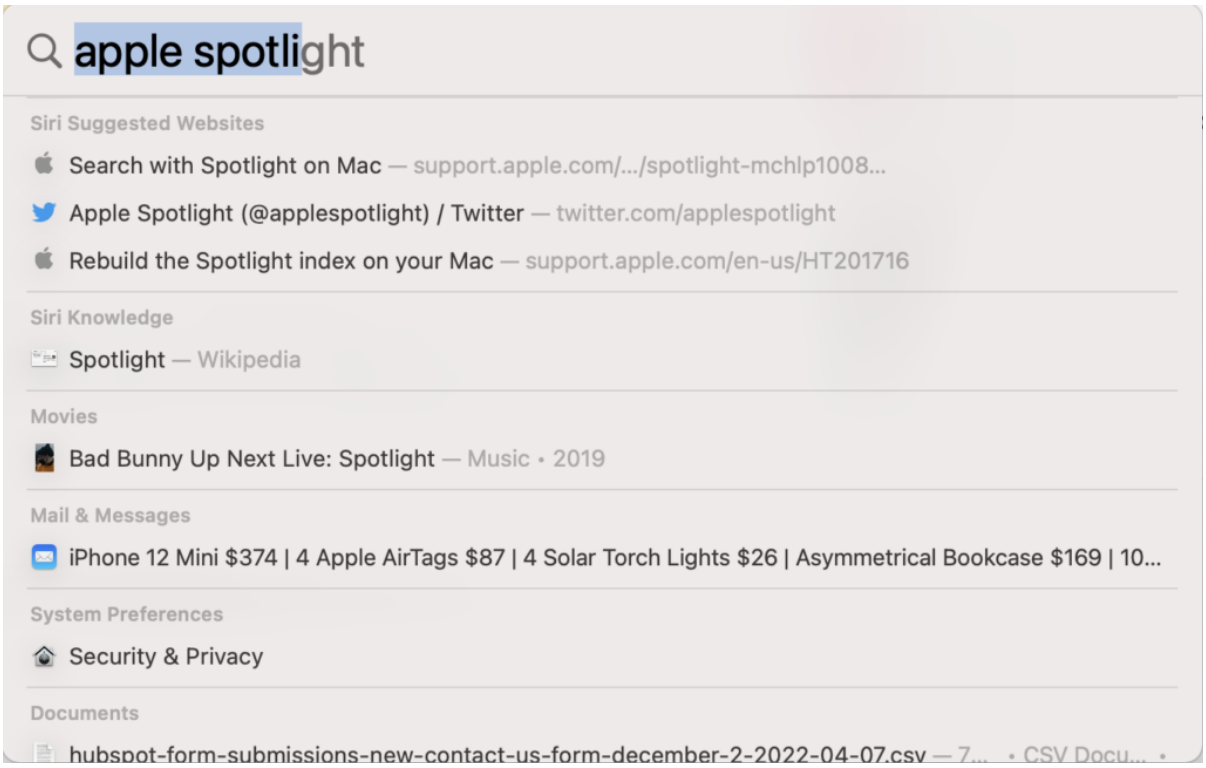


Image Source: (Morriss, 2022)

Figure 7: The cognitive processes of recall-directed and recognition-based scanning.

2.2.2.4 Learning

The product will have a user-friendly interface to help amateurs learn diving and snorkelling. Clear navigation and logical procedures will make learning easier and accelerate the learning curve. Instructional information, such as tooltips or help menus, may help users master the product's operations and capabilities (Helen Sharp & Preece, 2019).

Image source: (pinterest, 2023).

Figure 8: The application assists in providing guidance to the user.

2.2.2.5 Problem-Solving And Decision-Making

The device will provide exact, practical information and notifications during diving emergencies or ambiguity. If oxygen levels drop too low, the device can notify and urge climbing. Users can react to changing underwater circumstances and scenarios by using simpler menus and options to make quick decisions.

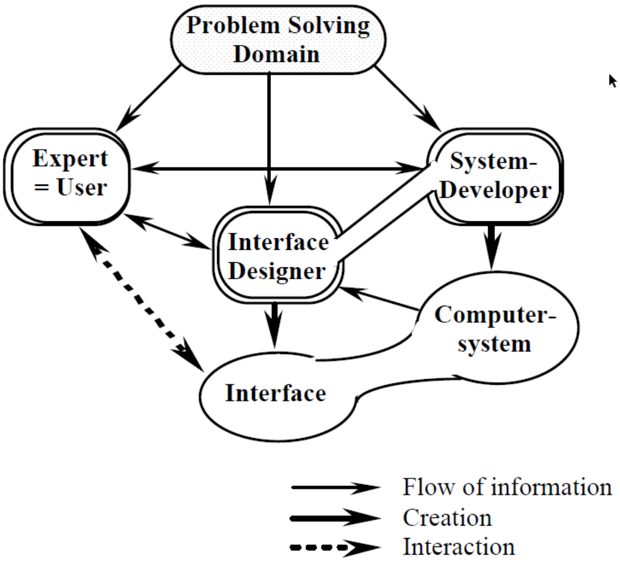


Image Source: (Verjans, 1994)

Figure 9: User-centered methods emphasise users and interface sign cognition.

The goal of applying cognitive psychology principles to product design is to provide a smooth, intuitive, and cognitively supportive user experience that improves usability and safety during underwater expeditions. The goal is to build a product that fits the user's cognitive framework for efficient, fun, and safe diving.

2.2.3 Interaction Design Theory

HCI Interaction Design Theory lets us design an innovative diving product that meets user needs and preferences reliably (Norman, 2013). The product's interface elements are chosen to maximise accessibility and user experience (Cooper, 2004). The device improves underwater exploration and photography with real-time HCI input (Rubin & Chisnell, 2008). Designed for visibility, consistency, and error prevention, the gadget gives users confidence and control (Nielsen, 1994). These interaction design concepts build a technologically advanced product that meets the user's cognitive processes and ergonomic needs, creating an engaging and effective user experience.

2.2.4 Different Modes of Interaction

Voice, touch, and Graphical User Interface (GUI) interactions have revolutionized technology, significantly enriching user experience. Voice commands enable hands-free operation, enhancing accessibility and convenience. Touch interaction introduces intuitive, gesture-based control, making technology user-friendly for a broader audience. GUIs, with their visual icons and interfaces, have transformed complex commands into simple, engaging interactions, streamlining and enriching the way users interact with their devices, thereby making technology more accessible and enjoyable for all.

*The particulars specifies in **Appendix E**.*

2.2.5 Types of Interaction

Instructing, **conversing**, **manipulating**, **exploring**, and **responding** improve product user experience (Helen Sharp & Preece, 2019). For adjusting options or controls while diving, instructing helps users command the device. Conversations, whether via chat or voice instructions, make it easy for consumers to get support. Touching or gesturing makes gadget interaction more intuitive and entertaining, especially for underwater menu navigation or setting adjustments. By discovering new diving locations or reviewing old dives, maps and dive logs enhance the user's experience. Finally, responding to device alarms and real-time updates ensures a safe and informed diving experience. All of these interactions make the product safe, fun, and user-friendly for divers.

The application of interaction type to the product is explained in ***Appendix F.***

2.2.6 Design Principles

The design principles proposed by Don Norman, commonly referred to as the User-Centred Design (UCD) principles, place significant emphasis on creating user interfaces that are intuitive, easily navigable, and user-friendly. The core tenets of his beliefs essentially revolve around the concepts of **visibility**, **feedback**, **constraints**, **consistency**, and **affordance**.

The principles and methods of application are specified in ***Appendix G.***

2.2.7 Design Patterns

Design patterns in HCI facilitate knowledge sharing among UI designers and non-experts, encompassing problem descriptions, context, and solutions. Structured patterns, enriched with relationships and semantics, enhance design management tools. Evaluating and validating these patterns ensures their effectiveness and user satisfaction in interface design (Kruschitz & Hitz, 2010).

3 DESIGN PROCESS

3.1 Conceptual Design

3.1.1 The Product Concept and Description

The envisioned product is an innovative system designed to elevate the underwater experience for scuba divers and snorkelers. Central to its design is a robust, waterproof case that not only ensures the protection of the smartphone but also enhances its functionality for underwater use. The case is tailored to interface seamlessly with a custom mobile application, displaying essential diving metrics like depth level, no-decompression limit, dive duration, oxygen level, and geographical positioning on the smartphone screen.

For safety and ease of use, the product includes a secure strap to prevent loss and an integrated flashlight for improved visibility, particularly beneficial for underwater photography. Additionally, the system features a dive computer, a wearable device that provides vibratory alerts, displays and send dive activity information to the smartphone, minimizing the need to frequently check the smartphone.

3.1.2 The Product Interaction

The product boasts a dual-mode interaction system. Underwater, it utilizes tactile buttons for control, circumventing issues with touch sensitivity. The system employs screen lights, the flashlight, and dive computer vibrations to relay feedback and alerts to the user. This design ensures efficient and safe interaction in the aquatic environment. Once above water, the interaction shifts to more conventional methods like touch, voice commands, and auditory notifications, adapting to the user's on-land interaction preferences. This dual-mode approach ensures seamless and intuitive usability, catering to the diver's needs both underwater and on the surface.

3.2 Conceptual Model

3.2.1 The Ideation Processes

The product description states that the design process moves to the ideation phase. This exercise stimulates creativity and innovation to generate a large number of ideas without technological or practical limits. Low-fidelity ideation techniques include sketching, cardboard or paper prototyping, storyboarding, crowdstorming, and co-creation workshops (Hirskyj & Douglas, 2019).

The concept is executed by a three-step process, encompassing housing or casing, app screen, and wristband. The combination of these components results in the creation of the product or solution.

3.2.1.1 Product Idea

The preliminary representation on blank paper shows the smartphone enclosed within a housing or casing, along with a set of navigational buttons intended for instructional purposes. The sketch exhibit is depicted in Figure 10.

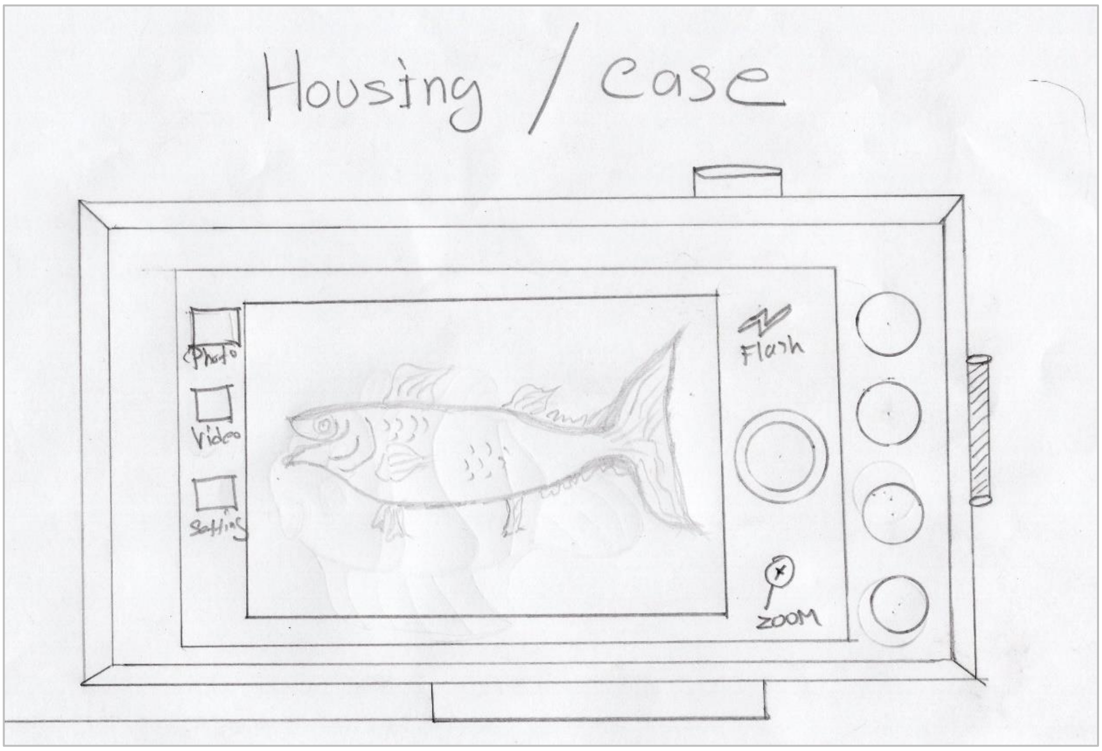


Figure 10:the preliminary product idea.

Following the initial concept, several improvements were incorporated into the product, including the integration of flashlights to facilitate photography in low-light conditions, the addition of safety strips, and the inclusion of navigation icons. The exhibit depicted in Figure 11 is presented in an exploded approach.

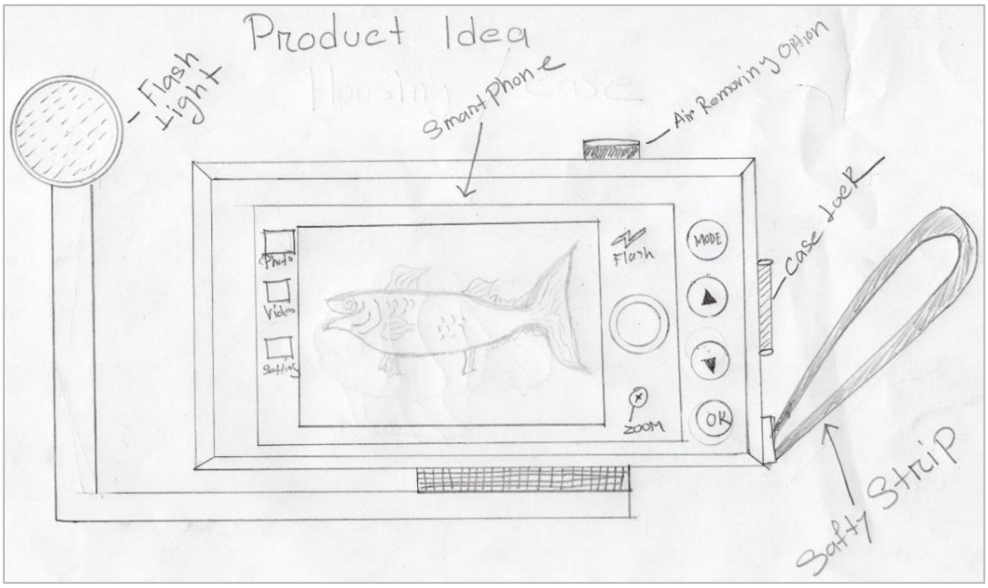


Figure 11: The proposed concept for the final product.

