Online Activity No. 8 and 9: Applying the User-Centred System Design Process

Objective

1. Innovate an existing interactive system and computer technology.
2. Perform and apply UCSD.

Materials

- Personal computer
- Any software for (Computer aided designs)or programming language

Background

Atakan(2006), UCSD is used in the design process. Reasons are evaluated why traditional-technology-focused design processes why it may result in unusable systems-and the consequences of those unusable or useless systems. This leads directly to a consideration of the different methodologies that go to make up a user-centered system design process.

Procedure

a.) Identify a scope or agenda
b.) Format for the document is given below as guide for the designers in the making the output both the document and design.

Chapter I. Introduction

Background of the study

Water scarcity and wastage remain critical concerns globally, especially in developing countries where resource management systems are outdated or inefficient. Households, businesses, and public institutions often rely on manual monitoring of water levels in tanks and reservoirs, which is not only time-consuming but also prone to human error. This inefficient system can result in water overflow, damage to property, or even depletion of water sources before replenishment is initiated.

Given these challenges, the study proposes the design and development of "AquaAligned**"**, an automatic water level monitoring system. This system uses sensors and real-time data to provide users with accurate information about water levels, allowing for timely decisions regarding water usage, storage, and refilling. By automating this monitoring process, the project aims to address the growing need for smarter, more sustainable water management solutions that align with the goals of environmental conservation and digital innovation.

Statement of the problem

1. **There is a lack of automated alert systems to inform users when water levels are critically low or nearing overflow.** Manual monitoring methods are inefficient and prone to human error, which can lead to water wastage, unregulated consumption, and potential system failure in water-dependent operations.

2. **Existing water level monitoring systems are often inaccessible due to high costs or lack of user-friendly interfaces.** Many available systems rely on complex installations or non-intuitive displays, making them impractical for average users who need a simple and reliable solution.

Assumption of the study

The proposed *AquaAligned* system will address the aforementioned problems through the following:

- **Water Level Detection**: The system uses ultrasonic water level sensors to accurately detect the current water level inside the tank.
- **Real-Time Monitoring**: Sensor data is continuously updated and displayed on a web-based dashboard for users to view the tank level remotely.
- **Threshold Alerts**: The system displays visual alerts on the website when the water reaches predefined low or high levels, immediately notifying the user.
- **Web-Based Interface**: The system features a user-friendly website that displays real-time readings and water level status, accessible via any device with internet access.
- **Data Logging:** The system stores previous water level data to help users track usage trends and manage water resources effectively.
- **Low Maintenance Design**: With a simple interface and durable hardware, the system ensures reliable monitoring with minimal user intervention.

These features validate the assumption that the proposed *AquaAligned* system can significantly improve water management by providing accurate, real-time, and remote monitoring of tank water levels through accessible and efficient technology.

Significance of the study

1. **Facility managers**
   They can use the system in schools, offices, or apartment buildings to automate water tank monitoring, reducing manual labor and ensuring uninterrupted water availability.
2. **Local communities**
   They can adopt the system in community water storage to ensure fair distribution and minimize wastage during periods of water scarcity.
3. **Environmental Advocates and Organizations**
   The system promotes sustainable water use and conservation efforts, contributing to broader ecological initiatives and awareness.

Chapter II. Research Design

The research design used by the developers in this project proposal is the User-Centered System Design (UCSD) model, because it ensures that the users' needs, wants, and expectations are met, and that a successful, intuitive, and relevant system is created to address the users' problems.

- **Task Analysis**

The primary tasks performed by the system are the following:

- Monitoring water tank levels using sensors (automated via water level sensors).
- Displaying real-time water level information on a web-based dashboard.
- Logging water usage and drainage data for reference.
- Accessing historical data through the web server.
- Allowing remote access via any device with a browser and internet connection.
- Preventing human error in manual measurements by automating volume tracking.

- **Requirements Gathering**

The following methods were utilized by the proponents to gather the necessary data needed in creating the proposal:

1. **Observation**: The team observed how manual draining and measurement of tanks often resulted in inaccurate estimations and inconsistent water use, particularly in agricultural settings.

2. **Interview**: Interviews were conducted with workers and supervisors in agricultural facilities to understand the frequency of errors and the specific pain points with manual checking.

3. **Survey/Questionnaire**: A short survey was given to potential users (farm staff and facility managers) to identify key features they want in a water level monitoring system.

User Requirements

- Accurate and real-time display of water level status.
- Web-based access that works across different devices.
- Simple and intuitive interface with visual indicators.
- Notification of irregular water levels.

Functional Requirements

- Monitor water levels through sensors.

- Store and display data in a web-based system.
- Provide real-time updates.
- Enable historical data viewing.

Data Requirements

- Water level sensor readings (in percentage or centimeters).
- Timestamped water drainage or fill logs.
- User login and access logs (optional for multi-user systems).

