Water Quality Monitoring System
TEAM Design Term 231 - Team 06

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AquaSense

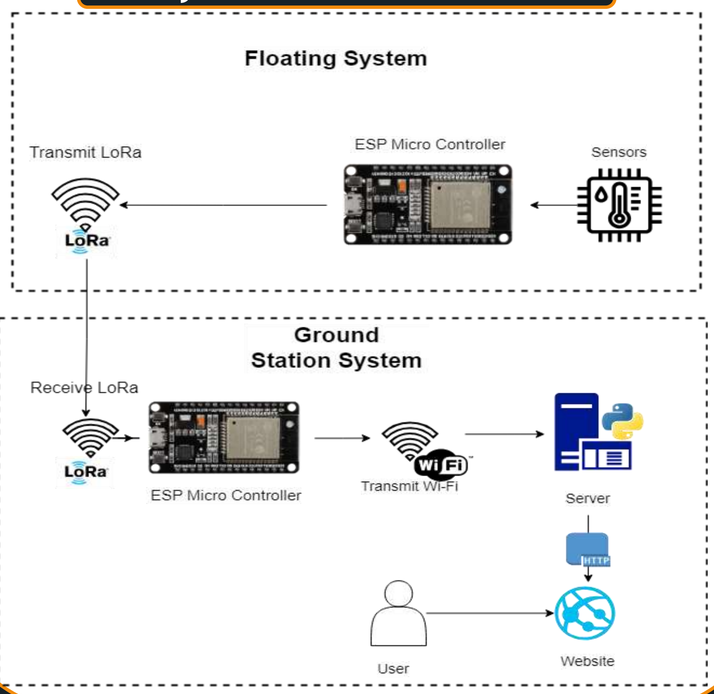
Introduction

- In Saudi Arabia, monitoring water quality, particularly for groundwater and wells, presents a significant challenge. AquaSense addresses this issue for customers seeking advanced water quality monitoring. Our advanced Water Quality Monitoring System utilizes advanced sensors and real-time monitoring, delivering accurate and instant results. The user-friendly interface, accessible via any web browser, enables customers to effortlessly track and interpret water quality data at their convenience.
  Our objective is to redefine water quality monitoring in Saudi Arabia with a focus on ensuring the safety of drinking water.

Specifications / Constraints

Target Specifications	Constraints
Water Quality data results with Accuracy >+15%-20% of the actual value	Harsh Environment: The system should withstand high temperatures and be water resistant
Completion of the entire process (measurement of parameters + communication + data processing) within 6 minutes	Communication: The system should have high communication range.
System operation efficiency (battery + sensors) up to temp of 40C	Lifespan: The system should have a long lifespan and not require high maintenance.
The system dimensions should not exceed 1m^3	Battery Life: The system should have high battery life
User-Friendly Program requiring zero learning time by users. The processed data will be directly presented through a website	
Ability to function at a depth of around 25m below the surface	

System Architecture



Sensors

PH

DO

TDS

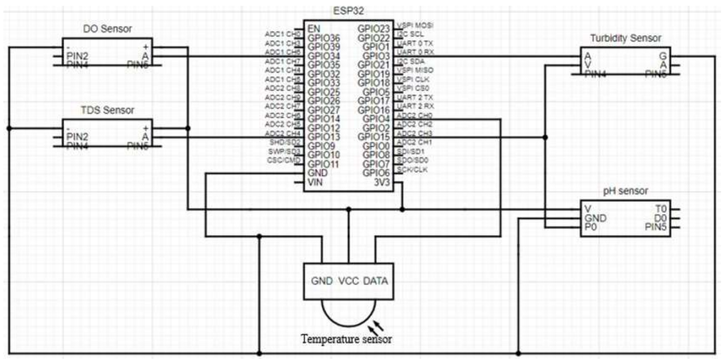
Turbidity

ESP

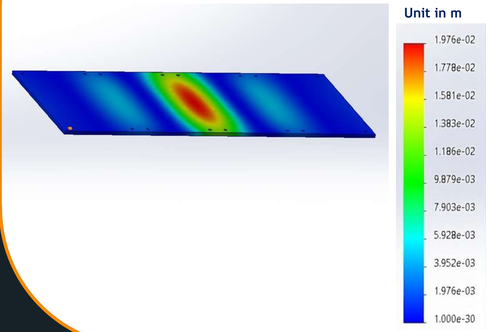
Temp

Sensor	Purpose
PH	PH sensor assesses the acidity or alkalinity of water. This crucial parameter indicates potential environmental stress, impacts on aquatic life, and effectiveness of water treatment.
Dissolved Oxygen (DO)	Crucial for aquatic ecosystems. They reveal the water's capacity to support life and help identify potential issues such as pollution or nutrient imbalance. DO sensor aids in sustainable water resource management.
Total Dissolved Solids (TDS)	TDS sensor measures the concentration of dissolved substances, providing insights into water purity. Furthermore, This parameter aids in detecting contaminants, salinity, and nutrient levels.
Turbidity	Turbidity sensors quantify water clarity by measuring suspended particle concentration, which indicates sedimentation, pollution, or algae presence.
Temperature	Monitoring water temperature is vital for understanding aquatic ecosystems, identifying potential stressors, and ensuring compliance with environmental standards.