Additional sketches of product ideas are presented in ***Appendix H.***

3.2.1.2 App Idea

One of the important aspects of the product is the dive mode application screen, which enables divers to monitor and record several aspects of their underwater activities, including depth level, oxygen levels, duration of the dive, no-decompression limits, temperature, and heart rate. The primary idea is demonstrated in Figure 12.

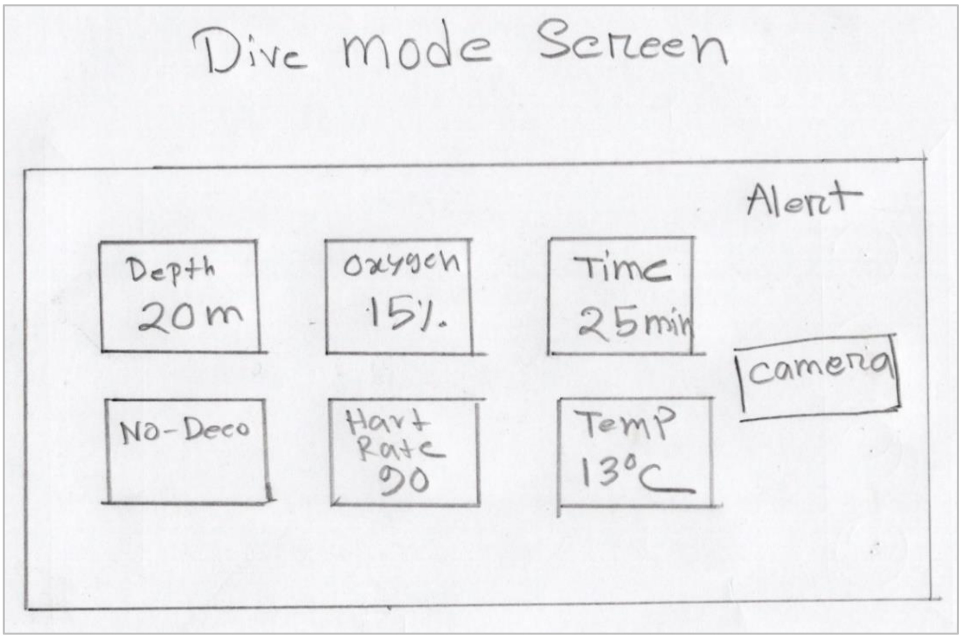


Figure 12: dive mode application screen primary idea.

Another important aspect of the product is that it allows divers to check their recorded images and videos as well as slot activity records while they are on the surface or shore. Figure 13 illustrates the concepts of these app screens.

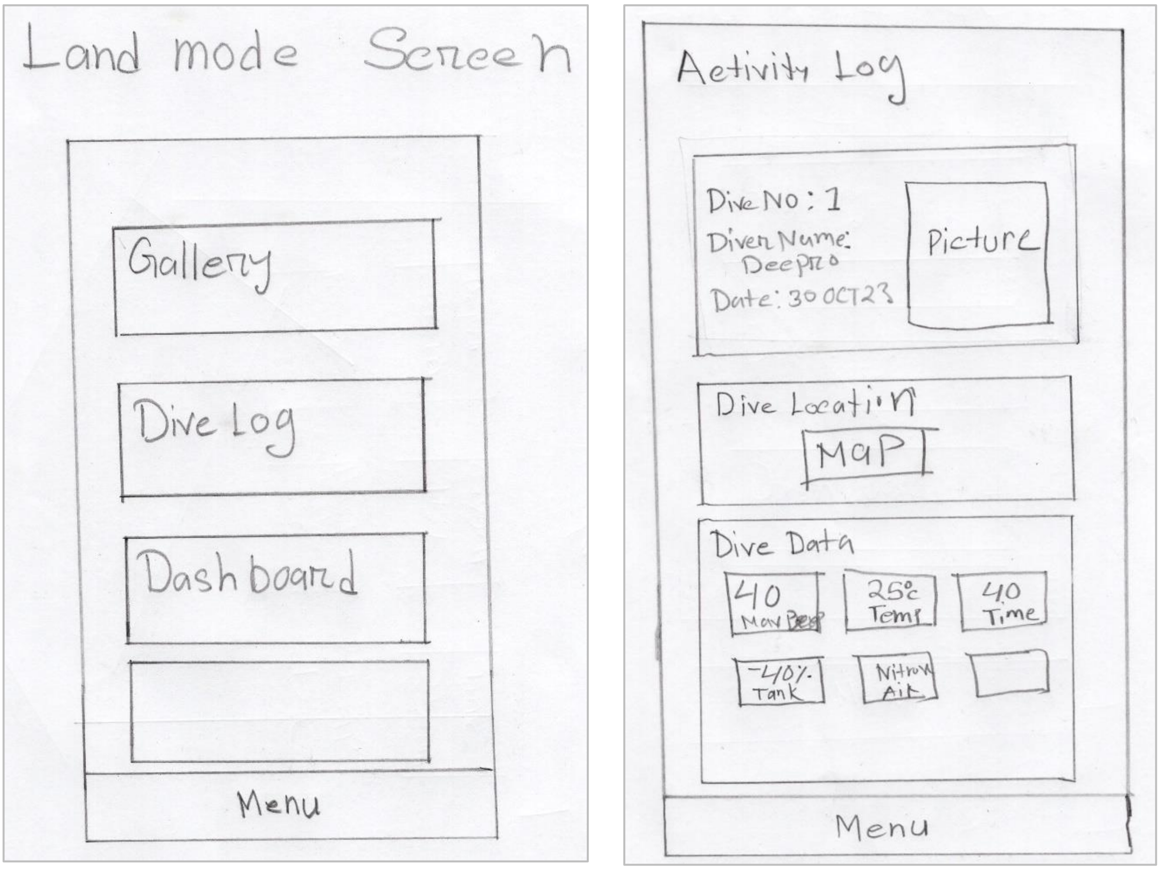


Figure 13: The concept of the app screens, while diver on the land.

3.2.1.3 Dive Computer Idea

The product includes a diving computer or smartwatch. Divers will attach the device to their wrists to link to the Smartphone. The component sends heart rate, depth, time, duration, oxygen level, ascent rate, no-deco and other dive information data to the smartphone and notifies the diver via vibration warnings or notifications while underwater. Figure 14 shows an initial idea.

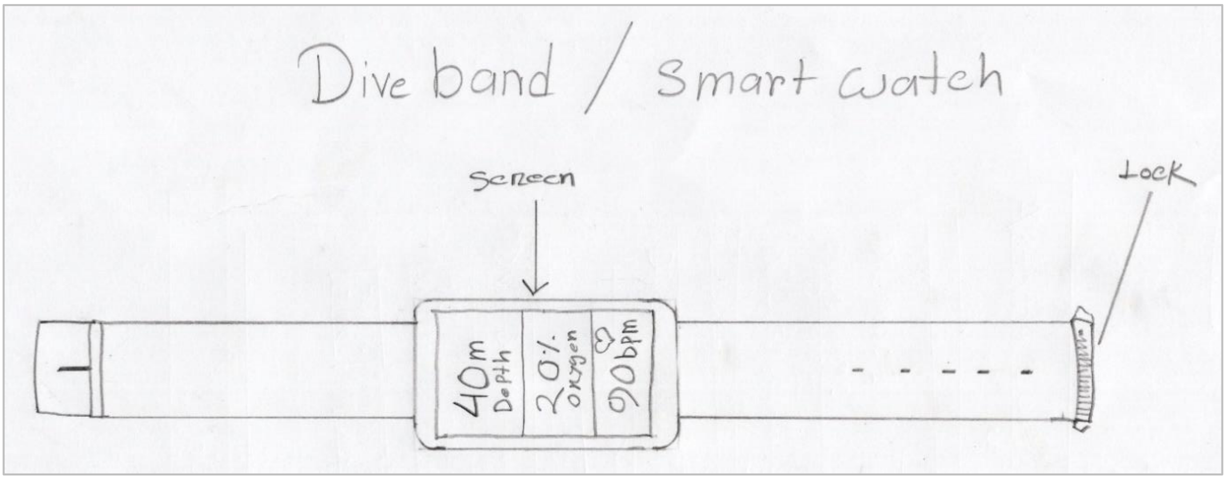


Figure 14: The preliminary idea of dive computer.

3.3 Task Analysis

In conceptual design, Task Analysis involves HTA for task breakdown, Use Cases for scenario-based functionality understanding (Oliveira, et al., 2015), and Wireframes for interface layout and interaction flow, shaping user experience design.

3.3.1 Hierarchy Task Analysis

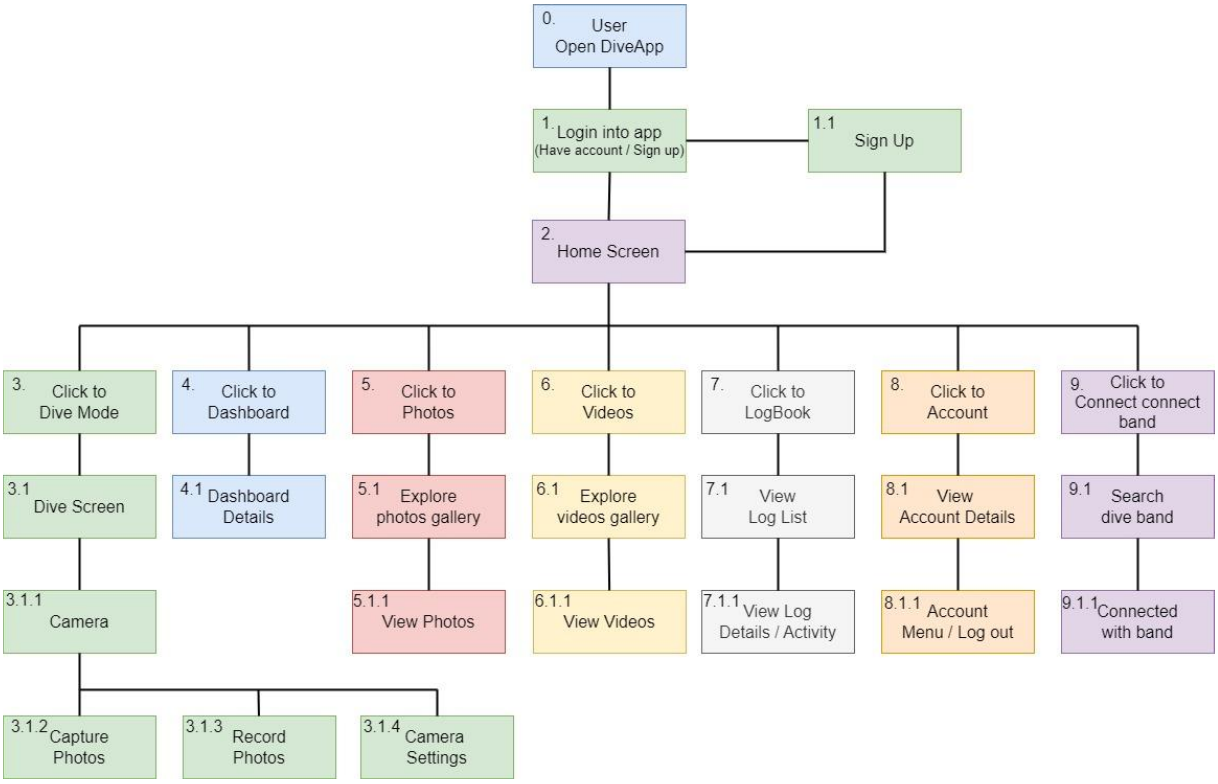


Figure 15: Hierarchy Task Analysis (HTA) of Dive App.

