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LIFE
BELOW WATER

SDG 14 - LIFE BELOW WATER

VELLORE INSTITUTE OF TECHNOLOGY,

VELLORE, TAMILNADU, INDIA - 632014

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ANNUAL REPORT

GOAL 14:
Life Below Water

Water bodies are indeed fundamental to the Earth's ecosystem, playing a crucial role in various aspects of our environment and daily lives. They offer essential services, including:

1. Rainwater Regulation: Water bodies, such as oceans, contribute significantly to the Earth's water cycle. They facilitate the evaporation of seawater, the formation of clouds, and ultimately the generation of rainfall. This rainfall is vital for agriculture and the sustenance of terrestrial ecosystems.
2. Oxygen Production: Oceans are a primary source of oxygen, generated through the photosynthesis of marine plants, especially phytoplankton. These microscopic organisms produce a substantial portion of the oxygen that we breathe.
3. Drinking Water: Many coastal communities rely on desalination of seawater to meet their freshwater needs, highlighting its critical importance for their survival.
4. Weather and Climate Regulation: Water bodies, particularly oceans, play a pivotal role in regulating climate patterns, impacting factors such as temperature and precipitation. They absorb and store heat, influencing global weather patterns and climate systems.

Vellore Institute of Technology (VIT) deserves recognition for its commendable contributions to marine conservation and raising awareness. Their initiatives encompass:

1. Education and Awareness: VIT actively engages in educating both students and faculty about the significance of marine diversity and its critical role in maintaining the planet's health.

2. Technical Conferences and Workshops: VIT regularly organizes conferences, workshops, and seminars dedicated to water conservation and management techniques. These events serve to raise awareness and promote sustainable practices.

3. Plastic Usage Reduction: The institution actively promotes the reduction of plastic consumption among faculty and students. This is particularly important because plastics are a major source of marine pollution. VIT has taken the laudable step of declaring its campus a plastic-free zone, setting an example for responsible plastic use.

4. Rainwater Harvesting: VIT's commitment to sustainability is evident through its rainwater harvesting efforts. The institution collects and filters rainwater from the campus, channeling it into a dedicated lake. This practice showcases a sustainable approach to water resource management.

5. Community Involvement: VIT actively involves the community through initiatives like public awareness rallies and river cleaning projects. Their efforts to clean the River Palar, a primary watercourse in the Vellore region, exemplify their dedication to social responsibility in preserving water bodies.

Vellore Institute of Technology (VIT) is making substantial efforts to raise awareness, educate, and actively contribute to the preservation and sustainability of water bodies, recognizing their indispensable role in supporting life on Earth.

Vellore Institute of Technology (VIT) and its faculty have been actively engaged in various sponsored research projects related to marine diversity and water resources. These projects demonstrate their commitment to advancing scientific knowledge and addressing critical environmental challenges. Some of the noteworthy projects include:

1. **Image Processing for Ocean Features:** This project, sanctioned by DRDO (Defense Research and Development Organization), Government of India, focuses on utilizing image processing techniques to extract ocean features from satellite imagery. Such work is vital for monitoring and understanding marine ecosystems.

2. **Tackling Ocean Acidification**: A project funded by DBT (Department of Biotechnology), Government of India, aims to engineer Prochlorococcus to address ocean acidification, a critical issue affecting marine life.

3. **Cyclonic Storm Prediction:** Sponsored under DST (Department of Science and Technology), Government of India, this project involves using high-resolution numerical modeling to predict extreme severe cyclonic storms in the North Indian Ocean, contributing to disaster preparedness efforts.

4. **Biobased Oil Nanoemulsion:** Another DST-funded project, this one focuses on the formulation and characterization of biobased oil nanoemulsions for controlling bacterial infections in aquaculture, with a special reference to fish and shrimp.

5. **Seaweed Antibacterial Research:** Funded by DST, this project investigates the antioxidant and antibacterial activity of seaweeds against fish bacterial pathogens, contributing to sustainable aquaculture practices.

6. **Antimicrobial Nanoparticles:** This DST-sponsored project examines the antimicrobial efficacy of polymer and semiconductor nanoparticles and their nanocomposites against fish pathogens.

7. **Marine Analogues and Chemical Transformations:** This project, sanctioned by Vellore Institute of Technology, explores marine analogues and their membrane damage mechanisms on fish pathogens, as well as chemical transformations of penipanoid C and Luotonin F.

8. **Probiotics for Freshwater Prawns:** Sponsored by Vellore Institute of Technology, this project investigates the use of probiotics as a feed for enhancing growth and disease resistance in freshwater prawns.

9. **Wastewater Treatment:** VIT has undertaken several projects related to the destruction of recalcitrant amoxicillin and the synthesis of novel carbon nitride nanostructures for pharmaceutical degradation in water and wastewater. These projects address the critical issue of pharmaceutical waste in water systems.

10. **Water Resource Development:** A project funded by DST explores the impounding of river floodwaters along the Dakshina Kannada Coast, offering a sustainable strategy for water resource development.

