Project: Web Application for Aqualab Sensor Monitoring and Analysis
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Client: Dr.Turingan - Ocean Engineering and Marine Sciences
Date(s) of Meeting(s) with the Client for developing Plan: Tuesday, January 20th 2025

Overall goal and motivation (help make the intended users "happier," limitations/pains of current systems):
Goal: Our goal is to develop an intuitive, easy-to-use web application customized for the lab team to improve their research efficiency and minimize the time wasted on errors. The application will have the capability to connect with and receive data from the sensors. The application will display current sensor measurements to be accessed remotely and give alerts when measurements are out of the desired range to ensure the lab team can respond to errors quickly. The application will record all sensor data, automatically plot the data, and allow the user to filter through the data to simplify data analysis. The application will simplify disk storage management by informing users of the currently used local disk storage and allowing them to move or delete data.
Motivation: The current lab systems include several sensors that are not connected to any network or system. Data and measurements from the sensors are only available in the lab and cannot be monitored remotely or automatically recorded.

Approach (key features of the system):

Types of Users:
-Lab Team Leader: In charge of the lab team and is the main researcher with overall authority in all research decisions.
-Lab Team Assistants: Works for/under the lab team leader, supports the research effort, and reports back to the lab team leader.
-Lab Mechanical Engineer: Works for/under the lab team leader, supports the lab equipment and sensors, and ensures the research environment is properly set up.

1. Allows all users to connect sensors to the web application.
    a. Sensors include water quality sensors measuring the amount of CO2 in seawater, air quality sensors measuring the amount of CO2 in the air, and pressure sensors measuring the pressure of the environment.
2. Allows users to monitor current/recent data measurements from the sensors
    a. All users can view the current data measurements given by the sensors
    b. All users can receive an alert if measurements aren't in specified values/range
    c. The Lab Team Leader can set expected values/ranges for sensor measurements
3. Allows users (the Lab Team Leader and Assistants) to view and analyze all recorded data
    a. Users can view recorded data in plotted graphs
    b. Users can apply filters to data to view desired data
    c. Users can view calculated relationships between sensor data
    d. Users can export desired data into a CSV file and retrieve archived data files from the cloud

4. Allows users (the Lab Team Leader and Assistants) to manage disk storage easily
    a. Users can view currently used local disk storage from the web application
    b. Users can receive alerts when local disk storage is getting full
    c. Users can move recorded data to chosen secondary storage and/or delete chosen data.

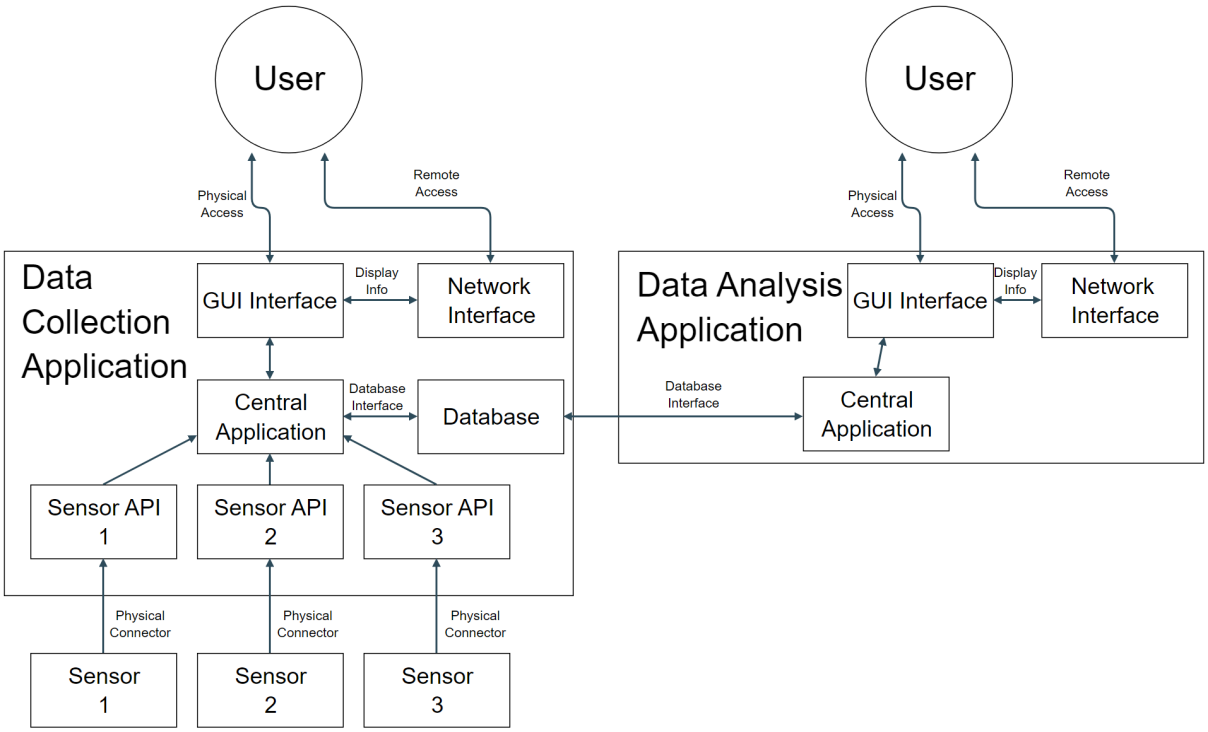
Novel features/functionalities: Discuss which features/functionalities, if any, are novel and why.