Environmental Requirements

- Outdoor/indoor agricultural water tanks.
- Must be operational in different weather conditions.
- Stable internet connection for real-time web server access.

Usability Requirements

- Simple dashboard with color-coded indicators.
- Accessible on mobile and desktop.
- Language-friendly (if multilingual support is required).
  Minimal training required for staff.

Designers Requirements

- Use low-cost but reliable water level sensors.
- Use a lightweight server setup (e.g., Flask or Node.js).
- Responsive design for cross-device compatibility.
- Ensure data is stored securely with backup options.

A. Storyboarding and Prototyping

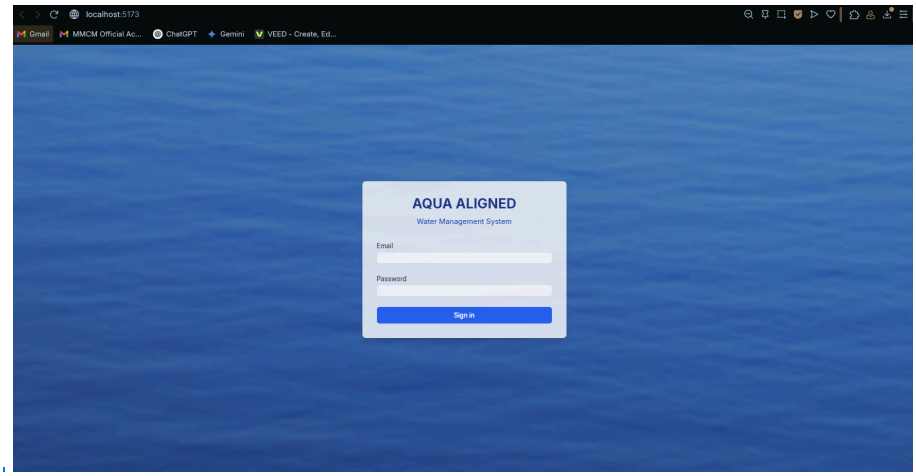
Storyboading:

The storyboard describes a use case for AquaAligned to monitor a water tank for usage. It highlights the capabilities and importance of realtime tracking.

Prototyping:

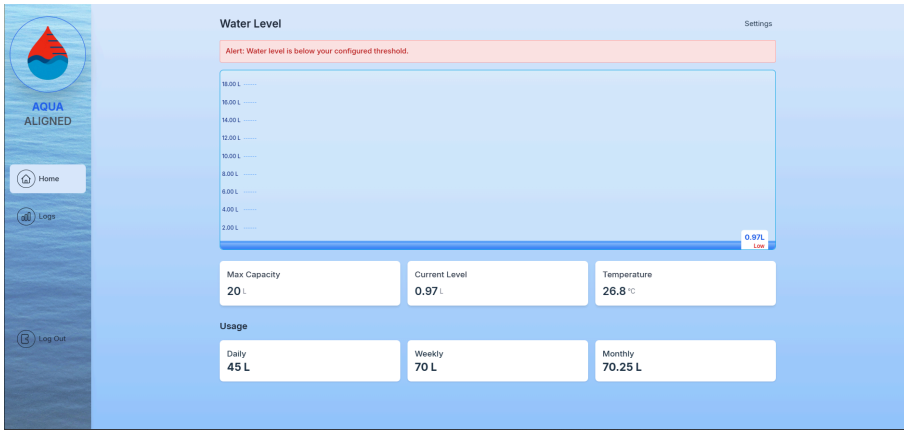
Opening and Login:

Upon opening the application users will arrive on the login screen to access the rest of the application.



Dashboard and settings:

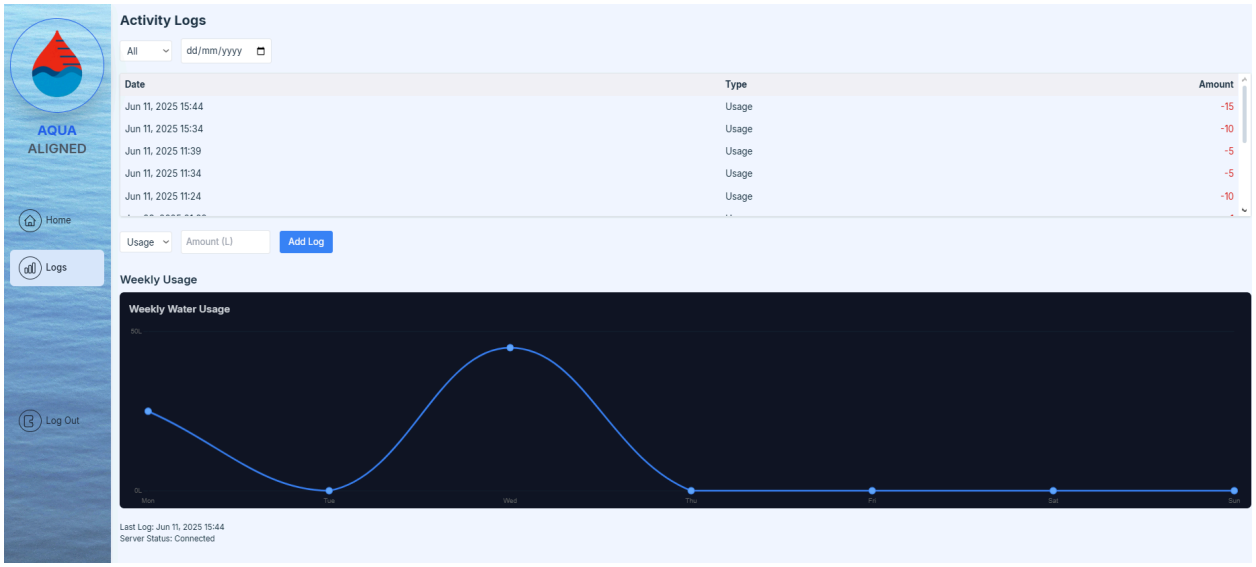
After successfully logging in, users can see the Dashboard that updates in realtime, displaying the maximum capacity, current water level, and temperature of the water of the tank. They can also see the usage in the daily, weekly, and monthly usage.