11. **Water Quantity Distribution:** Under BRNS (Board of Research in Nuclear Sciences), Government of India, VIT is involved in a project that focuses on the spatial distribution of water quantity parameters in specific regions.

12. **River Bank Filtration:** Another DST-funded project assesses the feasibility of river bank filtration for rural water supply around check dams in non-perennial rivers.

13. **Bioremediation with Bimetallic Nanoparticles:** This DST-sponsored project involves the preparation of biogenic bimetallic core-shell PdFe nanoparticles for wastewater bioremediation applications.

14. **Marine Nutraceuticals:** Sponsored by VIT, this project explores the use of marine nutraceuticals to control bacterial infections in aquaculture.

15. **Bioprospecting with Marine Actinomycetes:** Funded by DBT, this project focuses on constructing a library of polyketide synthase and non-ribosomal synthetase genes, as well as a natural product library from cultivable and uncultivable marine actinomycetes for bioprospecting.

These research projects reflect VIT's dedication to addressing marine and water-related challenges and contribute to the broader goal of preserving and sustaining our planet's ecosystems.

Event organised

Title: Harnessing Machine Learning in Advancing Marine Science and Technology
Date: April 20, 2022

Presenter:

Dr. Tien Anh Tran, Department of Marine Engineering, Vietnam Maritime University, Haiphong, Vietnam

Introduction:

The event titled "Harnessing Machine Learning in Advancing Marine Science and Technology" took place on April 20, 2022, featuring Dr. Tien Anh Tran from the Department of Marine Engineering at Vietnam Maritime University. The session aimed to explore the utilization of machine learning techniques in the context of marine science and technology.

Key Highlights:

1. **Insightful Presentation:** Dr. Tien Anh Tran commenced the session with a comprehensive presentation on the various ways in which machine learning is transforming marine science and technology. He emphasized the significant role of this technology in addressing complex challenges within the field.

2. **Applications in Marine Science:** The presentation covered several areas where machine learning techniques have been applied, such as oceanography, marine biology, and environmental monitoring. Machine learning is helping scientists analyze vast amounts of data, including ocean currents, marine life behavior, and the impact of climate change on marine ecosystems.

3. **Technological Advancements:** Dr. Tran highlighted how machine learning is driving advancements in autonomous marine vehicles and underwater robotics. These technologies are enabling more efficient data collection and exploration of the world's oceans.

4. **Environmental Impact Assessment:** Machine learning is being employed for environmental impact assessment and prediction. It is helping researchers and policymakers make data-driven decisions to protect marine environments.

5. **Collaboration and Knowledge Sharing:** The event facilitated discussions and knowledge sharing among attendees, fostering collaboration in the field of marine science and technology. Researchers, students, and professionals in attendance shared their insights and experiences.

Publications

Here is a list of research papers and articles related to various aspects of marine science, underwater technology, and related fields:

Marine Biology and Ecotoxicology:

1. "The toxicological effects of titanium dioxide nanoparticles on marine microalgae" - Thiagarajan V., Seenivasan R., Chandrasekaran N., Mukherjee A.

2. "Toxicity evaluation of nano-TiO2 in the presence of functionalized micro plastics at two trophic levels: Algae and crustaceans" - Thiagarajan V., Alex S.A., Seenivasan R., Chandrasekaran N., Mukherjee A.

Underwater Technology and Signal Processing:

3. "Image and signal processing in the underwater environment" - Reddy P.C.S., Pradeepa M., Venkatakiran S., Walia R., Saravanan M., Pillai V.J.

4. "An underwater cognitive acoustic network strategy for efficient spectrum utilization" - Mishachandar B., Vairamuthu S.

Nanotechnology and Biotechnology:

5. "Antioxidant and antibacterial activity of biogenic zirconium oxide nanoparticles from Candida orthopsilosis DSB1 isolated from backwaters of Sunderbans, West Bengal" - Sarkar A., Ghosh D., Das S., Rao K.V.B.

6. "Production of fibrinolytic protease from a halobacterium bacillus licheniformis vitlms isolated from marine sponges of Rameshwaram coast, India" - Kumar L.K.C., Samuel M.K., Mooventhan H., Arumugam M., Vaithialingam M., Chandrasekaran S.D.

7. "Antioxidant and antibacterial activity of Gelidium pusillum (Stackhouse) against Aeromonas caviae and its applications in aquaculture" - Agarwal P., Kayala P., Chandrasekaran N., Mukherjee A., Shah S., Thomas J.

Marine Environmental Studies:

8. "Diverse ocean noise classification using deep learning" - Mishachandar B., Vairamuthu S.

9. "Microplastics in seafood as an emerging threat to the marine environment: A case study in Goa, west coast of India" - Saha M., Naik A., Desai A., Nanajkar M., Rathore C., Kumar M., Gupta P.

Mathematical Modeling and Studies:

10. "Impact of overfishing of large predatory fish on algal blooms: A mathematical study" - Belshiasheela I.R., Ghosh M.

