

AI Applications in Ocean Energy Development Activities

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Today, the world faces several climate change-related issues due to environment pollution. The globe is seeing several alternate sources of renewable energy. Ocean energy includes power generated from Ocean thermal gradient, waves, and currents. In India, this development is led by the National Institute of Ocean Technology (NIOT). In ocean energy where new technologies can be tried and tested without affecting human settlement or the environment. Artificial Intelligence (AI) plays a major role in making ocean energy more efficient and reliable. Because the ocean is dynamic and unpredictable, AI helps manage complexity and improve performance in Ocean energy application. This paper talks about Internet of things (IoT) and Artificial Intelligence (AI) applications on ocean energy work carried out in NIOT ocean energy activities as few case studies.

Open Cycle (OC)-Ocean Thermal Energy Conversion (OTEC) is a promising technology in tropical islands for generation of power and freshwater from seawater. This OTEC technology uses the temperature gradient between warm surface sea water and cold deep-sea water for generation of electricity and freshwater. In order to control and operate the process remotely, there is a need to develop & incorporate smart automation system. This AI and IoT based smart system helps to optimize and forecast the process. In this process, the generation of power and freshwater depends on several parameters including the temperature gradient, mass flow rate, and pressure in the flash chamber. Change in any of the parameters will result in the drastic changes in the quality of power and freshwater generation. Hence, monitoring these OTEC parameters in real time plays a vital role in operating the plant more effectively. An Android/iOS Compatible User-Friendly mobile application has been created enabling the client for Real Time monitoring and which has display the historical parameters of the operation of plant. Also it has real time data of sea surface temperature (SST) from mobile based weather and Predictions application. Basically, the application has several math functions to monitor several plant performance parameters. All are linked with a single database. LSTM network has been deployed to forecast the SST (Sea Surface Temperature) by taking the past pre recorded data as input. Hyper parameter tuning is carried out by iterating over epochs thereby finding the best fit model. The indigenously developed software application based embedded controller can effectively perform and smart way demonstrated and being operational as a simulator in NIOT. Here the Open cycle OTEC desalination plant run automatically. The model system has already been developed and demonstrated at the laboratory and same enhanced model will be implemented in the upcoming plant at Kavaratti.

BIO DATA



Dr. Biren Pattanaik
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Expert members: International Standards IEC TC 114 and BIS ETD 54.

On job Experience:

- Eighteen years of experience in electrical and instrumentation engineering related to ocean energy.
- Leading of Electrical and Instrumentation (E&I) on research and development in Ocean renewable energy & freshwater (EFW).

Research work projects :

Involved in projects an ocean thermal energy conversation (OTEC) powered desalination plant in Kavaratti, as well as an OTEC-LTTD laboratory in the City of Chennai, a wave-powered navigational buoy, worked on a variety of research including desalination plants in Chennai and Lakshadweep Islands, a backward bent ducted buoy at Kamarajar Port and a wave energy plant in Vizhinjam, Kerala.

Major works on contribution :

Offshore instrumentation and data acquisition; desalination instrumentation and automation; and Design and development of electrical power takeoff systems.

Areas of Interest :

Developments of ocean energy technologies, Internet of Things (IoT) and Artificial Intelligence (AI) application in ocean energy and Desalination, Control and automation, Development of electric drives for Ocean energy devices on grid and off grid application, Underwater energy storage.

Publication:

- ✓ Patents granted : 2 Patent under process : 2
- ✓ International journal : 4
- ✓ Book chapter: 2
- ✓ Conferences : 24

Education:

- ✓ Bachelor of Technology in Electrical and Electronic Engineering from the Biju Patnaik University of Technology.
- ✓ Master of Technology in Ocean Technology and Management from the Institute of Technology Madras (IITM).
- ✓ Ph D in Anna University on topic AI-based predictive control schemes for OC-OTEC process.