3.3.2 Use Case

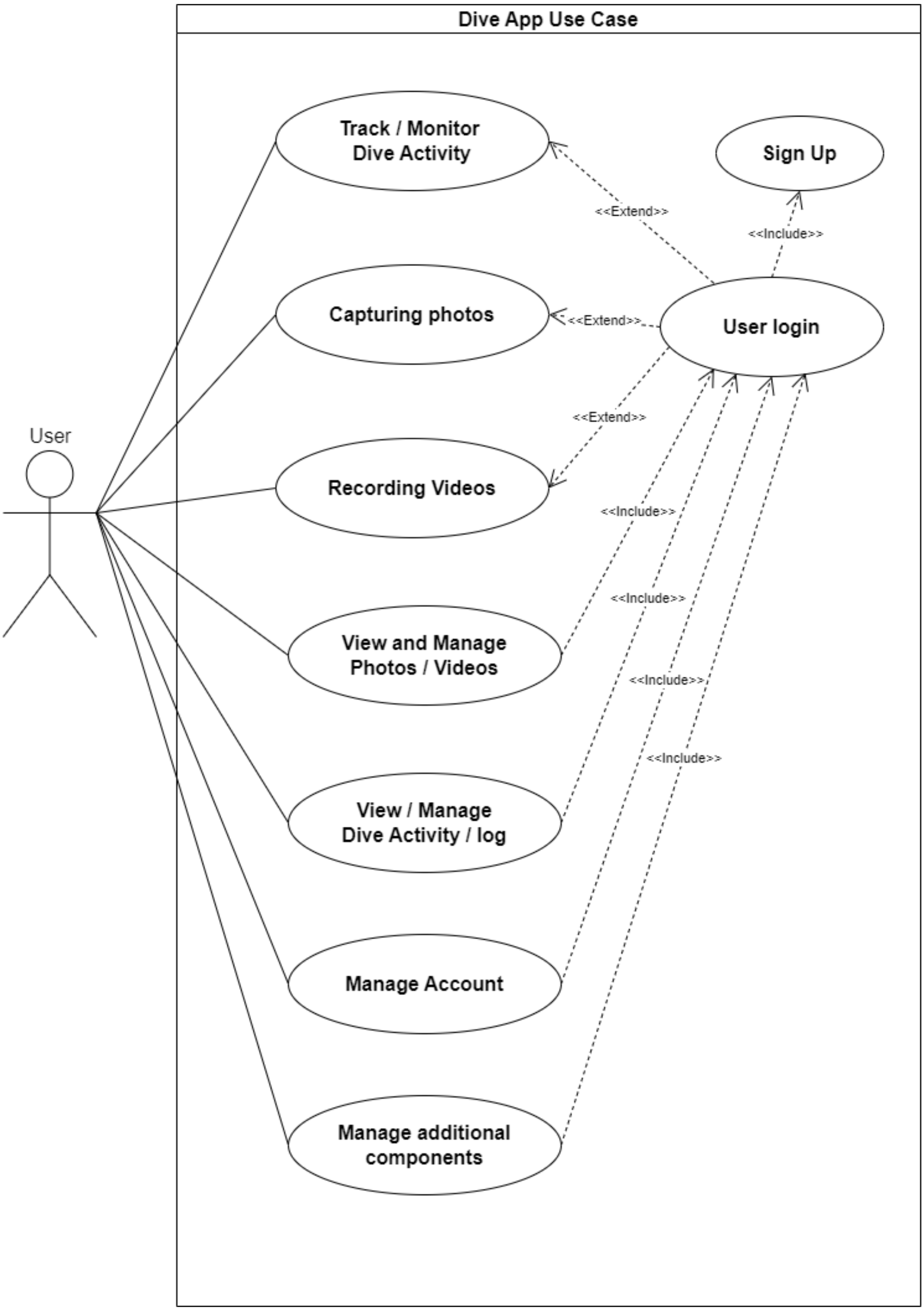


Figure 16: Use case of dive app.

3.3.3 Wireframes

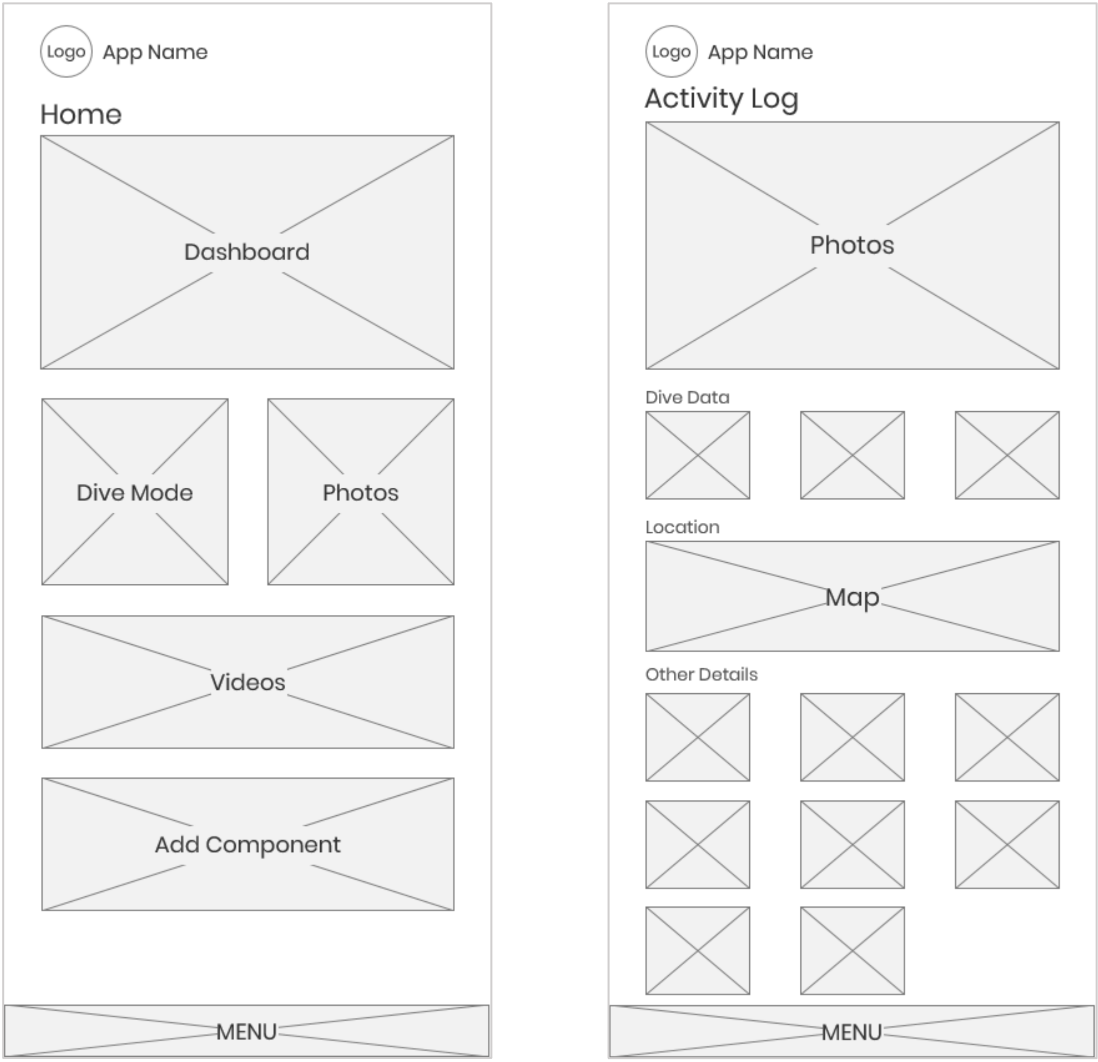


Figure 17: Wireframe of Home screen and Activity log screen

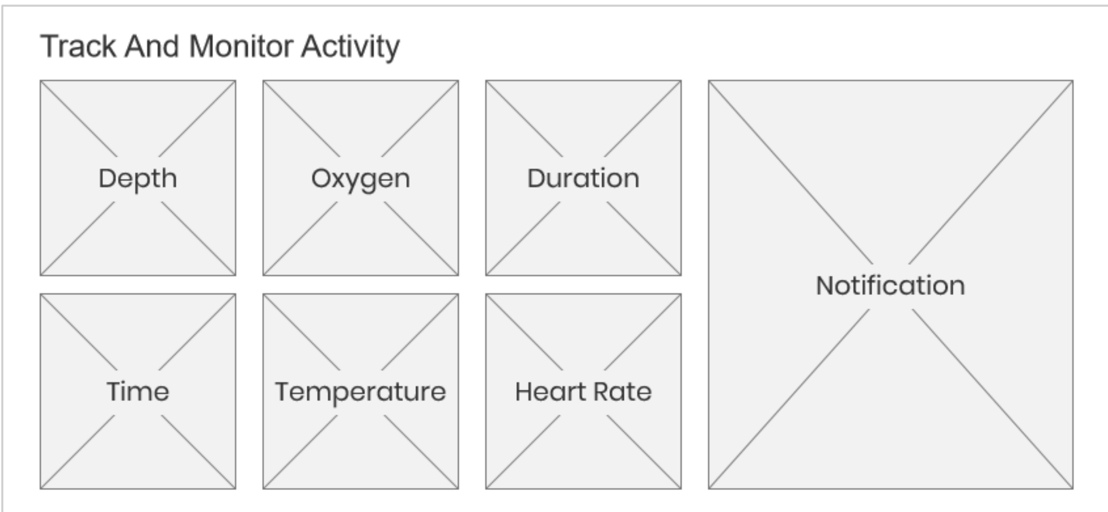


Figure 18: Wireframe of Dive mode screen.

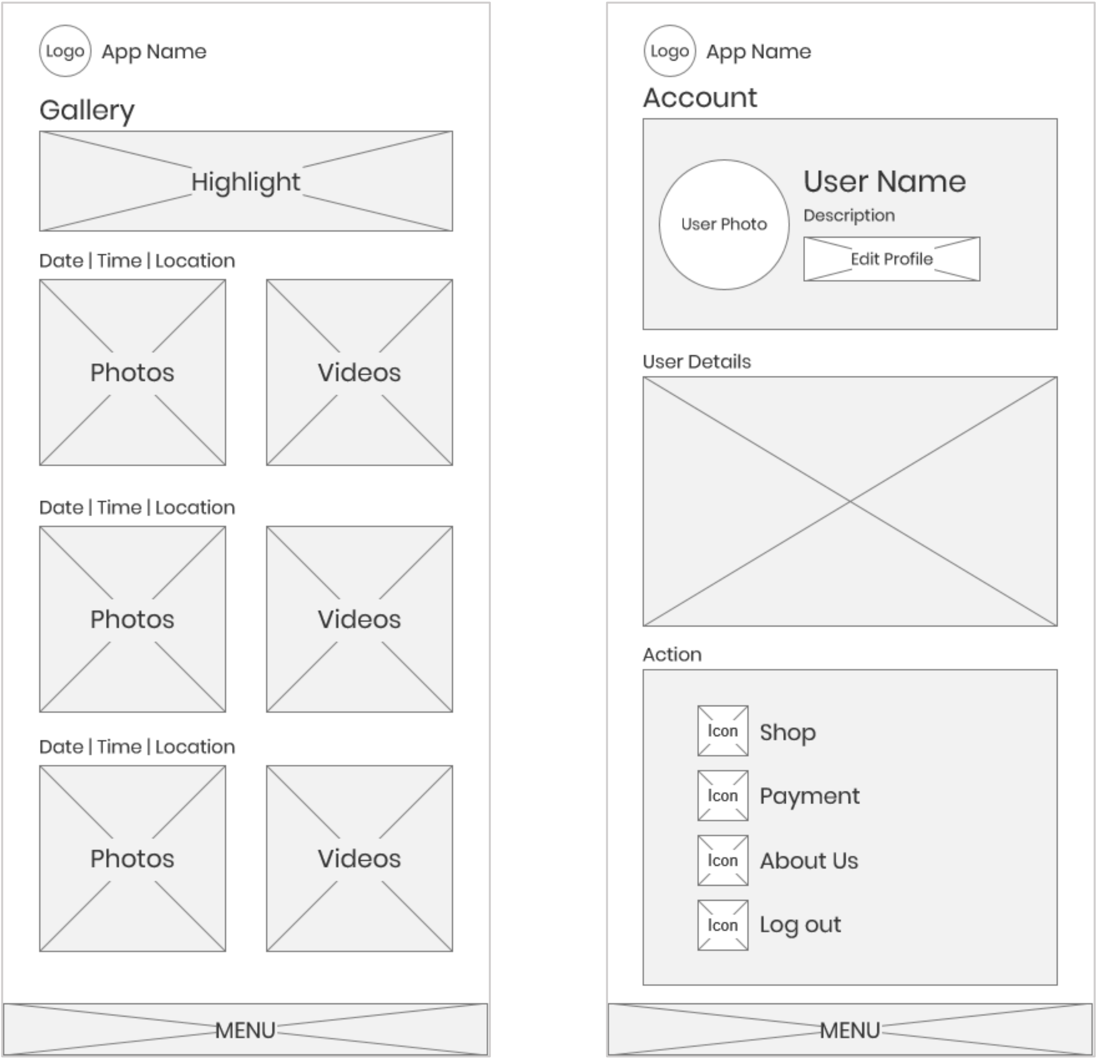


Figure 19: Wireframe of Gallery screen and User account screen

3.4 Design Principles

The snorkelling and scuba diving app can be analysed using Don Norman's design principles (Sharp, et al., 2019). Consider to see how each principle applies to the app's different aspects:

Visibility: This idea focuses on making essential parts visible and accessible. Clear, easily distinguishable icons for the camera, gallery, activity log, and dashboard can improve visibility in this app. Dive mode screens should indicate important underwater data including depth, oxygen level, and dive time.

Figure 20: Norman's visibility principle applies to the interface 1.

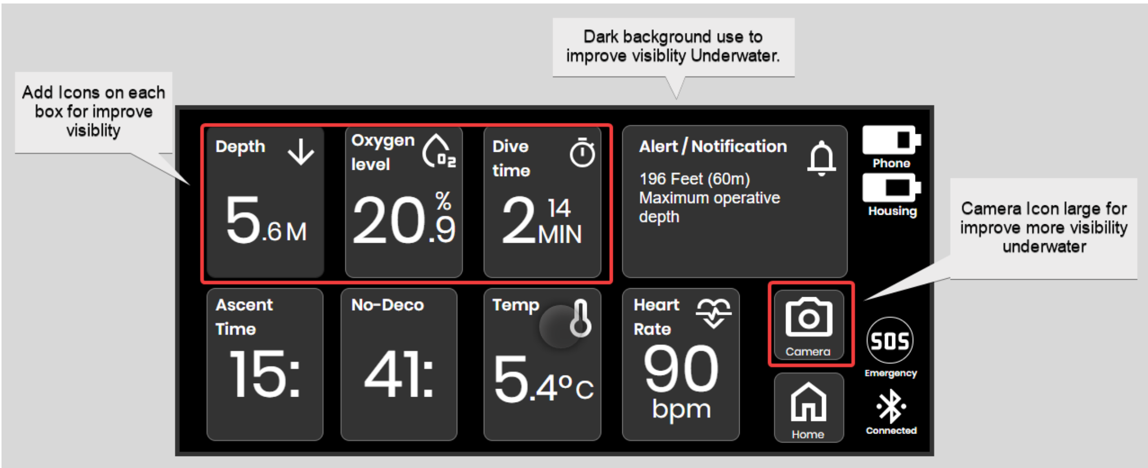


Figure 21: Norman's visibility principle applies to the interface

Feedback: Feedback involves immediate and unambiguous replies to user actions. When a diver takes a photo or video, the app may provide a thumbnail preview or short animation to confirm success. Any changes in depth or oxygen levels should be displayed immediately and clearly, with visual or vibrating signals.

