

COMP1649 CW

[Document subtitle]



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greenwich

1. Introduction
2. Background literature:

The diving device I have developed is a tool designed to enhance the underwater experience for professional and amateur divers, providing a seamless combination of information, position tracking and recording fun. capture the breathtaking moments beneath the surface. This innovative device is more than just a diving accessory; It's a comprehensive solution created to enrich the overall diving adventure. Through an intuitive interface, divers can conveniently view real-time data related to their dive, including depth, temperature and remaining dive time. The device leverages advanced sensor technology to ensure accurate and reliable data, providing divers with the insights they need for a safe and enjoyable underwater journey. The device provides a compass display, allowing divers to plan and track their routes, discovering new dive locations.

Capturing the essence of the diving experience, the device is integrated with a high-quality camera system. Now divers can immortalize the beauty of the underwater world by easily taking photos and videos. The device is designed to withstand the pressures of deep-sea exploration, ensuring that every moment captured is clear and vivid. To enhance the social aspect of diving, the device integrates seamlessly with a dedicated mobile app. Divers can sync their dive logs, photos and videos to the app, creating a digital dive log that can be shared with the diving community.

In short, this diving device pushes the traditional boundaries of underwater exploration. It not only provides essential information for divers but also integrates advanced features to capture and share the beauty of the underwater world. With a focus on user experience, safety and community engagement, this device is poised to redefine the way divers experience and interact with the ocean depths.

* 1. HCI Research:

What Is HCI?

Human-Computer Interaction (HCI) is a dynamic and multidisciplinary field that places a paramount focus on refining the interaction between users and computers. At its core, HCI is driven by the objective of crafting interactive computer interfaces that are not only technically efficient but also seamlessly align with the diverse needs and preferences of users (Kanade, 2022). This field is characterized by its integration of insights from a spectrum of disciplines, reflecting its complex and multifaceted nature. Embracing elements of computer science, HCI draws on the technical aspects of software and hardware design to optimize the functionality and performance of interactive systems. Behavioral sciences contribute to the understanding of how users engage with technology, exploring patterns of user behavior and preferences.

Importance of HCI

Human-Computer Interaction (HCI) plays a crucial role in optimizing the interaction between users and technology, leading to a multitude of benefits:

Enhancing User Experience: HCI places a strong emphasis on designing technology that is user-friendly and intuitive, aiming to create positive experiences that promote the adoption and effective utilization of the technology, ultimately leading to increased user satisfaction. (simplilearn, 2023).

User Satisfaction and Loyalty: Satisfactory user experiences cultivate loyalty and contentment. Users who are pleased are more likely to endorse products or services to others, playing a pivotal role in building brand reputation and facilitating growth. (simplilearn, 2023).

Cost Savings: Incorporating HCI principles into technology design results in cost savings by minimizing the need for customer support, reducing errors and the necessity for rework, and enhancing overall user efficiency. (simplilearn, 2023).

* 1. HCI Theory

Usability Principles:

Focus on making systems easy to learn, efficient to use, and satisfying for the users. This involves principles such as learnability, efficiency, memorability, error prevention, and user satisfaction.

Cognitive Load Theory:

Examines the cognitive load imposed on users when interacting with a system. The goal is to design interfaces that minimize cognitive load and enhance user understanding and performance.

GOMS Model (Goals, Operators, Methods, and Selection Rules):

Analyzes human-computer interaction in terms of goals users want to achieve, the operators available to achieve those goals, the methods for employing the operators, and the selection rules for choosing among them.

Affordance Theory:

Proposes that the design of an object or system should suggest how it is used. An affordance is a quality of an object or an environment that allows an individual to perform an action.

User-Centered Design (UCD):

Advocates for involving users throughout the design process to ensure that the final product meets their needs and preferences. This theory emphasizes iterative design, user feedback, and usability testing.

Activity Theory:

Originating from psychology, this theory explores how individuals engage in activities within a social context. In HCI, it helps designers understand users' motivations, goals, and the social and cultural influences on their interactions with technology.

Hedonic/Emotional Design:

Recognizes the importance of emotional responses in user experience. It emphasizes designing products not only for usability but also for the emotional satisfaction and enjoyment of users.