Connection



Material Testing

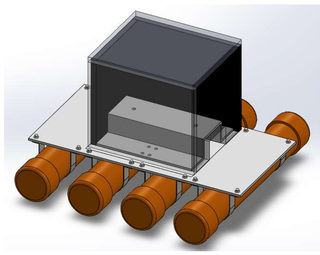


Ensures the structure aligns with safety and performance standards: Linear Static Analysis Solver has been used to run a simulation generating results such as stress distribution and deformation. Deflection resulted from the maximum stress generated of the normal axial force, illustrates negligible struct ural displacement in response to applied forces, providing insights into the plate's flexibility and compliance

Material Management

Bill Of Materials	Distinguishing Characteristics
HDPE	Recyclability, Strong and Durable, Screw Holding Capability
PVC Foam plastic Sheet	Lightweight, High Impact Strength, Thermal Insulation, Easy Fabrication
PU Foam	Perfect Thermal Insulation, Lightweight, Bonding Capabilities
PVC Pipes	Buoyancy Potential, Low Maintenance, Cost Effectiveness, Availability
Stainless steel 316L (Hinges, straps, ..etc.)	High Strength, Long Service Life, Corrosion Resistance, Durability.
Ethyl Vinyl Acetate (EVA)	Flexibility and Elasticity, Impact Resistance, Water Resistance

Prototype Specification



Considerations in Floating System Design: During the design phase of the floating system, a multitude of considerations:
Fitting Geometry for Wells Application: Deliberate selection of geometry tailored to wells application requirements.
Weight Distribution: Systematic management of weight distribution to optimize performance.
Buoyancy Force Requirements: Precise determination and incorporation of buoyancy forces essential for operational stability.
Material Management & Characteristics: Rigorous attention to material selection and its inherent characteristics to ensure structural integrity and functionality.

- Insulation of Heat, Humidity, and Environmental Resilience: Implementation of robust insulation strategies to shield against external influences such as heat and humidity. Rigorous ventilation systems to maintain optimal internal conditions, reducing maintenance needs and enhancing accuracy.
- Maintenance Reduction: Strategic design elements aimed at minimizing maintenance requirements for prolonged operational efficiency.
- Accuracy Enhancement: Integration of features designed to enhance precision and accuracy in system functionality.
- Stability Analysis: The system has undergone a comprehensive assessment concerning its stability adequacy under specific loading conditions.

Hydrostatic Analysis

The design process incorporates hydrostatics as a system to uphold equilibrium and buoyancy within a submersed environment.

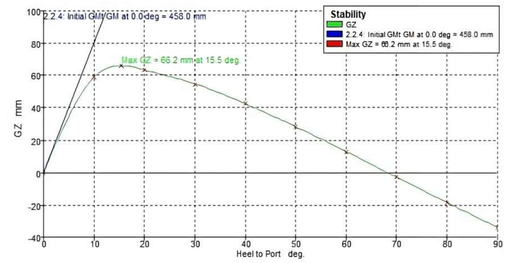
•Analysis of Forces: Rigorous examination of forces acting upon the hull is conducted to ascertain the vessel's stability, draft, and overall buoyant response.

•System Equilibrium: denotes the pivotal endeavor of sustaining balance within the aquatic medium, specifically in ground water scenarios, thereby enhancing safety and operational efficiency.

•Design Considerations: factors Like weight, buoyancy, and external forces as paramount elements in orchestrating equilibrium within the hydrostatic system.

•Equilibrium Assurance: The paramount objective of equilibrium lies in ensuring the vessel's poised orientation, facilitating adept maneuvering capabilities, and fortifying resilience amid varied ground water conditions.

Draft Amidships mm	Displacement kg	Heel deg	Draft at LCF mm	Trim (+ve by stern) mm	WL Length mm	Beam max extents on WL mm	Wetted Area mm^2	Waterpl. Area mm^2
57.8	9.104	0	57.8	0	541.9	540	254326.1	183846.8
Prismatic coeff. (Cp)	**Block coeff. (Cb)**	**Max Sect. area coeff. (Cm)**	**Waterpl. area coeff. (Cwp)**	**LCB from zero pt. (+ve fwd) mm**	**LCF from zero pt. (+ve fwd) mm**	**Immersion (TPc) tonne/cm**	**MTc tonne.m**	**RM at 1deg = GMt.Disp.sin(1) kg.mm**
0.529	0.529	1	0.628	272.4	277	0.002	0	55.3



Conclusion

- The achieved data results accuracy is within 99-98% of the actual value.
- The time required starting form data gathering to data analysis and display did not exceed 3 minutes
- All system equipment were proven to operate sufficiently at high temperatures.
- The Dimensions of the system is around 0.6m^3.
- The website is accessible and requires no learning time for users.