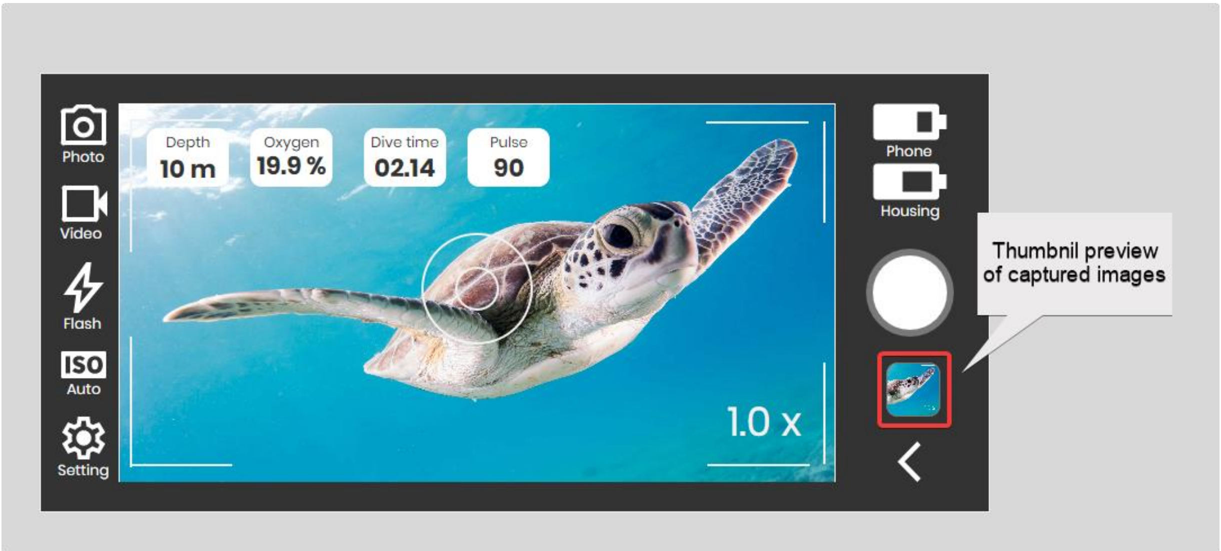


Figure 22: Norman's Feedback principle applies to the interface part 1.

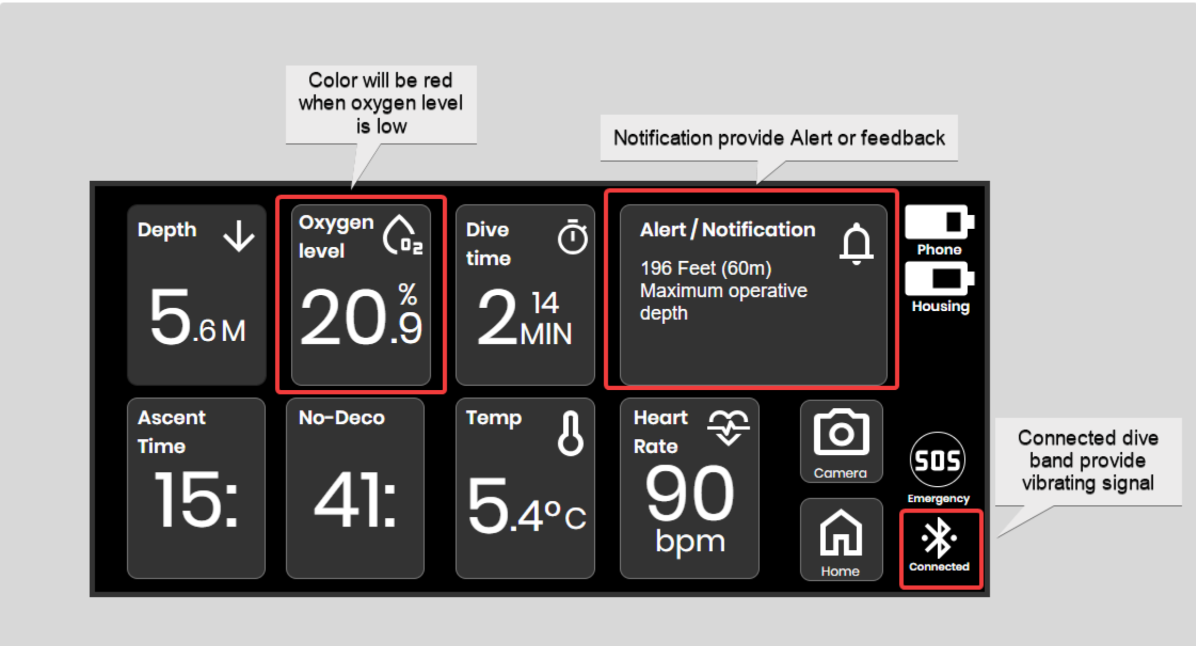


Figure 23: Norman's Feedback principle applies to the interface part 2.

Constraints: Constraints limit error-prevention actions. The software might disable gallery and activity log access underwater to focus divers' attention on oxygen level and depth. The programme may also block additional photographs and videos if storage is low.

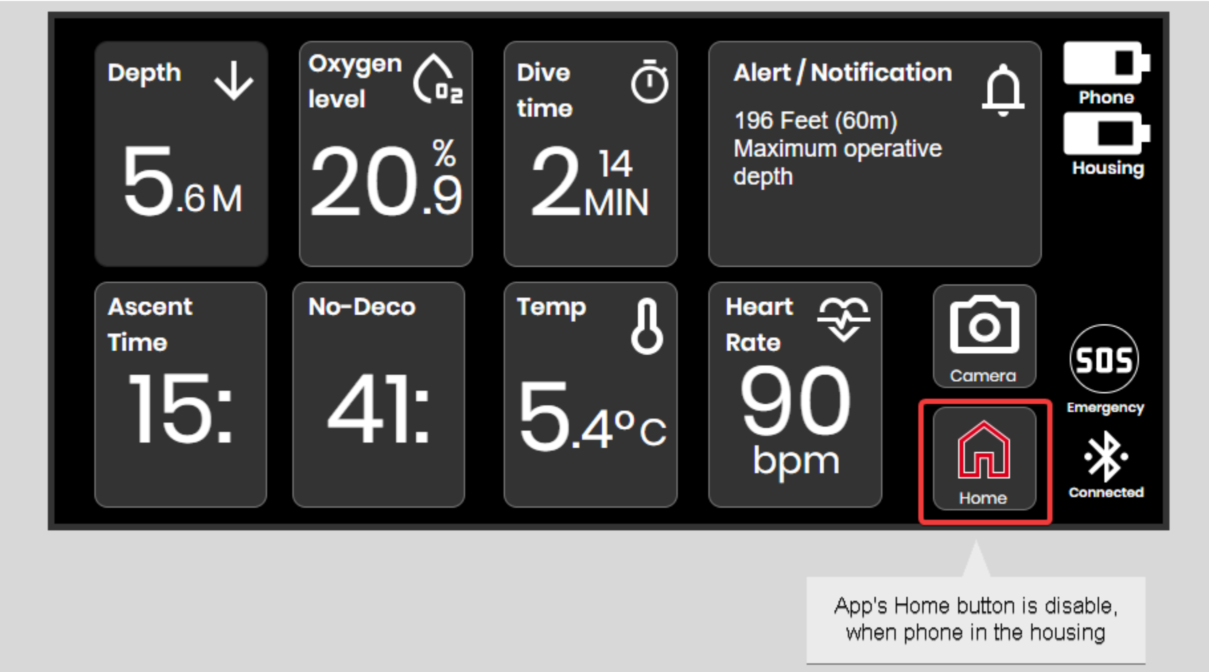


Figure 24: App's home button is disable, phone in the housing.

Consistency: The principle involves building interfaces so that similar items have similar actions across the application. The app should use consistent icons and colour palettes across its interfaces (gallery, activity log, dashboard, home etc). It makes the user experience smooth and intuitive.

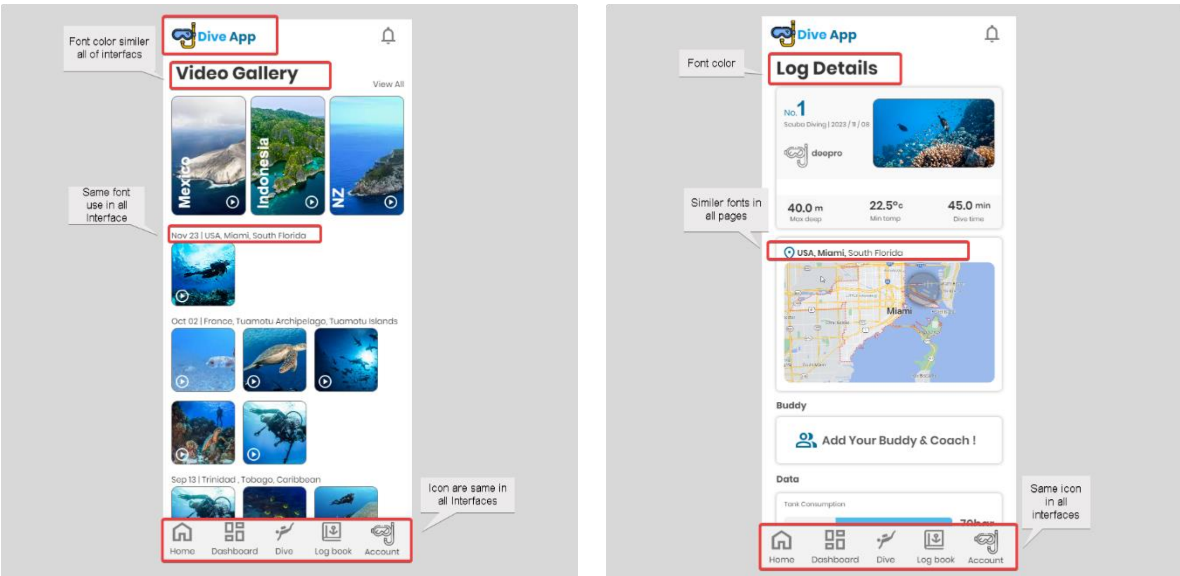


Figure 25: Norman's Consistency principle applies to the interface.

Affordance: Affordability involves creating components with clear functions. App buttons and controls should look clickable or tapable. For instance, the underwater video recording button should be large and clear, perhaps with a video camera icon.

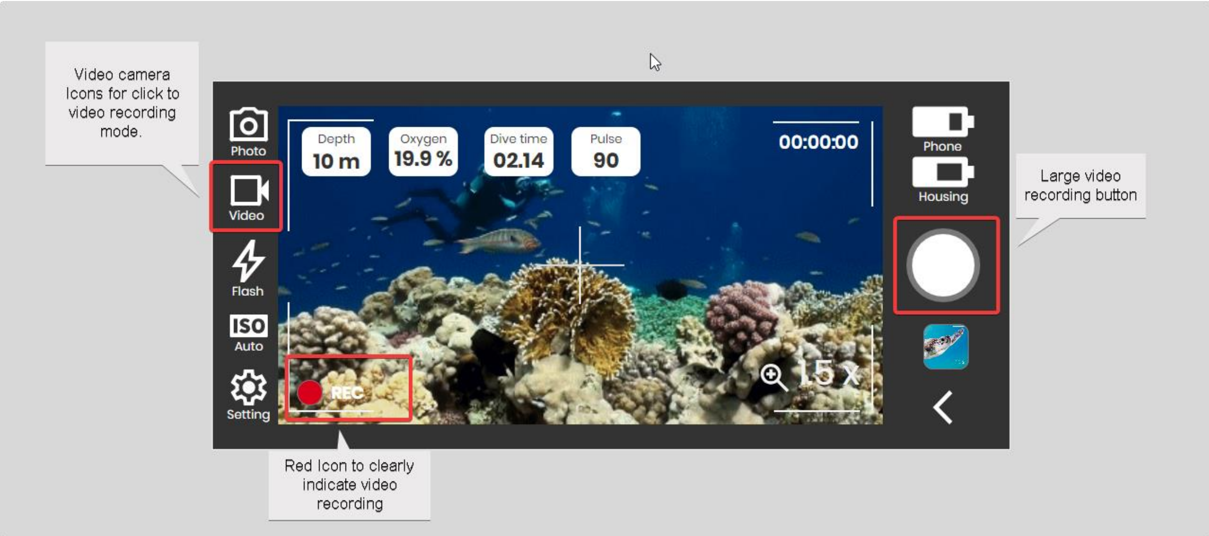


Figure 26: Norman's Affordance principle applies to the interface.

In addition to these principles, underwater use presents specific environmental constraints such as reduced vision and the requirement to utilise the app with diving gear. Larger buttons and high-contrast displays for underwater visibility should be integrated into the app.

