

ABSTRACT

The clean water crisis is still a major problem, especially in coastal and remote areas. Desalination technologies such as reverse osmosis and multi-stage flash distillation have constraints such as high cost and large energy consumption. This research designs and realizes a portable thermal evaporation-based desalination system integrated with Internet of Things (IoT) technology to provide an energy-saving, efficient, and practical solution.

The system works by heating seawater using a heater to produce steam, then condensing it into fresh water. The system is equipped with a MAX31865 temperature sensor, TDS sensor, ultrasonic sensor, and float switch, which are controlled by an ESP32 microcontroller. IoT integration with the Blynk platform enables real-time monitoring of temperature, water quality, and water level, as well as pump and heater control in two modes: manual and automatic.

The test results show that the system is capable of producing fresh water at an average rate of 2.7 mL/min with a range of desalinated TDS between 32 and 48 ppm, depending on the efficiency of the heating and condensation cycles. After calibration, the accuracy of the TDS sensor 89,3%, while the ultrasonic sensor reached 95.8% accuracy. The average efficiency of the desalination process reached 67.32%, demonstrating the effectiveness of the system in maintaining the volume of water resulting from evaporation and condensation. This performance makes the system feasible as a practical solution for clean water supply in areas with limited freshwater resources.

Keywords: Clean water, Desalination, ESP32, Thermal Evaporation, IoT, Portable, TDS