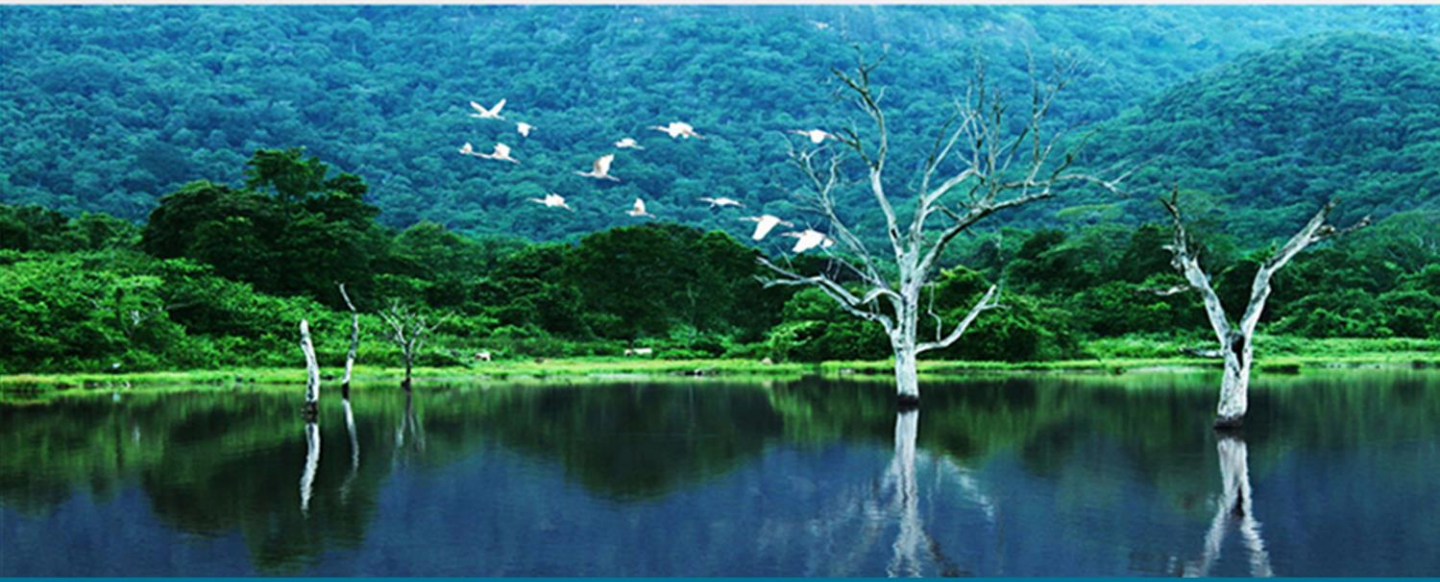
PROCEEDINGS

INTERNATIONAL SYMPOSIUM ON WATER QUALITY AND HUMAN HEALTH

2024

CHALLENGES AHEAD



History Culture Ecosystems Biodiversity Sustainability Livelihood Services Leisure Future

All begins with water

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PR07

DESIGNING CLOUD-CONTROLLED LABORATORY-SCALE WATER DESALINATION PLANT FOR RURAL COMMUNITY EDUCATION AND SKILLS DEVELOPMENT

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Tailored water membrane topology in response to variable water quality parameters is of paramount importance. The ability to customize and control membrane topology allows technologists to address water salinity fluctuations. Currently, a demonstrative laboratory-scale water desalination plant comprising reverse osmosis, nanofiltration, and ultra membranes has been developed. It includes a customizing facility designed to serve as an instructive tool for plant operators and technologists to assess the most suitable membrane topology. The plant automation was achieved on an ESP 32 platform. Low-powered microcontrollers (5 V) with embedded modules were used to control the water treatment plant. This module offers Node-RED nodes for building a live data dashboard. Also, it offers a text editor that runs in the browser to facilitate data to flow with a variety of configurations in the palette which can be instantaneously pushed to the runtime mode. The MQTT protocol was used to transfer data between the controller and the user interface (UI)-cloud. Five cycles of the water treatment plant, *viz*., purification, water filling, water flushing, low water level detection and rainwater flushing cycles were remotely controlled. In the dashboards (physical and virtual) an LED display panel appears with the Wi-Fi connectivity status. When the main switch is on and Wi-Fi connects the water treatment plant, the user can remotely control various segments, *i.e*., solenoids, pumps, TDS, pH sensors, etc. of the plant via the controller. The user can also manipulate the system in virtual mode to attain required training under treatment plant run time. A trained technologist by this method can provide services to the community in plant operation, daily cleaning, and user maintenance remotely. The ESP 32 platform demonstrates significant potential for the broader application of such systems in community-scale water treatment and lays the groundwork for future advancements. The conversion of the controller to a dedicated printed circuit board (PCB) module for use in community-scale water treatment plants is currently in progress.

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Keywords: ESP 32, Membrane topology, Microcontroller, MQTT protocol, Nanofiltration, Node-RED, Real-time monitoring, Reverse osmosis

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