Don Norman's principles can make the app user-friendly, intuitive, and safe for divers, improving their underwater experience and making essential data easily available.

4 PROTOTYPE

The conceptual design of the product, informed by research findings, addresses key underwater challenges faced by scuba divers and snorkelers. It incorporates solutions for signal issues in dive computers and tackles corrosion and salinity water issues in its housing design.

The prototype solves features and functions, optimises the user interface for underwater visibility, and ensures safety through threat management and alert systems. A smartphone app for scuba diving and snorkelling has an underwater-friendly UI. Divers need this aquatic-specific programme to monitor depth and oxygen levels and capture and review underwater imagery.

4.1 Mid Fidelity Prototype

4.1.1 Home Interface

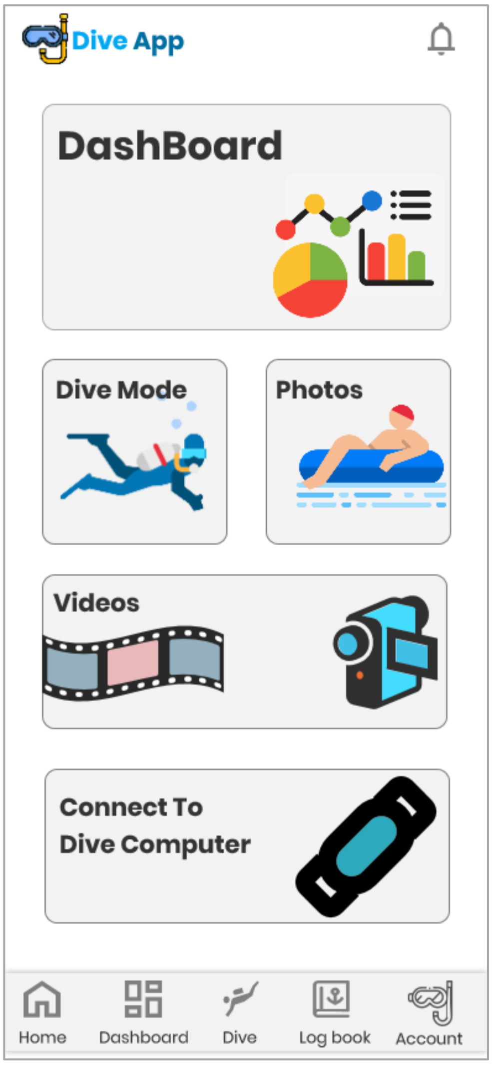


Figure 27: Dive App Home Screen.

A Dashboard, Dive Mode, Videos, and Connect to Band make the app's home interface easy to use for divers. This design simplifies dive monitoring and video capturing. Integration with a wrist band makes data instantly available, boosting safety and convenience.

4.1.2 Dive Mode Interface

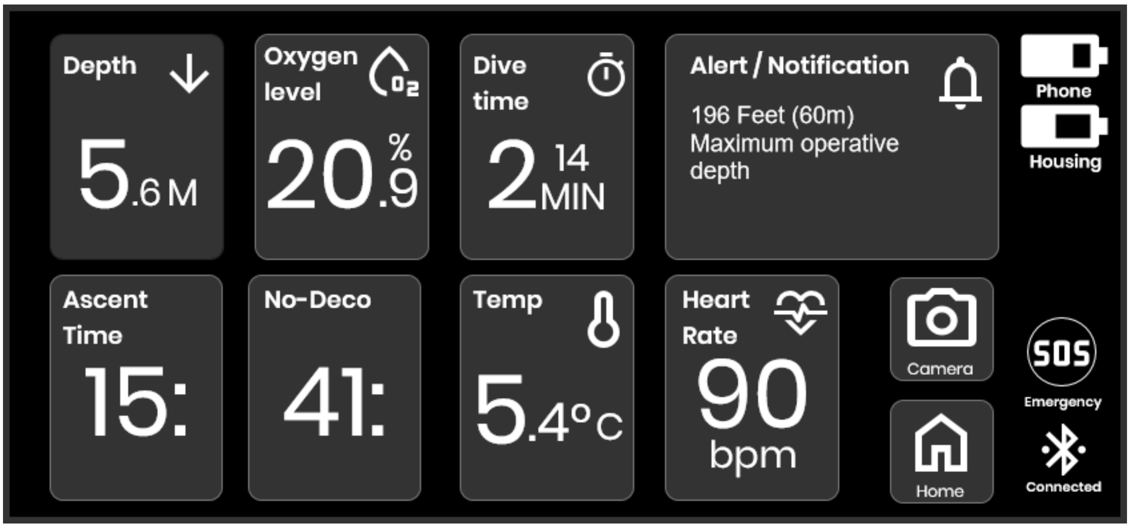


Figure 28: Dive mode interface.

The app's Dive Mode interface addresses underwater **usability and safety issues**. It keeps divers informed of their environment and health by showing depth, oxygen level, dive time, temperature, and heart rate. Larger buttons make underwater interaction easier, and the dark background with light letters improves visibility. Most importantly, alerts and notifications inform divers of potential safety issues and essential actions, improving underwater safety and usability.

4.1.3 Dive Mode Camera interface

Figure 29: Camera interface in Dive mode.

The app's Dive Mode camera interface combines photo and video capture with dive monitoring. Divers can simply control their shots with its clear image, video, flash, ISO, settings, and camera operating controls. Dive safety requires monitoring depth, oxygen, dive time, and pulse simultaneously. Dark backdrop with light symbols improves **visibility** underwater, and bigger buttons make use easier, especially with gloves. As shown in the research, this intelligent UI design balances **functionality and user restrictions**.

4.1.4 Dashboard Interface

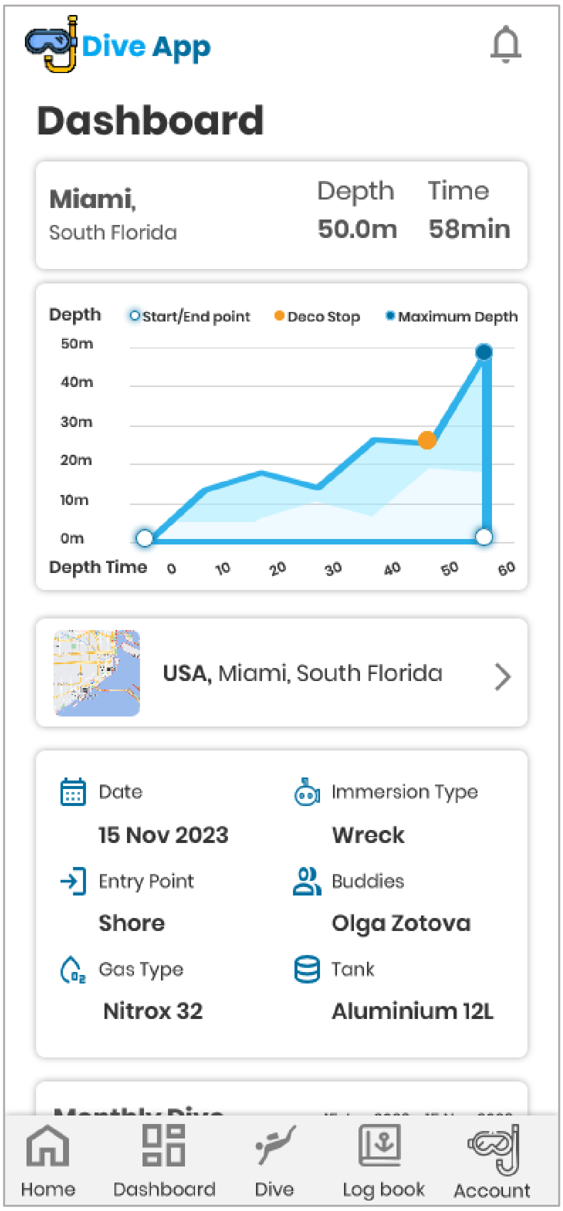


Figure 30: Dashboard user interface.

The app's Dashboard gives land-based divers location-based statistics in simple charts and activity details. As mentioned in the research section, this user-friendly **UI is designed** for on-land use and allows divers to easily examine and analyse their diving experiences and trends.

4.1.5 Logbook Interface

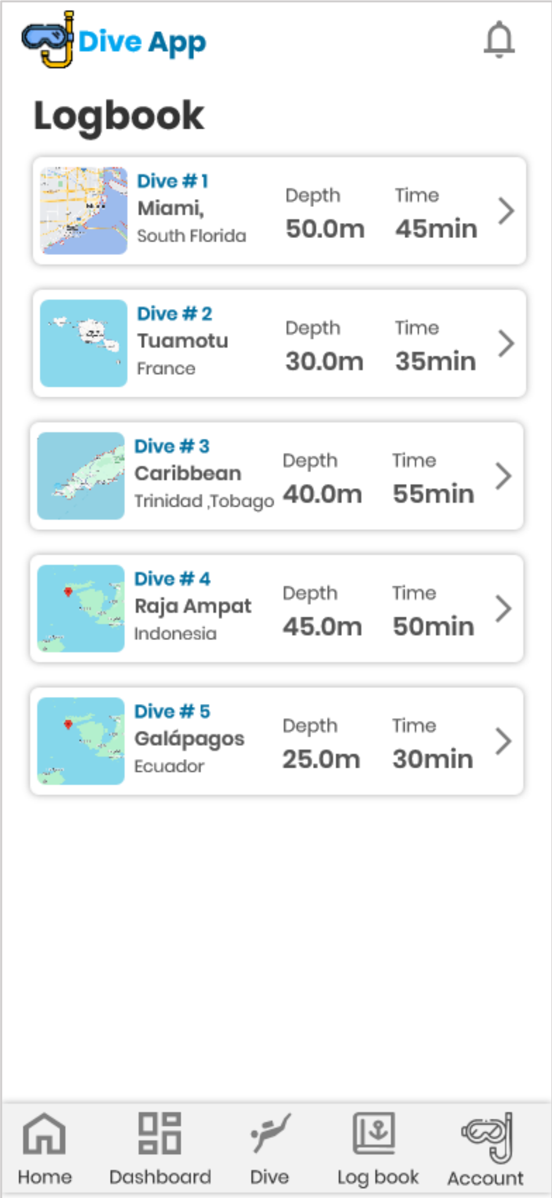


Figure 31: Logbook user interface.

The app's Logbook interface lets land divers easily view their dives and brief descriptions of their locations, depths, and durations. This tool simplifies tracking and reviewing past dives, improving the diving experience.

4.1.6 Log Details Interface

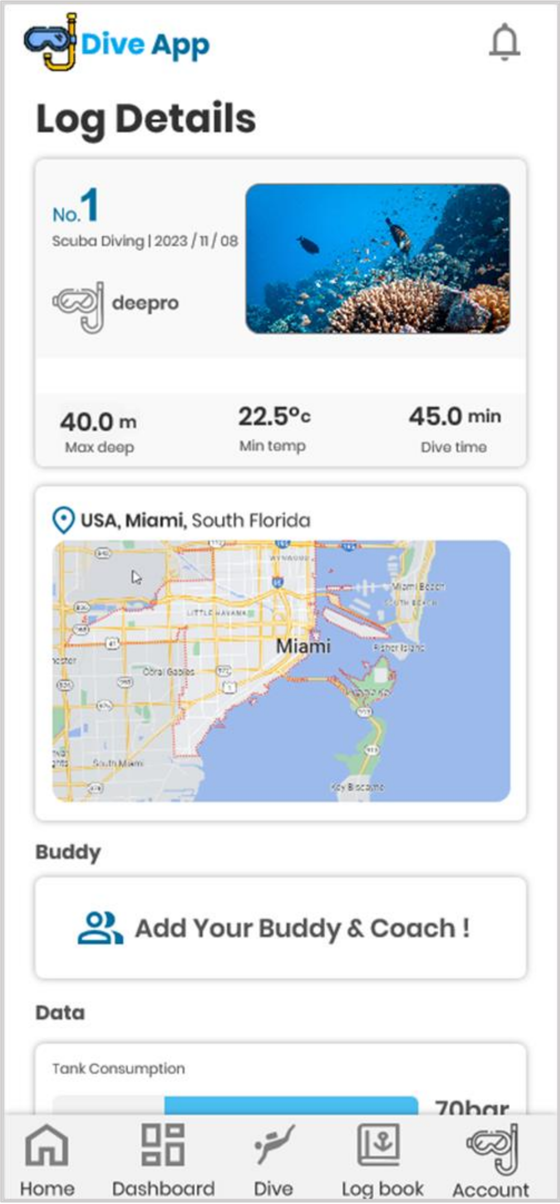


Figure 32: log Details user interface.

The app's Logbook interface summarises each dive with photographs, date, max depth, min temperature, dive time, location, dive buddies, and oxygen usage and circumstances. This in-depth review tool lets land divers thoroughly evaluate and relive their underwater experiences, enriching their diving history and improving dive planning.