Underwater Data Analytics and IoT:

11. "Intelligent data analytics in energy optimization for the internet of under water things" - Arul R., Alroobaea R., Mechti S., Rubaiee S., Andejany M., Tariq U., Iftikhar S.

Environmental Science and Paleontology:

12. "Palaeoecological significances of deep-sea benthic foraminifera from Cascadia Margin, North East Pacific Ocean" - Thena T., Mohan K., Prakasam M., Saravanan K.

Biosensors and Virology:

13. "Detection of white spot syndrome virus in seafood samples using a magnetosome-based impedimetric biosensor" - Sannigrahi S., Arumugasamy S.K., Mathiyarasu J., Sudhakaran R., Suthindhiran K.

Computer Vision and Machine Learning in Marine Research:

14. "Fish species recognition using transfer learning techniques" - Murugaiyan J.S., Palaniappan M., Durairaj T., Muthukumar V.

Image Segmentation in Underwater Imaging:

15. "An efficient interactive segmentation algorithm using color correction for underwater images" - Sudhakar M., Meena M.J.

These articles cover a wide range of topics in marine science, from environmental impact studies to technological advancements in underwater exploration and marine biology.

A marine ecosystem can be defined as the intricate web of relationships between living organisms and their physical surroundings within the marine or oceanic realm. This ecosystem encompasses a diverse array of habitats, including the Open Ocean, coral reefs, estuaries, mangroves, seagrass meadows, and deep-sea environments.

Marine ecosystems possess a high degree of biological diversity and are instrumental in maintaining the well-being of our planet. These ecosystems offer a range of ecosystem services, including the production of oxygen, the sequestration of carbon, the regulation of climate, the cycling of nutrients, and the protection of coastlines. Furthermore, they support the fisheries and aquaculture industries, provide recreational opportunities, and possess cultural and aesthetic value.

Last two decades, Marine ecosystems are confronted with a multitude of challenges, such as overfishing, habitat destruction, pollution, climate change, and ocean acidification. These factors can hinder the intricate balance of marine ecosystems, resulting in the decline of biodiversity, deterioration of habitats, and the depletion of fisheries. It is imperative that appropriate measures are taken to mitigate these threats and preserve the health and resilience of these ecosystems.

To guarantee the lasting preservation of marine ecosystems, it is imperative to implement effective conservation and management strategies. Such efforts may include the establishment of marine protected areas, the implementation of sustainable fishing practices, and the reduction of pollution inputs, the promotion of habitat restoration, and the addressing of the impacts of climate change.

The preservation and responsible management of marine ecosystems are of utmost importance for both the health of aquatic life and the well-being of human communities that rely on these resources. As such, faculty, research scholars, students, and their collaborators at VIT are engaged in research aimed at conserving and sustainably utilizing the ocean, sea, and marine resources. As a result, seven notable publications have been produced from 2021 to 2022.

Publications

[1] B. Nirmal, K. Mohan, M. Prakasam, A. Tripati, P.G. Mortyn, L. Rodríguez-Sanz, Pleistocene surface-ocean changes across the Southern subtropical front recorded by cryptic species of Orbulina universa, Mar. Micropaleontol. 168 (2021) 102056. https://doi.org/https://-doi.org/10.1016/j.marmicro.2021.102056.

[2] T. Thena, K. Mohan, M. Prakasam, K. Saravanan, Palaeoecological significances of deep-sea benthic foraminifera from Cascadia Margin, North East Pacific Ocean, Reg. Stud. Mar. Sci. 47 (2021) 101949. https://-doi.org/https://doi.org/10.1016/j.rsma.2021.101949.

[3] R. Arul, R. Alroobaea, S. Mechti, S. Rubaiee, M. Andejany, U. Tariq, S. Iftikhar, Intelligent data analytics in energy optimization for the internet of underwater things, Soft Comput. 25 (2021) 12507–12519. https://-doi.org/10.1007/s00500-021-06002-x.

[4] T. Thena, K. Mohan, M. Prakasam, K. Saravanan, Early-Middle Pleistocene productivity changes of the Northern Cascadia Margin, Pacific Ocean, Polar Sci. 28 (2021) 100659. https://doi.org/https://doi.org/10.1016/j.po-lar.2021.100659.

[5] Belshiasheela I.R., Ghosh M., Impact of overfishing of large predatory fish on algal blooms: A mathematical study, Nonlinear Studies, Vol:27, Issue: 2, 405-413, 2021.

[6] Sudhakar M., Meena M.J., An efficient interactive segmentation algorithm using color correction for underwater images, Wireless Networks, 2021, Vol. 27 Issue 8, p5435-5446.

[7] Sudhakara M., Meena M.J., Reddy O., Mahalakshmi V., Balobaid A., A Study on Fish Classification Techniques using Convolutional Neural Networks on Highly Challenged Underwater Images, International Journal on Recent and Innovation Trends in Computing and Communication, 2022,10(4), 1-9, DOI: 10.17762/ijritcc.v10i4.5524