Working with and receiving input from specific sensors to display and be recorded by centralized software.

Technical Challenges: Discuss three main CSE-related challenges

- Collecting data and displaying it accurately in real time
- Ensuring database reliability and security for data collection and analysis
- Allowing users the ability to move/delete recorded data

Design: system architecture diagram:



Evaluation: how to measure success?:

- The system reliably stores the correct measurements for each sensor.
    - Verify the readings on the sensors are accurate in the database and displayed on the user interface.
- The system accurately displays real-time sensor measurements on the user interface.

        - Verify users are able to view the application home page and tabs to see accurate and updated data from all sensors of all tanks.
    - Remote access is quick and responsive.
        - A user can remotely access the application in under a minute, including clicking through application pages and viewing updated data.
    - User notifications are delivered appropriately.
        - Verify notifications are sent to the correct users using the correct method (email/text/both) and only when a sensor measurement is out of range. Verify notifications are sent in under a minute.
    - User interface is simple and intuitive.
        - Includes giving users a survey to quantify "look and feel" and ease of use as well as giving users different tasks to accomplish and measuring the time to quantify intuitiveness.

Progress Summary:

Module/feature	Completion	To Do
Back End	**70%**	**Functions independently but still needs interfaces with sensors and frontend**
Front End	**80%**	**Web server and GUI are functional. Missing the ability for the front end to communicate settings changes to the back end.**
Sensors	**20%**	**Most physical sensors have yet to be delivered. Stubs are currently playing the role of sensors for testing.**
Database	**60%**	**MongoDB Database is implemented and functional. Efficient retrieval and analysis needs to be implemented.**

Milestone 4 (Feb 24): itemized tasks:

- Implement, test, and demo interface between frontend, backend, and database
- Implement, test, and demo water sensor implementation
- Implement, test, and demo UI tweaks/improvements
- Implement, test, and demo additions to Analysis Tool (filtering, calculated data relationships, csv exporting)
- Implement, test, and demo user notifications

Milestone 5 (Mar 26): itemized tasks:

- Implement, test, and demo all sensor implementations
- Implement, test, and demo program recovery after shutdown

- Implement, test, and demo backing up data/disk space management
- Conduct evaluation and analyze results
- Create poster for Senior Design Showcase

Milestone 6 (Apr 21): itemized tasks:

- Implement, test, and demo final UI
- Implement, test, and demo user permissions
- Test/demo of the entire system
- Conduct evaluation and analyze results
- Create user/developer manual
- Create demo video

Task matrix for Milestone 4 (teams with more than one person)

Task	**Greg**	**Haley**	**Ruth**
Implement, test, and demo interface between frontend, backend, and database	80%	10%	10%
Implement, test, and demo water sensor implementation	10%	80%	10%
Implement, test, and demo UI tweaks/improvements	10%	10%	80%
Implement, test, and demo additions to Analysis Tool (filtering, calculated data relationships, csv exporting)	20%	60%	20%
Implement, test, and demo user notifications	40%	20%	40%

Description (at least a few sentences) of each planned task for Milestone 4:

- **Task 1:** In the current iteration, the backend and web server can function independently. They do not, however, interact with each other, instead relying on custom stubs for testing. In this milestone, we hope to connect the two working pieces of software to enable overall system functionality.

- **Task 2:** The Lab team has elected to use a water sensor they already have instead of buying a new model. In this milestone, we plan to connect to this water sensor to record test data for testing all system parts. Once all sensors have been delivered, we will utilize an Arduino or similar product to enable communication with all sensors simultaneously.
- **Task 3:** We will workshop with the lab team regarding their suggestions for the UI. While the current UI iteration is functional, several areas of the user experience can be polished to enable more efficient use.
- **Task 4:** This task includes adding and testing more functionality to the analysis tool, allowing users to filter the data they wish to see, displaying specific calculated relationships in the tool, and allowing users to export the data they are viewing and have filtered into CSV files for further analysis.
- **Task 5:** This task includes further implementing and testing the notification system to ensure the users are recent notifications at the appropriate time(when sensor measurements are out of range) and of the appropriate method(email/text/both).

Approval from Faculty Advisor

"I have discussed with the team and approve this project plan. I will evaluate the progress and assign a grade for each of the three milestones."

Signature: ___Dr Khaled Slhoub_____ Date: ____1/23/2025____