Clicking the settings allows users to set an alert threshold that triggers on the current water level. This is also where they give the dimensions of the tank for maximum capacity and tracking the water level.

Longview:

Users can also see the longview tab where they can create and view logs of usage and refills. Here they filter the logs as well. A weekly usage chart is seen below that displays the usage of the current week by day.



- **Evaluation of prototype**
  Use heuristic evaluation with format given below. This is the criteria of how the design will be graded. **(Select the best design among 3 to 5 alternative designs within your team and evaluate)**

Evaluation Criteria (Based on the 10 heuristics of design evaluation)

Area of Evaluation	5	4	3	2	1
A. Visibility of System Status - The system design provides appropriate feedback like message prompts in response to user actions.	x				
- The message prompts are clear, visible and understandable.	x				
B. Match between the system and the real world - Used words, phrases and concepts according to users' language rather than system oriented words and computer jargons.		x			
C. User control and freedom - The system design provides ways of allowing users to easily "get in" and "get out" if they find themselves in unfamiliar parts of the system.	x				
D. Consistency and Standards - The colors, text, labels, buttons and other elements in the design are uniform from start to finish**.**		x			
- Text and icons are not too small or too big.		x			
- Menus and other features of the system are arranged and positioned in a consistent way. (For ex. If your website has navigation buttons on the top under the page title on one page, the users will automatically look there for the same features on other pages.		x			
● **Error Prevention** - The system design provides an automatic detection of errors and preventing them to occur in the first place.		x			
- Idiot proofing mechanisms are applied		x			
F. Help users recognize, diagnose and recover from errors **-** Error messages and the terms used are recognizable, familiar and understandable for the users.		x			
G. Recognition rather than recall **-** Objects, icons, actions and options are visible for the user. - Objects are labeled well with text and icons that can immediately be spotted by the user and matched with what they want to do.	x				
H. Flexibility and efficiency of use	x				

- The system design provides easy to navigate menus. - the system does not make wasteful time of system resources.					
I. Aesthetic and minimalist design -Graphics and animations used are not difficult to look at and does not clutter (mess) up the screen. - Information provided is relevant and needed for the system design.		x			
J. Help and Documentation -the system design provides information that can be easily searched and provides help in a set of concrete steps that can easily be followed.		x			

Chapter III. Conclusion and Recommendation

Conclusion:

The development of AquaAligned: Automatic Water Level Monitor addresses the pressing need for efficient water monitoring in residential, agricultural, and industrial settings. By applying User-Centered System Design (UCSD) principles and integrating accessible IoT components such as water level sensors, an Arduino Uno, and web-based monitoring, the system offers a cost-effective and intuitive solution for real-time water level management.

AquaAligned enhances usability by providing a web-based interface that is simple, responsive, and accessible even to users with limited technical experience. The system focuses on visual clarity, responsiveness, and feedback, allowing users to monitor water levels remotely and receive alerts when thresholds are breached, preventing overflow or depletion.

This project not only presents a technological solution to a practical problem but also reinforces the importance of Human-Computer Interaction (HCI) in system design. The researchers developed empathy-driven design skills, refined their understanding of user needs through task analysis and prototyping, and strengthened their awareness of how interactivity and usability are central to real-world impact.

Recommendations:

- **SMS and Voice Alerts**
  Enable multi-channel alert systems such as SMS or voice calls for areas with limited access to stable internet.
- **Mobile App Integration**
  Develop a companion mobile application for more personalized control, push notifications, and real-time access.
- **Multi-Tank Support**
  Expand the system's capability to monitor multiple tanks simultaneously with individual thresholds and labels.

- **Data Analytics and Reports**
  Incorporate historical data logging and analytics to help users optimize water usage and detect patterns or leaks.