PORTABLE SALINE WATER SYNTHESIZER AND PURIFIER

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Keywords:

Desalination, Distillation, Water Management, Solar Energy, Energy Efficient.

Introduction:

Due to the consequences of climate change, rapid urbanization, and population growth, there is a growing shortage of water on a global scale. Coastal regions, where conventional freshwater supplies are insufficient to meet growing demand. Even while traditional desalination methods are effective at turning seawater into drinkable water, they usually come with a high energy cost. There is an urgent need for portable, innovative, environmentally friendly, and economically viable desalination techniques that can minimize operating costs while providing a steady and reliable supply of freshwater to meet the needs of diverse sectors.

Objectives:

- The goal is to develop an portable desalination system using distillation techniques to produce clean, drinkable water efficiently.
- This system should focus on minimizing energy consumption and operational costs by using energy efficient technologies, reducing both its environmental impact and the expense of running it.
- It must also meet all regulatory standards for water quality to ensure the water is safe for consumption. The system will also be designed to meet the diverse water needs of different sectors, including residential, construction, and

industrial applications.

- Finally, the system aims to strengthen water security, particularly in coastal areas ensuring a reliable and long-term supply of freshwater.

Methodology:

The system works by allowing users to request a specific amount of desalinated water through a website, choosing whether it's for drinking, construction, or industrial use. Each type of water has different quality standards for dissolved solids (TDS), drinking water needs to have less than 500 TDS, construction water less than 700, and industrial water less than 1000. The water is first checked for TDS using a sensor controlled by an ESP32 microcontroller. The seawater is then heated in a distillation chamber until it evaporates, and the vapor is collected as fresh water. Once the water has been distilled, a second TDS test is done. If the water is used for human consumption, additional treatments are applied which includes adding minerals like calcium and magnesium. For construction or industrial water, no further treatment is needed. Throughout the process, the system continuously monitors water quality checking TDS, turbidity, pH, and temperature to ensure it meets the required standards. The system is fully automated by using a microcontroller it runs without much manual intervention, and it is designed to be scalable, so it can handle larger volumes of water or adjust treatment levels as needed. This makes the system efficient and flexible, providing clean water for various purposes.

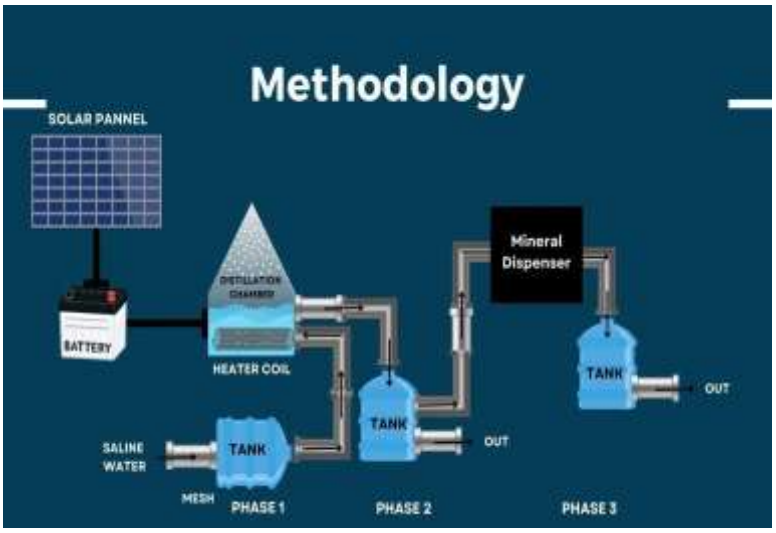

Figure 1:Block Diagram

Result and Conclusion:

The portable desalination system offers a practical solution to global water scarcity. With distillation, the system consistently delivers high-quality freshwater suitable for drinking, construction, and industrial use, reducing total dissolved solids (TDS) to safe level below 500 mg/L for drinking water, and safe levels for construction and industrial needs. With ESP32 microcontrollers and Firebase integration, the system provides real time monitoring of key water quality indicators such as TDS, turbidity, pH, and temperature, ensuring quality standards are maintained and adjustments can be made promptly. A user-friendly website interface enables easy system interaction, water requests, and live status updates. The modular design allows for flexible scaling to meet diverse needs from household to small scale industrial applications and ensures easy maintenance. This desalination system is a scalable, adaptable, and sustainable approach to water shortage challenges. Its robust performance, flexibility, and low environmental footprint make it a valuable asset in sustainable water management and future water security.

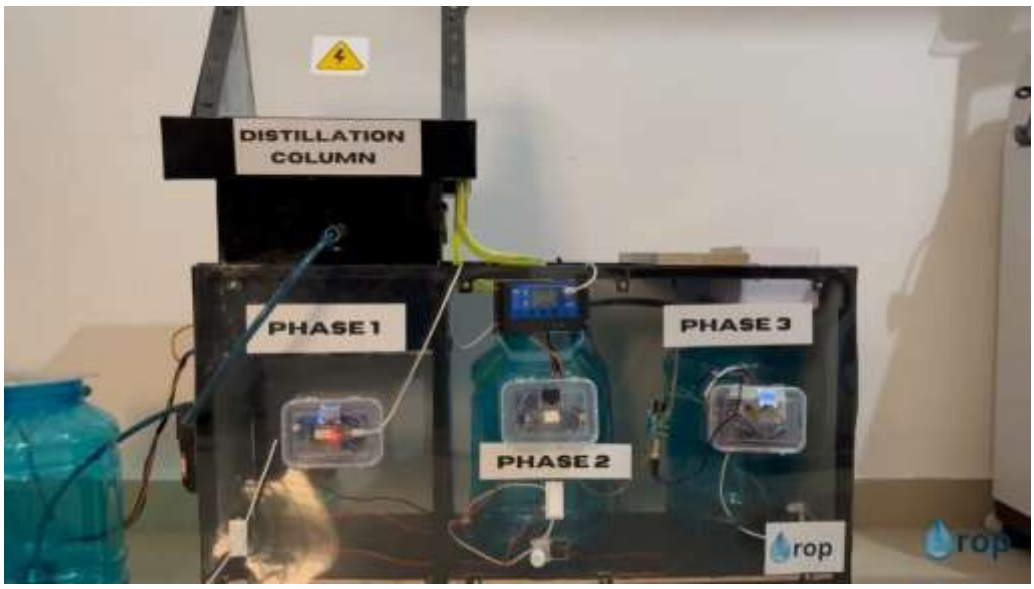

Figure 2: Final Prototype

Future Scope:

1. Renewable Energy Integration
2. Expansion of Sensor Capabilities