Ecological Interface Design:

Focuses on creating interfaces that mimic the natural environment and how information is naturally presented, making it more intuitive and user-friendly.

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1. Design Process
   1. Conceptual Design
   2. Design principles

"UCD" usually refers to User Centered Design. User-centered design is an iterative design process in which designers focus on end users and their needs throughout the development process. UCD's goal is to create products and systems that are not only functional and effective, but also user-friendly and enjoyable. This process usually includes the following key principles:

User research: Understanding the needs, goals, and behaviors of your target users is a fundamental step. This includes conducting interviews, surveys, observations, and other research methods to gather insights about user preferences and pain points.

Develop personas: Creating user personas helps humanize the design process by representing the characteristics, behaviors, and goals of different user groups. Design decisions are then made based on these characteristics, ensuring that the final product meets the diverse needs of the user base.

Iterative design: UCD emphasizes an iterative approach in which prototypes are created and tested with users throughout the design process. This allows designers to gather feedback early and often, making necessary adjustments to improve the user experience.

Usability Testing: Usability testing involves observing real users as they interact with a prototype or final product. This helps identify usability issues, areas for improvement, and user satisfaction.

Accessibility: Designing products that are accessible to users of diverse abilities is an important aspect of UCD. This includes considerations for people with disabilities to ensure that as many people as possible can use the product.

Information architecture: UCD is concerned with structuring and organizing information in a way that is intuitive to the user. This includes designing navigation systems, menus, and other elements to help users easily find the information they need.

Intuitive design: While functionality is important, visual design plays a vital role in user experience. UCD reviews the aesthetics of the product, ensuring that it is visually appealing and consistent with the brand while maintaining usability.

Feedback and improvement: UCD is a continuous process and feedback from users is crucial for continuous improvement. After launch, designers collect feedback, analyze user behavior, and make updates to enhance the product's usability and performance.

By focusing on the user throughout the design process, UCD aims to create products that not only meet user needs but also provide a positive and satisfying experience. This approach is widely used in various design fields, including software development, web design, product design, and more.

1. Prototype
   1. Low-fidelity prototype

A screenshot of a smart watch

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Figure 1: low-fidelity prototype

After coming up with the concepts and understanding of low fidelity, I designed a low fidelity diving watch. I will use paint (computer application) to draw the interface of the main functions of the device. Includes a home screen that will display the watch's battery percentage. The next screens are Date and time screen, Oxygen parameters screen, Dive time and depth screen, Heart rate monitor screen, Compass screen. Screen records video and takes photos. Whether monitoring vital parameters, tracking time and depth, or capturing stunning images, the watch meets the diverse needs of underwater enthusiasts, enhancing both safety and performance. enjoyment of their diving efforts.

* 1. Hight-fidelity prototype

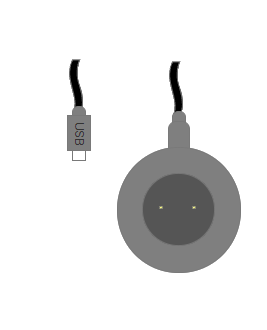


Figure 1: watch charging dock

The watch charging dock is designed in a circular shape to fit the back of the watch. When the watch runs out of battery, the user can place the back on it to charge the battery. The charging cord is designed with 2 ports: 1 type-C port for faster charging speed, the other port is USB to easily connect to chargers and devices with USB connection ports.



Figure 2: diving watch

The diving equipment I designed was a wristwatch. Color screen with LED backlight. Most importantly, I used MIP (memory in pixel) screen technology. MIP (memory in pixel) screen technology, in addition to helping the device save electricity, also has excellent visibility in many complex lighting conditions. Water resistant to 100 meters ~ 328 ft according to EN 13319-ISO 6425 standards for diving equipment. Wirelessly connect to oxygen tank to display pressure right on the watch. Alerts with both vibration and sound, 3D Digital Compass. The wire uses quick disassembly and can adapt to all wires with a width of 24mm. Battery life: 6-12 hours of continuous diving.

The watch is designed with 3 buttons: Next, Previous and Camera. Next and Previous are used to change the display on the watch. Camera pen is used to connect to the camera on the mask.