4.1.7 Dive Computer Search and Pairing Interface

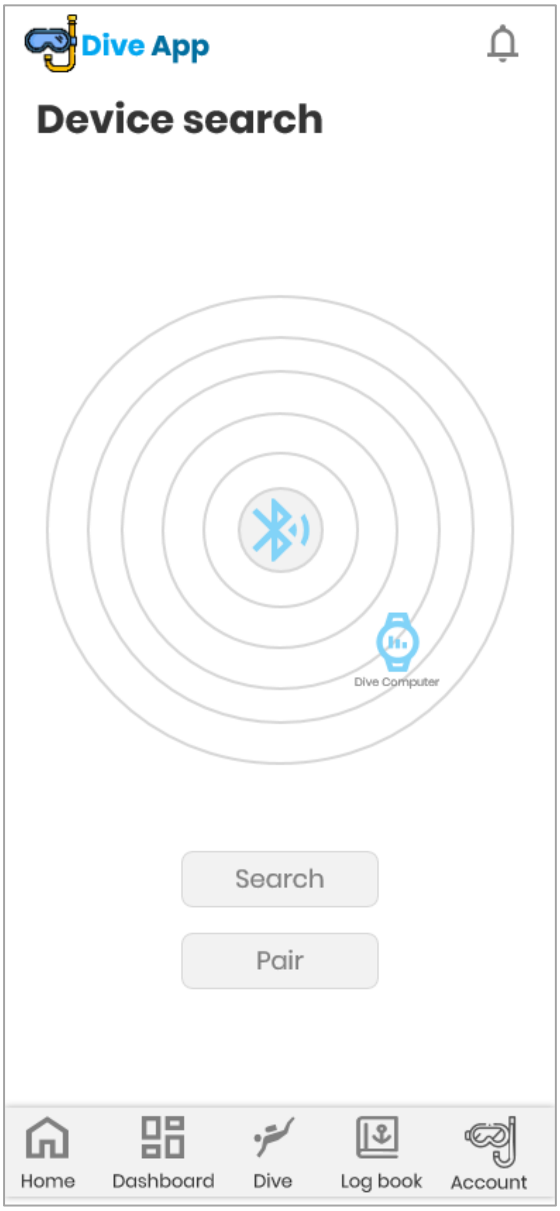


Figure 33: Dive computer search and pairing interface.

Before activate the diving mode, user need to connect dive computer to gather diving activity data such as depth, time, duration, heart rate, oxygen level, ascent rate, no-deco and other dive information. It also fixes **alert and notification** concerns, which mention in the research.

4.1.8 Video gallery Interface

Figure 34: Video gallery user interface.

Divers may easily examine their underwater videos by date and location in the app's video gallery. This feature makes it easy to revisit and share underwater activities on land, enriching the experience.

4.1.9 Photo Gallery Interface

Figure 35: Photo gallery interface.

The app's photo gallery lets divers browse their underwater photos by date and location. This organisation makes it easy for divers to review their underwater capitalises on land and share them with others.

4.1.10 User login Interface

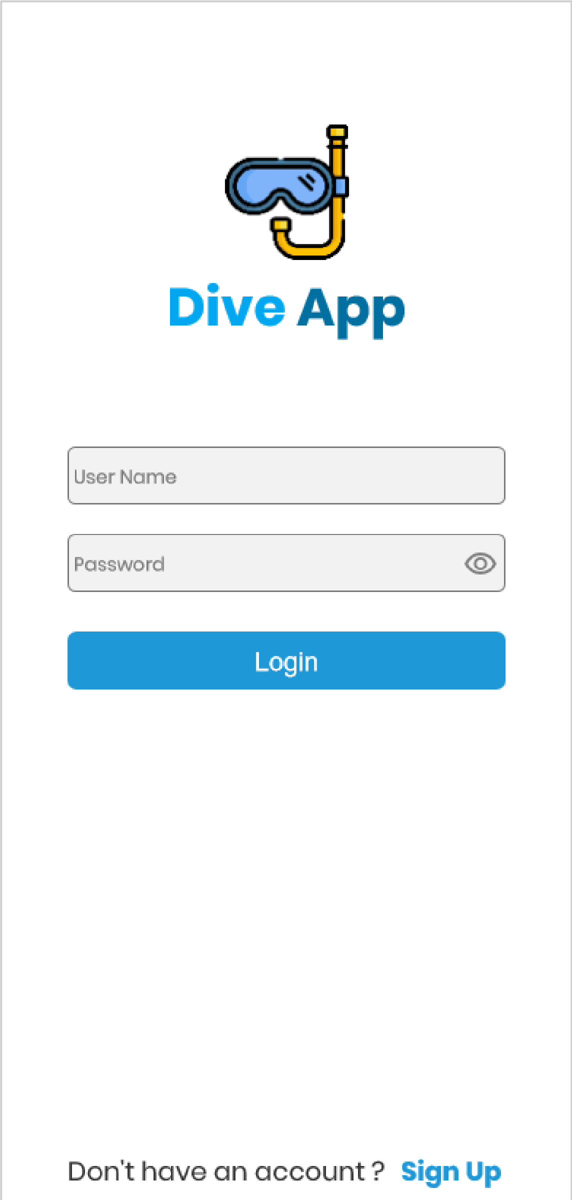


Figure 36: User login interface.

The app's User Login interface protects and customises each diver's data, preferences, and records.

4.1.11 User Sign Up Interface

User Sign Up in the dive app is simple and secure, allowing divers to establish personalised profiles to track and improve their underwater experiences.

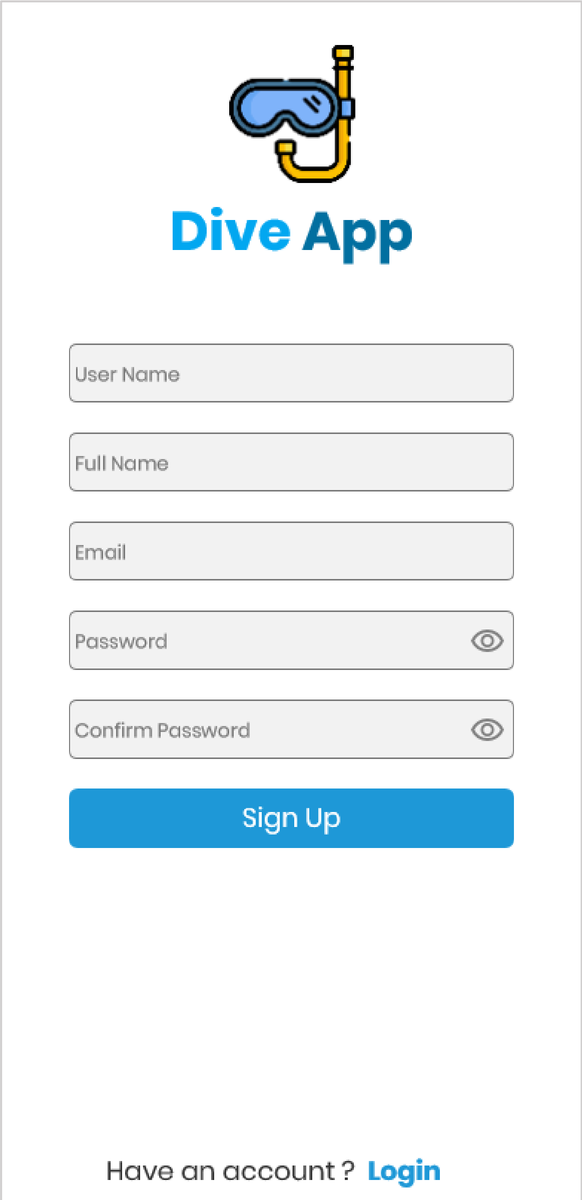


Figure 37: Dive app sign up screen.

4.1.12 User Account Interface

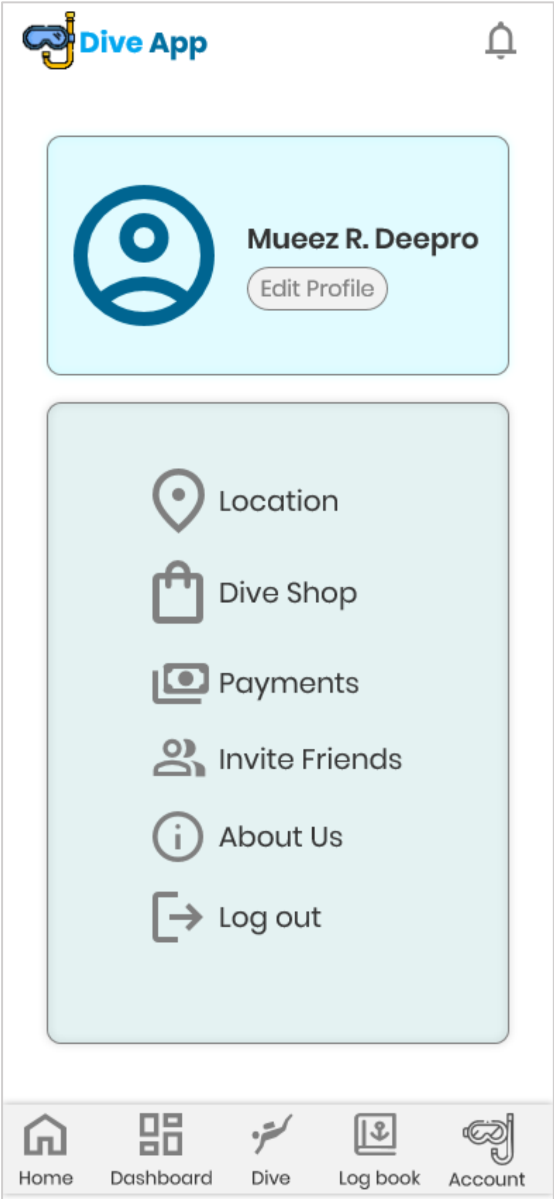


Figure 38: Diver's account user interface.

The app's diver account interface facilitates profile administration, location tracking, Dive shop access, payments, social features like inviting friends, and informational and security options.

5 RESEARCH STUDY

This proposal presents a comprehensive empirical research study that aims to evaluate the fundamental assumptions underlying the creation of a mobile app targeting scuba divers and snorkelers. The app incorporates functionalities for capturing images and videos underwater, as well as for monitoring and recording various dive parameters such as depth level, oxygen levels, dive time, ascent time, no-decompression limits, temperature, and heart rate. Additionally, it allows users to check their dive logs, and dashboard, which include multimedia material, on land.

*The research study producer's details are specifies in the **Appendix I**.*

6 CONCLUSION

The coursework about Human-Computer Interaction (HCI) study has been a comprehensive examination of the convergence of technology, user experience, and the specific requirements of scuba divers and snorkelers. The primary focus has been on the design and implementation of a mobile app targeting this particular user group. The study conducted was extensive, covering a range of aspects such as problem identification, analysis of the target audience, theories related to human-computer interaction (HCI), conceptual design, task analysis, application of Norman's design principles, construction of prototypes, and the design of empirical research.

Reflecting on the coursework, it becomes evident that HCI is a multidimensional field that intricately weaves cognitive psychology, interaction design theory, and practical application. The development of the app for divers and snorkelers highlighted the importance of understanding user needs and behaviours. The design process, from conceptualization to the creation of mid-fidelity prototypes, underscored the value of iterative design and user feedback. Applying Norman's design principles was instrumental in ensuring the app was not only functional but also intuitive and user-friendly.

Nevertheless, the coursework also had certain constraints. The application of theories and design principles posed difficulties and necessitated compromises when attempting to translate them into tangible design solutions. The emphasis on a distinct target demographic, although essential for customised solutions, also constrained the applicability of the application to a single user cohort. The prototype and research study, while extensive, were primarily theoretical in nature and did not incorporate practical testing or implementation. This omission limits the potential for uncovering further insights and identifying potential obstacles that may arise in real-world scenarios.

When considering future prospects, there exist many possibilities for more research and development. Obtaining feedback from real divers and snorkelers through real-world testing of the prototype has the potential to offer significant insights to refine the product. In order to boost the inclusivity and utility of the application, it is recommended to broaden the scope of the research by incorporating a diverse spectrum of users with varying diving backgrounds and skill levels. The investigation of nascent technologies, such as augmented reality or improved biometrics, has the potential to introduce inventive functionalities in forthcoming iterations of the application. Furthermore, conducting long-term research to assess the effects of the application on diving practises and safety could yield valuable insights.

In conclusion, this coursework has provided a comprehensive opportunity to apply principles of Human-Computer Interaction (HCI) to a practical, real-world context. The previously mentioned research produced significant findings regarding the intricacies involved in the development of user-centric applications, hence establishing a solid groundwork for further investigations within the area of Human-Computer Interaction (HCI).

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APPENDIX A: PRODUCT COMPARISON

Table 2: *table provides a structured comparison of various underwater photography products, helping to identify the best fit based on user needs and camera compatibility*

Product	Characteristics	Features	Integrated Components
Canon Housing	Flat port, designed for compact cameras	High durability, easy access to camera controls	Flat port for lens clarity
Watershot iPhone	Specifically for iPhones	User-friendly, lightweight	Customizable buttons
TteooBL Waterproof Bag	Universal compatibility	Portable, budget-friendly	Transparent material for touch
Outex	Versatile design	Robust protection, adaptable to various camera models	Flexible casing
GoPro Hero 3 Case	Protective waterproof c ase for GoPro Hero 3	Compact, durable	In-built waterproof protection
Sealife with Twin-Flash	Designed for deeper dives	Advanced lighting capabilities	Twin-flash system
Equinox DSLR Nikon	For DSLR Nikon cameras	Professional-grade, sturdy build	Housing tailored for Nikon
Ikelite for Canon	Tailored for Canon cameras	Reliable underwater performance	Custom housing design
Seacam with Dome Port	Includes a dome port	Enhanced field of view, superior image quality	Dome port for wide-angle shots

APPENDIX B: ANNUAL COUNT OF SNORKEL AND SCUBA DIVES AT LOCATIONS ACROSS THE GLOBE.

