Proposal

Desalination System Using RO Method Powered by Solar Energy for Water Well in Coastal Areas of Yemen

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1. *Abstract:*

This proposal outlines the design and implementation of a desalination system using reverse osmosis (RO) technology powered by solar energy. The system aims to address the issue of high salinity levels in water wells, specifically targeting the coastal areas of Yemen, particularly Al-Hodaidah province. By employing a fully automated system that monitors sensor values and controls actuators, the proposed solution seeks to provide clean water with controlled salt levels. Additionally, an irrigation system and soil humidity controller will be integrated to optimize water usage for plant growth. The project emphasizes the development of an advanced and reliable software system, utilizing a friendly Human-Machine Interface (HMI) designed using the Flutter language.

2. Introduction:

Access to clean water is a critical challenge in many coastal areas of Yemen, where water wells often contain high levels of salts, reaching approximately 3000 to 4000 ppm. Traditional desalination methods are energy-intensive, making them impractical for regions with limited power resources. To address this issue, our graduation project proposes a sustainable solution that combines the RO desalination method with solar energy to reduce power consumption while ensuring efficient water purification. The integration of automated monitoring and control systems, as well as an optimized irrigation system, will contribute to the effective utilization of water resources.

3. Objectives and Features:

The primary objectives of our project are as follows:

- Design and construct a desalination system using RO technology.

- Implement solar energy as the primary power source for the system.

- Develop an advanced software system to automate monitoring and control processes.

- Incorporate an irrigation system with controlled salt levels and a soil humidity controller.

- Design a user-friendly HMI using the Flutter language.

- Optimize water usage for irrigation by implementing a specific schedule.

4. Methodology:

The proposed methodology for achieving our project objectives is as follows:

a) System Design and Construction:

- Analyze the water well characteristics, considering high salinity levels (3000-4000 ppm).

- Design and construct an RO-based desalination system.

- Integrate solar panels and batteries to provide sustainable power supply.

- Incorporate necessary sensors and actuators for system monitoring and control.

b) Software Development:

- Develop a comprehensive software system to monitor sensor values.

- Implement control algorithms to regulate actuator operations.

- Design a user-friendly HMI using the Flutter language.

- Utilize local server infrastructure for efficient data management and display.

c) Integration of Irrigation System:

- Design and integrate an irrigation system with controlled salt levels.

- Develop a schedule for optimized plant watering to minimize evaporation.

- Incorporate a soil humidity controller to ensure optimal water usage.

5. Budget and Timeline:

The project budget will include the following categories:

- Materials and components for system construction and integration.

- Solar panels, batteries, and related solar energy equipment.

- Software development and HMI design using the Flutter language.

- Irrigation system components and soil humidity controller.

- Testing and prototyping expenses.

- Contingency and miscellaneous costs.

The timeline for the project will be divided into the following phases:

- Research and system design: 2 months

- System construction and integration: 3 months

- Software development and HMI design: 2 months

- Integration of irrigation system and soil humidity controller: 1 month

- Testing, optimization, and documentation: 2 months

6. Expected Outcomes:

The anticipated outcomes of our project include:

- A fully functional desalination system utilizing RO technology.

- Clean water with controlled salt levels suitable for various purposes.

- Effective utilization of solar energy to reduce power consumption.

- Automation of monitoring and control processes through advanced software.

-An irrigation system with optimized water usage for plant growth.

- Improved water resource management in coastal areas of Yemen.

7. Principle of Working:

The proposed desalination system will operate based on the following principles:

- Water from the high-salinity water well will be pumped into the RO system.

- The RO membrane will remove salts and impurities from the water.

- Solar panels will generate electricity to power the system's components.

- Sensors will monitor various parameters such as salinity, water level, and temperature.

- Actuators will be controlled to optimize the system's performance.

- Clean water will be directed to the irrigation system and distributed to plants.

- Soil humidity will be monitored and controlled to ensure optimal water usage.

8. Team Management:

To ensure effective collaboration and communication within the research team, we will utilize GitHub and Notion as our primary tools for team management.

8.1 GitHub:

GitHub will serve as our version control platform, allowing team members to collaborate on the research project seamlessly. We will create a dedicated repository on GitHub to store and manage all project-related files, including research documents, code scripts, and datasets. This will enable version tracking, easy access, and simultaneous collaboration on different project components. GitHub's issue tracking system will be utilized to assign tasks, track progress, and address any technical challenges encountered during the research process.

8.2 Notion:

Notion will be used as our central communication and organization platform. We will create a shared workspace in Notion, where team members can collaborate, share updates, and maintain project documentation. Notion provides features like task lists, Kanban boards, and real-time collaboration, ensuring efficient task management and

clear communication. ***Additionally, we will utilize Notion for meeting agendas, scheduling, and keeping track of important research milestones and deadlines.***

By utilizing GitHub and Notion, we aim to streamline our team's communication, enhance productivity, and foster a collaborative environment that promotes effective research management and documentation. These tools will enable efficient coordination, easy access to project resources, and transparent communication channels for the entire research team.

9. Conclusion:

Our graduation project aims to develop a sustainable desalination system powered by solar energy to address the high salinity levels in water wells of coastal areas in Yemen, specifically Al-Hodaidah province. The proposed system will utilize RO technology, automation, and advanced software to achieve efficient water purification and irrigation. By optimizing water usage and controlling salt levels, the project seeks to contribute to the sustainable development of the region while ensuring a reliable and user-friendly operation.

10. References:

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6. https://www.sciencedirect.com/science/article/pii/S2666790821002445 (deep study in RO)
7. https://www.oas.org/dsd/publications/unit/oea59e/ch20.htm