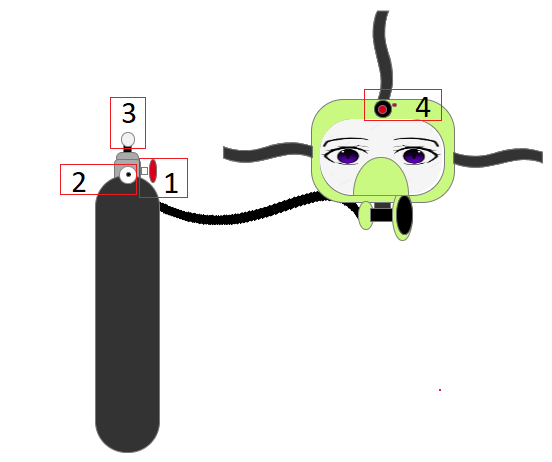


Figure 3: Oxygen tank and diving mask.

Diver oxygen tanks are mainly used for divers from professional to amateur. With the use of providing oxygen to breathe underwater for long periods of time with other uses. An oxygen tank made of aluminum alloy has 21% oxygen compressed inside the tank for the purpose of supplying air to the mask for the user when diving. Used to provide air so you can breathe safely underwater for a period. There is a valve to open and close (1), a meter to measure the amount of oxygen in the tank (2), a signal light connected to the diving watch (3). The pressure a diving tank can withstand is higher than about Mpa (300 bar).

Scuba diving masks are designed with quality lenses, allowing for uninterrupted vision. Product size: 16 x 2 x 2cm, product weight: 7.2 grams. Furthermore, the mask strap is also very easy to adjust, creating the most comfortable feeling for the wearer. In addition, a camera is installed on the top of the mask and is wirelessly linked to the diving watch (4). The camera mounted on the mask is waterproof: up to 20 meters within 2 hours, shockproof: 2 meters, Rotation angle: 204 degrees and 151 degrees, Clear area: from 0.2 meters to infinity, Compute Electronic Image Stabilization (Movie SR), Photo format: JPEG ,Video format: MPEG-4 AVC/H.264 (MOV), Photo resolution: (4:3) 8M: 3264x2448, 5M: 2592x1944, (16:9) 6M: 3264x1840, 4M: 2592x1464, (1:1) 6M: 2448x2448, Video resolution: 3840x2160 @ 30fps, 1920x1080 @ 60fps/30fps, 1280x7 20 @ 120fps/60fps/30fps. and connected to the watch using the middle button on the watch.



Figure 4: open device

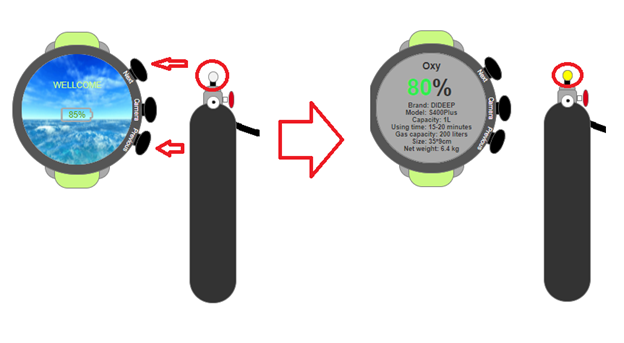


Figure 5: using device

When you start using it, the watch will automatically connect to the oxygen tank. When connected successfully, the indicator light will change to yellow