Geographic location	Dive site name	Dives per year	
		SCUBA	Snorkeler
Australia, Great Barrier Reef	Heron Island	16,000	--
Australia, Great Barrier Reef	Lady Elliot Island	10,000	–
Australia, Great Barrier Reef	Solitary Island	2,000	–
Australia, Great Barrier Reef	Orpheus Island	–	3,120
Australia, Great Barrier Reef	Unspecified high use site	2,500	–
Australia, Great Barrier Reef	Unspecified low use site	800	–
Caribbean, Bonaire	Jerrys Jam	5,101	–
Caribbean, Bonaire	Carls Hill	5,074	–
Caribbean, Bonaire	Forrest	3,850	–
Caribbean, Grand Cayman	Paradise Reef	17,827	–
Caribbean, Grand Cayman	Aquarium	8,700	–
Caribbean, Grand Cayman	Royal Palms	6,001	–
Caribbean, Grand Cayman	Armchair	794	–
Caribbean, Grand Cayman	Smiths Cove	754	–
Caribbean, Grand Cayman	Jax Dax	588	–
Red Sea, Egypt, Ras Mohammed Nat. Pk.	Unspecified high use mooring	20,000	–
Red Sea, Egypt, Hurghada	Small Giftun	121,200	29,700
Red Sea, Egypt, Safaga	Ras Abu Soma	45,600	9,750
Red Sea, Egypt, Hurghada	El Fanous	43,200	11,250
Red Sea, Egypt, Hurghada	Gotta Abu Ramada	12,900	3,450
Red Sea, Egypt, Hurghada	CS Giftun Canal	3,600	0
Red Sea, Israel, Eilat	Unspecified high use site	30,000	–
Red Sea, Israel, Eilat	Caves	16,352	–
Red Sea, Israel, Eilat	Central Reserve	8,168	–
Red Sea, Israel, Eilat	Lighthouse	5,980	–
Red Sea, Israel, Eilat	Japanese Gardens	4,396	–
Hawaii, Oahu	Pupukea MLCD	22,493	47,721
Hawaii, Hawaii Island	Kealakekua MLCD	1,440	103,320
Hawaii, Lanai	Manele-Hulopoe MLCD	1,740	28,216
Hawaii, Maui	Honolua MLCD	2,045	83,880
Hawaii, Oahu	Hanauma Bay MLCD	–	818,140
South Africa, Sodwana Bay	Two-Mile Reef, High use site	28,000	–

Table Data Source: (Meyer & Holland, 2008).

APPENDIX C: USER REQUIREMENTS

Key requirements include:

- **Ease of Functionality:** The foremost necessity entails a waterproof casing that is user-friendly, facilitating efficient operation of smartphones in underwater environments.
- **Flexible and Detachable Components:** The design ought to have adaptable elements such as a removable flashlight, ergonomic hand grips, and protective strips in order to augment the functionality and versatility of the housing in accordance with varying diving circumstances.
- **User-Friendly Mobile App:** The product's user-friendly smartphone app simplifies underwater video capture and recording. Users can monitor and record depth, oxygen concentration, dive, ascent, no-decompression limit, water temperature, and heart rate using the app.
- **Dive Log with Multimedia Capabilities:** The app should let users browse, examine, and manage their dive and snorkelling photos, videos, and records. This feature would turn the smartphone into a dive journal, adding photographs and videos to the post-dive experience.
- **Additional Components:** The durability of the housing is essential in order to endure the pressures exerted underwater and effectively safeguard the smartphone. Additionally, incorporating safety mechanisms that prevent unintended opening or leaking is crucial.
- **Durability and Safety:** The durability of the housing is crucial in order to endure the pressures experienced underwater and effectively safeguard the smartphone. Additionally, incorporating safety mechanisms that prevent unintended opening or leakage is essential.
- **Compatibility and Versatility:** The design should possess compatibility with a range of smartphone models and demonstrate adaptability to varying diving depths and conditions.

In summary, these requirements aim to create a product that not only protects and enables the use of smartphones underwater but also enriches the diving experience with useful features like a comprehensive dive log, easy photo and video capture, and essential dive metric tracking, all within a user-friendly and versatile design.

APPENDIX D: DESIGN FRAMEWORK IMPLEMENTATION AND JUSTIFICATION IN THE PRODUCT

Human-Centered Design (HCD) expands on this by focusing not just on the users but also on human values and well-being (Landry, 2020). In the product, HCD influenced the inclusion of safety features and ergonomic design to ensure comfort and security during diving activities.

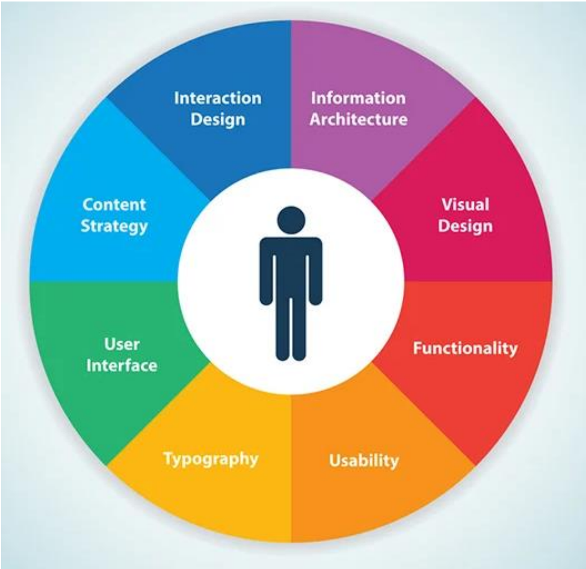

Image source: (Widdowson, 2023).

Figure 39: The process of Human-Centered Design.

Participatory Design (PD) involves users directly in the design process, offering a more collaborative approach. By engaging amateur divers and snorkelers in the development process, their first-hand experiences and insights shaped the product's functionality, ensuring it catered to their specific needs and preferences (Velden, 2018).

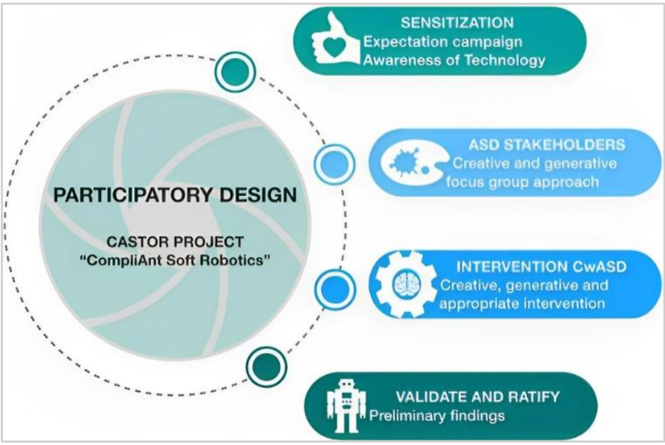

Figure 40: The process Participatory Design (PD) (Velden, 2018).

Implementation in the Product:

1. **User-Centered Design (UCD)**
   - Regular user feedback sessions to refine the app's interface.
   - Usability testing to ensure intuitive navigation and ease of use.
2. **Human-Centered Design (HCD)**
   - Focus groups to understand the emotional and physical impact of the product on users.
   - Designing for inclusivity, ensuring the product is accessible to a diverse range of users.
3. **Participatory Design (PD)**
   - Workshops with potential users to co-create features and design elements.
   - Continuous iteration based on user-created ideas and solutions.

These frameworks ensured the final product was not only functional and user-friendly but also aligned with the deeper needs and values of the diving community, fostering a more engaging and satisfying user experience.

Justification:

User-Centered Design (UCD)

UCD was adopted to ensure the product addresses amateur divers' and snorkelers' demands and challenges. This method produced an intuitive, easy-to-use user interface, even in difficult underwater settings. User feedback was regularly integrated into the design process to improve the product's user experience and make it more appealing and useful for the target demographic.

Human-Centered Design (HCD)

HCD was needed to guarantee the product met functional needs and considered emotional, psychological, and physical well-being. This technique helped incorporate safety measures like depth alarms and emergency signals and ergonomic design to reduce user fatigue and boost comfort. HCD helps build a product that users trust and feel safe with.

Participatory Design (PD)

Amateur divers and snorkelers were directly involved in design using PD. This collaboration was warranted since it yielded significant insights and unique suggestions from product users. Engagement with the diving community made product development more inclusive and responsive to real-world demands. The finished product was functional, culturally relevant, and user-friendly due to direct involvement

APPENDIX E: DIFFERENT MODES OF INTERACTION

Voice Interaction

Voice interactions enable the control of devices without the need for manual operation, hence boosting user accessibility, particularly in situations when manual control is difficult (Kinsella, 2022). This interface integrates various operating modes such as hands-free operation and voice command navigation, which divers are going to utilise when on the surface to access their activity logs, photographs, and videos.

Touch Interaction

Touch interactions provide a user experience that is characterised by intuitiveness, facilitating the smooth and direct manipulation of digital content (Buxton, 2007). The device integrates a touch interface that allows surface divers to engage with various features such as images, videos, and app settings. On the other hand, certain types of mobile housing enable the utilisation of mobile touch screens in underwater environments, as shown by the Divevolk SeaTouch 4 MAX (Divevolk, 2022). Through the utilisation of this product, divers can capture photographs and videos, as well as access other functionalities of the application, all through touch-based interaction.

Graphical User Interface (GUI) Interaction

GUI interactions utilise visual elements, which contribute to the fluid understanding and exploration of features, hence improving the usability and engagement of users (Shneiderman, et al., 2009). GUI modes improve divers' user experience by linking functionality and interactions above and below water. For detailed pre-dive preparation, equipment checks, and real-time weather and environmental data, the GUI is essential. Divers can record and analyse post-dive observations with it.

Underwater, the GUI offers simple navigation and real-time dive statistics. Divers may take underwater images and films with easy controls. Also, the GUI makes emergency protocols and communications easier to access. A seamless, user-friendly GUI improves dive safety, enjoyment, and success.

APPENDIX F: TYPE OF INTERACTION

Instructing

The process of instruction interaction entails the user providing explicit commands to the system to execute particular tasks (Helen Sharp & Preece, 2019). Users can set the maximum depth warning and photographic mode. User experience will be improved by introducing straightforward and simply accessible input mechanisms for performing commands, ensuring the device meets the diver's needs.

Conversing

Conversational interaction refers to the ongoing exchange of information between the user and the system, like a bilateral discourse (Helen Sharp & Preece, 2019). The device might give users real-time diving statistics updates, providing a steady stream of relevant information. The device can alert the user if oxygen levels drop faster than expected. This ensures diver safety and well-being through ongoing and informed engagement.

Manipulating

The manipulation interaction refers to the user's direct engagement with the interface elements of the system, such as buttons or sliders, to modify settings or regulate different aspects (Helen Sharp & Preece, 2019). Individuals can directly adjust device settings like display brightness and photographic mode. Tactile or touchscreen controls allow divers to make instantaneous changes, giving them a sense of agency and customization over the equipment.

Exploring

The process of exploring interaction involves users traversing through distinct components of the system, uncovering functionality, and gaining access to a diverse range of features and information (Helen Sharp & Preece, 2019). Users can explore features, modes, and settings through menus to discover and use the device's full potential. A well-structured and user-friendly menu system with clear and intuitive navigation instructions will make the device's functionality easier to use.

Responding

In the context of interactive systems, the system is capable of responding to user actions or changes in the environment autonomously, without explicit direction (Helen Sharp & Preece, 2019). This may involve giving comments or making changes. The diving device may adjust screen brightness to ambient light or issue notifications based on real-time oxygen usage and dive depth. Responsive design ensures that the gadget prioritises user welfare, enhancing safety and experience.

APPENDIX G: DESIGN PRINCIPLES

The design principles followed by the Don Norman's Principles of Interaction Design (Rekhi, 2017).

Visibility

Principle: The higher the visibility of functions, the greater the likelihood that users will possess the knowledge of subsequent actions.

Application: The main screen of the diving product will prominently display vital capabilities such as photo capture, oxygen level checking, and current depth monitoring. This design feature enables customers to conveniently access key functionalities without the need for extensive navigation.

Feedback

Principle: Feedback involves the transmission of information regarding the actions undertaken and the achievements attained.

Application: When a user captures an image, modifies a setting, or examines dive data, the device will promptly deliver unambiguous feedback, such as an audible signal, physical sensation, or visual indication, to validate the activity.

Constraints

Principle: The implementation of constraints on potential activities serves to mitigate the occurrence of errors.

Application: The design of the product interface will incorporate limitations to mitigate the risk of users making inadvertent mistakes, such as unintentionally modifying critical dive configurations or erasing acquired photographs. This approach aims to improve user satisfaction and bolster the dependability of the product.

Consistency

Principle: The objective is to maintain consistency in the expression of similar components.

Application: The device will ensure consistency in design components and user interactions by employing recognisable icons, terminology, and layouts across various functionalities. This approach aims to enhance user experience by facilitating simplicity of use and instilling user confidence.

Affordance

Principle: The design ought to express the intended purpose or utility of a thing or choice.
Application: The buttons and controls inside the interface of the diving equipment will be developed intuitively, employing shapes, sizes, and layouts that effectively convey their respective functions and usage. This design approach will facilitate users' smooth navigation and engagement with the device.

APPENDIX H: ADDITIONAL PRODUCT IDEAS SKETCH

Product Idea - 2

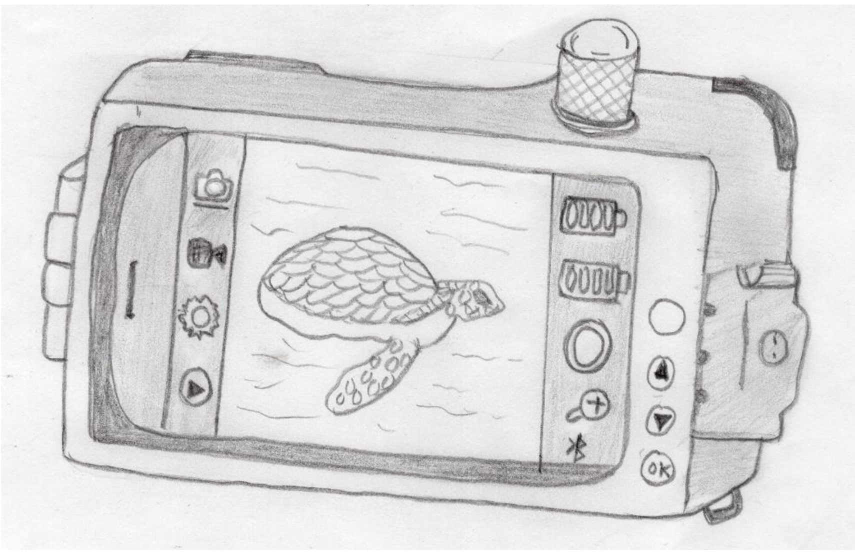

Figure 41: Product Idea-2 sketch.