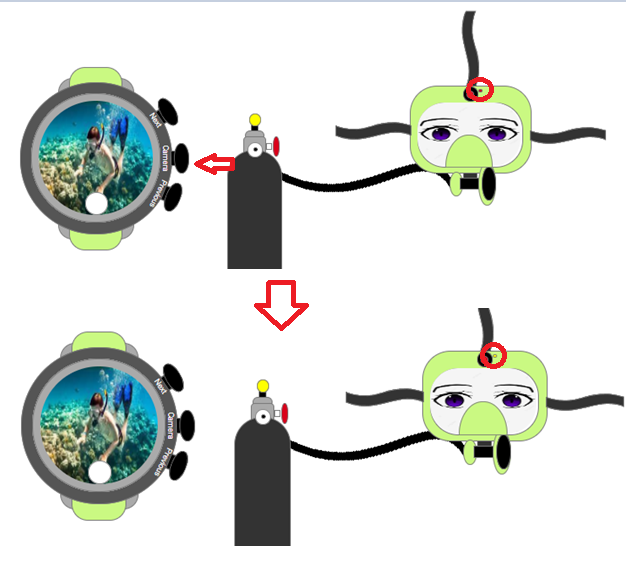


Figure 6: opening camera

On the left side of the watch there are 3 buttons. The 2 outside buttons will be used to change the clock screen (next, previous). The button held will be used to connect to the camera mounted on the top of the mask. When connected successfully, the indicator light will change to yellow



Figure 7: display screen

The multi-function diving watch boasts a user-friendly interface designed to meet the specific needs of divers. As you navigate through the different screens, each stage opens up a wealth of important information for a safe and enjoyable diving experience.

1. Battery level screen:

Once activated, the watch will greet you with a clear indication of the battery level. This initial screen ensures that you start your dive confidently knowing the power status of your device.

2. Date, time and temperature screen:

With a simple press of the Next button, the watch will switch to a screen displaying the current date, time and temperature. This information is essential to coordinate diving and to be aware of external conditions.

3. Depth and dive time display:

The third screen of the watch interface provides data on the diver's elapsed diving depth and time. This important information assists divers in managing their underwater activities effectively and ensuring safety procedures are followed.

4. Heart rate control monitor:

Moving to the fourth screen, the watch introduces a feature intended to help divers regulate their heart rate. Monitoring this vital sign contributes to overall safety, allowing users to adjust their speed and activity accordingly.

5. Oxygen tank parameters and remaining air monitor:

The fifth screen delves into the specifics of the oxygen tank, showing the necessary parameters and the amount of air remaining. This data is indispensable for divers to plan their underwater activities, ensuring they have enough oxygen for the entire dive session.

6. Compass screen:

The sixth screen introduces a built-in compass, providing users with a reliable tool for underwater navigation. Ensuring that divers can maintain their bearings is important for a safe and enjoyable diving experience.

7. Screen capture:

Diving enthusiasts can capture the beauty of their underwater adventures with a seventh screen dedicated to photography. Users can capture stunning images directly from their dive sessions, creating lasting memories of the diverse marine environments they explore.

8. Video recording screen:

The final screen serves as a versatile tool to record the entire diving experience. With the video recording function, users can capture the vivid underwater world, creating vivid records of their adventures.



Figure 8: taking a photo.

The watch's capabilities of image capture and video recording redefine the way divers document their underwater experiences. The smooth operation, high-quality output, and integration with other features make this watch a reliable and versatile tool for capturing and preserving the wonders of the underwater world. Whether you are an avid underwater photographer or simply want to relive the magic of your dives, this watch stands as a testament to the convergence of technology and exploration.



Figure 9: recording the video

* 1. App

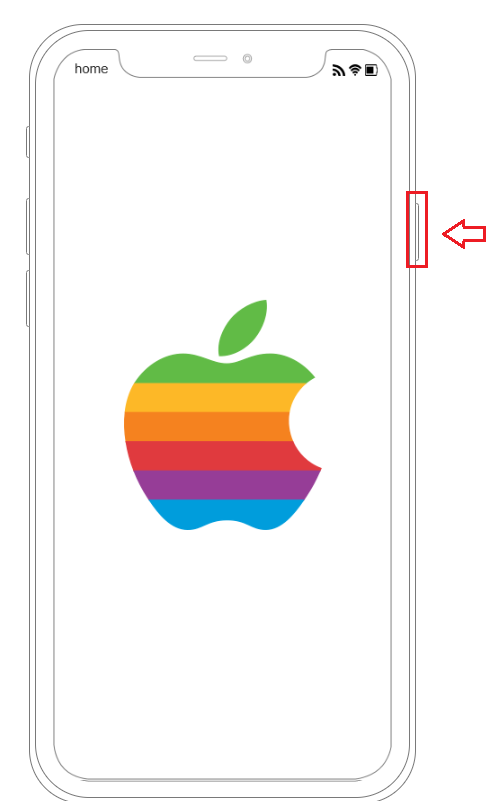


Figure 10:mobile devices

A mobile device is a smartphone whose main function is to save diving trip information, images, videos, and beautiful moments when the user goes scuba diving. When you press the open button on the right, the mobile device is started and the main screen is displayed.