Product Idea - 3

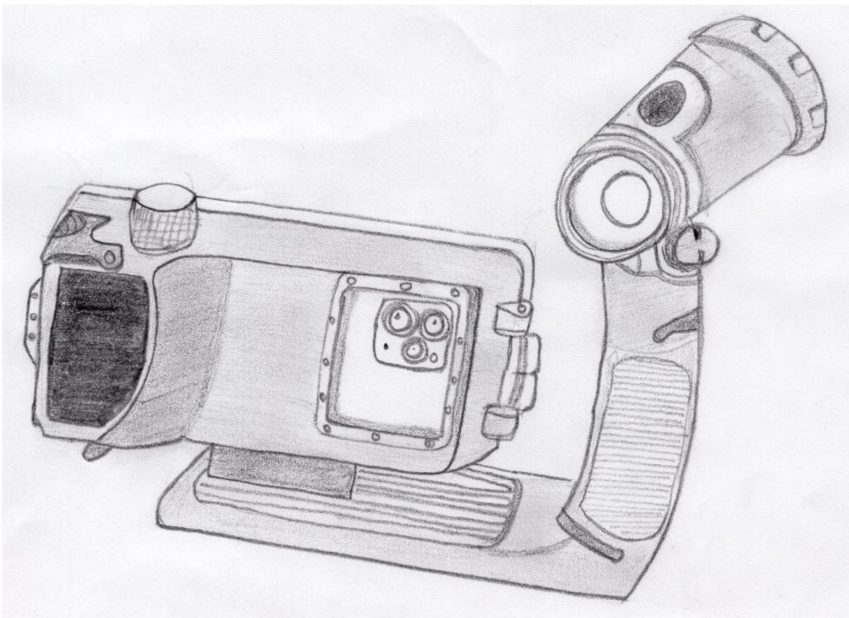

Figure 42: Product Ides – 3 with additional external flashlight component.

Product Idea - 4

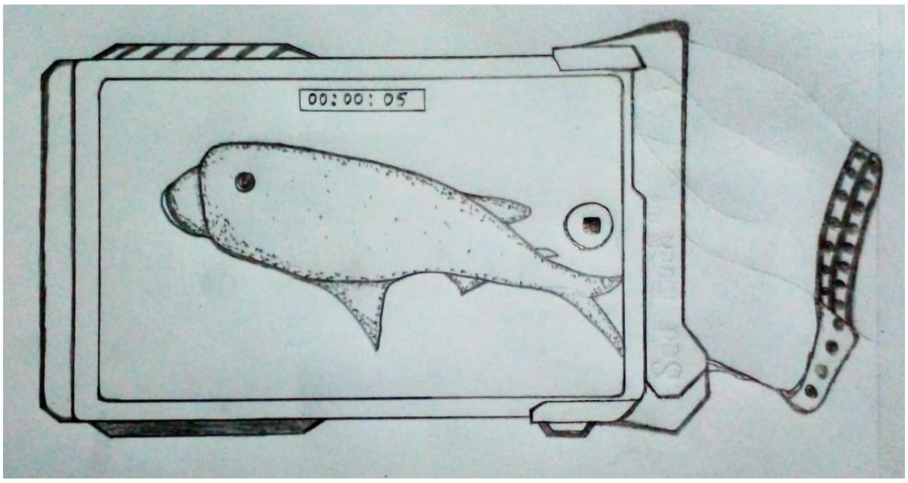

Figure 43: Touch screen underwater housing with safety strip.

Dive Computer Idea

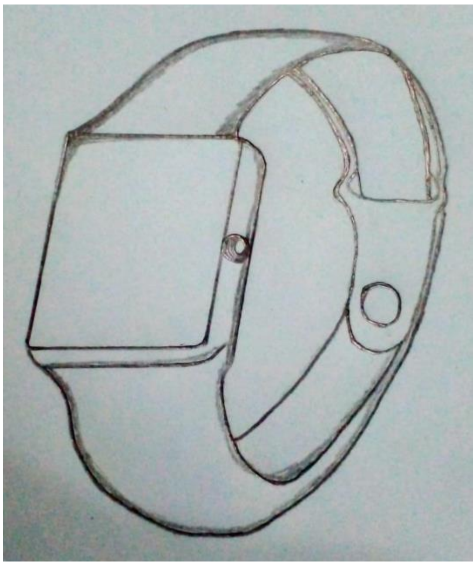

Figure 44: Dive computer idea.

APPENDIX I: RESEARCH STUDY

Research Question

"How does the use of a mobile app with underwater photo and video capture capabilities, dive metrics tracking, and post-dive multimedia log review enhance the overall diving experience and the accuracy of dive logging for scuba divers and snorkelers?"

Participants

Target Demographic

The participant demographics for the research study on a scuba diving and snorkelling app have been carefully selected to ensure representation from a wide range of users. The study incorporates individuals of both genders, ensuring the inclusion of gender diversity. The divers can be categorised into many groups, encompassing tourists who partake in diving and snorkelling for recreational purposes while on holiday, as well as professionals such as dive instructors, marine biologists, and underwater photographers, who engage in diving as an integral aspect of their respective occupations. Furthermore, individuals who partake in diving daily but do not do it professionally will also be included in the study.

The participant pool encompasses individuals ranging in age from 18 to 55 years, to encompass a diverse variety of users spanning from young people to individuals in the middle-age demographic. Moreover, the research will encompass individuals with diverse degrees of experience in diving, ranging from novices lacking formal qualifications to intermediate divers with some experience and certifications, as well as advanced divers who exhibit significant expertise and possess advanced certifications. The inclusion of a diversified demographic targeting strategy is of utmost importance to provide thorough insights into the usage patterns of the app among various user groups. This information can then be utilised to guide future development efforts and enhance the overall user experience.

Recruitment Strategy

To enhance participant recruitment for the study, it is recommended to actively connect with diverse diving communities, with a particular focus on diving clubs, online forums dedicated to diving, and social media groups. These forums attract individuals with varying degrees of experience, ranging from beginners to professionals, assuring a broad and inclusive sample. Moreover, establishing partnerships with diving equipment retailers becomes advantageous, as these establishments serve as central hubs for the diving community and cater to a diverse array of divers with varying levels of proficiency and expertise.

Study Design

Initial Survey

The initial survey was carried out to gather preliminary data about the participants, focusing on their demographic profiles and the methods employed in their recruitment, to understand their current practices in monitoring and organizing diving records.

Sessions

The organised briefing for the open session on app usage focuses the following necessary points:

1. **Session Format**
   - The session is designed to facilitate exploration, enabling users to utilise the app in accordance with their individual preferences and requirements.
   - Limited instructions are given to promote authentic engagement with the app by replicating a genuine user encounter.
2. **Participant Engagement**
   - Participants are strongly urged to thoroughly explore all the aspects of the usage, ranging from the planning of dives to the examination of dive logs, dashboard underwater activities, and underwater photographs.
   - The objective is to ascertain the level of intuitiveness and user-friendliness exhibited by the application when utilised autonomously.
3. **Feedback Collection**
   - The presence of observers will be ensured to document the interactions and reactions of participants, while refraining from any interference in their use of the app.
   - Participants are strongly urged to articulate their thoughts and feelings to offer real-time feedback.
4. **Post-Session Discussion**
   - After the exploratory session, a discourse ensues with the aim of collecting extensive feedback and meticulous impressions pertaining to the app's functionality.
   - The purpose of this discussion is to further explore the participants' comprehensive experience, encompassing aspects such as usability and the pertinence of features.

The carrying out of this methodical technique ensures that individuals are well knowledgeable of the investigative personalities of the session and their involvement in it, hence helping the acquisition of authentic and perceptive feedback.

Post-Usage Survey and Interviews

Presented below is a tabular representation designed to collect quantitative data about user experiences with the scuba diving and snorkelling application. This table is constructed to capture data based on particular parameters.

Table 3: *Data collection table.*

Metric	Rating Scale (1-5)
Ease of Navigation	1 = Very Difficult, 5 = Very Easy
Feature Relevance	1 = Irrelevant, 5 = Highly Relevant
User Satisfaction	1 = Very Unsatisfied, 5 = Very Satisfied
App Stability	1 = Very Unstable, 5 = Very Stable
Performance Efficiency	1 = Very Inefficient, 5 = Very Efficient
Accuracy of Dive Metrics	1 = Highly Inaccurate, 5 = Highly Accurate
Quality of Underwater Photography Features	1 = Poor Quality, 5 = Excellent Quality

Equipment

- Smartphone capable of supporting application installation.

Data Collection Instruments

System Usability Scale

The System Usability Scale (SUS) is reliable and efficient, making it suitable for assessing the scuba diving and snorkelling app's usability. It covers app usability, including user pleasure, simplicity of use, and learnability, in 10 questions. Communication with stakeholders and comparing against industry norms is easy with the quantified SUS score. This tool is essential for identifying areas for improvement and tailoring the app to its various users. Its universality makes it ideal for the diverse scuba diving and snorkelling communities.

System Usability Scale form exhibited in Figure 45.

System Usability Scale (SUS) Calculation and Score

1. **Quantify responses**

   The SUS survey provides point values for each response option. Subjective user feedback can be quantified with this conversion. Convert the scale to numbers first:

   - Disagree strongly: 1 point
   - I disagree: 2 points
   - Three points for neutral.
   - Yes: 4 points
   - Agree strongly: 5 points

2. **Calculate x and y**

   For calculation, the SUS survey's 10 statements are separated into odd-numbered and even-numbered questions. Consider:

   - x = 5 minus the total of odd-numbered questions' points.
   - y = Deduct 25 from all even-numbered question points.

3. **SUS Score Calculator**

   Formula for final SUS score:

   - SUS = x + y * 2.5

   The SUS score, which measures system usability, is calculated by combining the x and y values.

   Consider that all odd-numbered questions total 20 points. So,

   - x = 20 – 5 = 15

   Consider 25 points for all even-numbered questions.

   - y = 25-25= 0

SUS Score = 15+0*2.5=37.5

SUS Score Interpretation:

- SUS scores are percentages from 0 to 100.
- A 100% score indicates excellent usability and user experience.
- Up to 70% of SUS scores are good, indicating decent usability. The average is 68.
- ratings below 50% imply low sus ratings, a probable usability issue, and the need for significant user satisfaction changes.

SUS Formula Source: (Bhat, 2023).

Consent Form

A permission document is needed for the scuba diving and snorkelling app usability study to be ethical. It communicates the study's aim, procedures, and participants' rights, including data privacy and security. This builds trust, stimulates genuine engagement, and meets regulatory criteria for human subject studies. The permission form clearly states that participants can withdraw at any moment, protecting their interests and the study's integrity. This is essential for transparent, courteous, and legal research.

Consent form form exhibited in Figure 46.

Quantitative Analysis

The present study involves doing a statistical analysis to compare the survey responses collected before and after the implementation of a certain intervention.

Here's a table outlining the key metrics for the quantitative analysis of the scuba diving and snorkelling app, along with their descriptions and target values:

Table 4: *Quantitative Analysis.*

Metric	**Description**	**Target Value**
User Interaction Time	Average time taken by users to complete key tasks in the app	< 30 seconds
Error Rate	Percentage of tasks resulting in errors or user difficulties	< 5%
App Loading Time	Time taken for the app to launch and become operational	< 5 seconds
User Engagement	Daily/Monthly active users and frequency of app usage	75% of registered users monthly
User Satisfaction Score	Average rating from user surveys and app store reviews	> 4 out of 5
Average Session Length	The average duration of a user session within the app	>= 5 minutes

Ethical Considerations

- It is imperative to uphold the principles of informed consent and confidentiality.
- It is imperative to underscore that engagement in the activity is entirely optional and can be terminated at any given point.

Final Considerations

- **Pilot Test:** Conduct a pilot test to refine the study design and materials.
- **Feedback Loop:** Plan for ongoing refinement of the prototype based on study findings.
- **Reporting:** Prepare a format for presenting the results to stakeholders.

System Usability Scale

	Strongly disagree				Strongly agree
1. I think that I would like to use this system frequently	1	2	3	4	5
2. I found the system unnecessarily complex	1	2	3	4	5
3. I thought the system was easy to use	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this system	1	2	3	4	5
5. I found the various functions in this system were well integrated	1	2	3	4	5
6. I thought there was too much inconsistency in this system	1	2	3	4	5
7. I would imagine that most people would learn to use this system very quickly	1	2	3	4	5
8. I found the system very cumbersome to use	1	2	3	4	5
9. I felt very confident using the system	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this system	1	2	3	4	5

Figure 45: System Usability Scale form.

Form source: (Brooke, 1995).

Consent Form (Adult)

I agree to participate in the study conducted by the [Agency/Organization].

I understand that participation in this usability study is voluntary and I agree to immediately raise any concerns or areas of discomfort during the session with the study administrator.

Please sign below to indicate that you have read and you understand the information on this form and that any questions you might have about the session have been answered.

Date:_________

Please print your name: ____

Please sign your name: ____

Thank you!

We appreciate your participation.

Figure 46: Consent Form.

Form source: (usability.gov, 2023).