A screenshot of a cell phone

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Figure 11: Home Page

The main screen of a mobile device includes an application to help users easily share beautiful moments, store images, videos, etc.

The first is the album application, which helps users store images and videos recorded on the watch. The second is the Story application, which helps users share beautiful moments during their diving time. The third is the Diving application, which helps users save a list of sea areas and times they have explored. The fourth is the Device application, which helps users connect their mobile device to the diving watch.

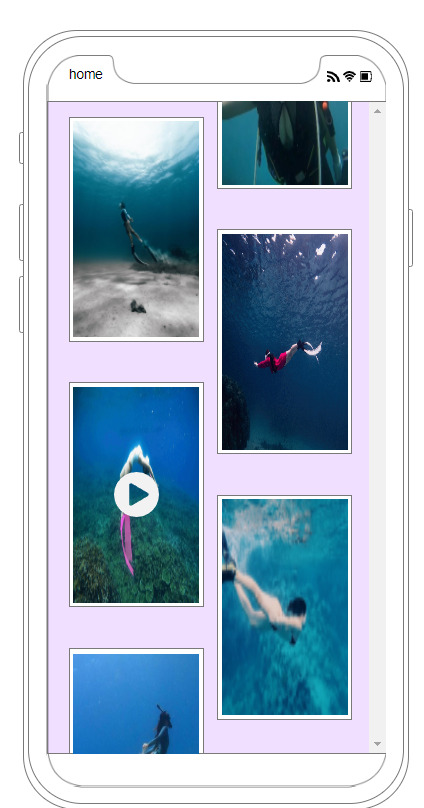


Figure12: Album Page

Select the Album app on your mobile device, and the interface will seamlessly transition to a screen dedicated to your photo and video library. The design philosophy behind this interaction is rooted in user-centric principles, aiming to provide a clear and intuitive path for users to access and explore their media content. The design of this display is carefully crafted to present content in an organized and aesthetically pleasing manner. And press "home" in the upper left corner to return to the main screen.

A screenshot of a cell phone

Description automatically generated

Figure13: Story Page

Choose the Story app to show off to your friends about your scuba diving trip. With the photo as the center to highlight the content the user wants to share, a small line of text describes the details of the posted photo, and below the photo is the time the article was posted. Above is the word "public" to notify that the article is in public mode and "ellipsis" helps users select many hidden functions such as editing the article, ... Below there is a trash can icon for users to use. Users can delete their posts, next to them is an emoticon so viewers can express their feelings about the post. And sharing icon so viewers can share with more people. And press "home" in the upper left corner to return to the main screen.

A screenshot of a cell phone

Description automatically generated

Figure 14: Diving Page

When selecting the Diving application, the screen switches to a screen containing a list of the user's diving trips. The centerpiece is a listing of each dive with name and date and featured photos. At the top is a search bar that helps users search for trips by name. Next to the search bar alf trash icon it will delete trips that the user does not want to save anymore. And press "home" in the upper left corner to return to the main screen.

A cell phone with a picture of a person swimming underwater

Description automatically generated

Figure 15: Diving Detail

When clicking on any trip, detailed information of that trip will be displayed. Pressing the arrow in the upper left corner will return to the list of dive trips and the home button will return to the main screen.

A screen shot of a smart watch

Description automatically generated

Figure16: Page Device

Connect to the watch, the user will click to select the Device application. The application will search for diving equipment and connect when clicking Connect.

A screenshot of a smart watch

Description automatically generated

Figure 17: Connect with device

When connecting successfully, a blue Connected Successfully message will appear and next to it is a Disconnect button when not in use anymore. The upper right corner will have the word "open device" to open the watch when connected successfully.

1. Research Study
2. Conclusion