Integrative Approaches for Mitigating Microplastic Pollution in River Water: Insights from Deep Learning, Physico-Chemical Analysis, and Health Impacts Analysis in the Krishna River Ecosystem

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PROPOSAL DETAILS

(SPG/2024/002249)

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Technical Details :

Scheme :	SERB-POWER Grant		
Research Area :	Computer Science and Engineering (Engineering Sciences)		
Duration :	36 Months	**Contact No :**	+917730973355
Date of Birth :	05-Mar-1985		
Nationality :	INDIAN	**Total Cost (INR)**	25,26,728

Project Summary :

The proposed research project is highly significant in the current environment as it aims to solve crucial knowledge gaps regarding microplastic pollution in the Krishna River Basin. The Krishna River courses adjacent to the city of Vijayawada in the Indian state of Andhra Pradesh. Vijayawada is located on the northern side of the Krishna River. The Krishna River begins in the Western Ghats and flows eastward across the Deccan Plateau before ultimately reaching the Bay of Bengal. As it traverses Vijayawada, the river serves as a crucial water source for the neighboring territories, encompassing agricultural fields and urban zones. This research diverges from earlier studies that mostly concentrated on maritime environments by utilizing sophisticated technology, including the novel application of deep learning to analyzed imagery, in order to gain a more comprehensive understanding of microplastic movements. The incorporation of deep learning emerges as a crucial element, providing a detailed and extensive evaluation of high-resolution aerial images that will be gathered utilizing cameras mounted on drones. This methodology allows for the recognition of spatial and temporal patterns, hence providing a thorough comprehension of the origins of contamination. By incorporating chemical analysis of water samples simultaneously, the precision of the inquiry is enhanced, allowing for a broader field of study, and providing specific information on the types, concentrations, and features of microplastics. The utilization of modern imaging and chemical analysis in a dual methodology not only enhances our understanding of the magnitude of microplastic contamination but also assists in identifying its origins. The collected data is essential for accurately identifying the source, which enables the formulation of focused and well-informed solutions to mitigate the issue. This research project seeks to make a substantial contribution to worldwide efforts in mitigating microplastic contamination by addressing current gaps in knowledge. Fundamentally, the significance of this undertaking goes beyond its potential influence on local environmental administration. The larger scientific contributions of this align with worldwide efforts to tackle the growing problem of microplastic pollution. Furthermore, the study's investigation of the microbial components of microplastic pollution, assessing microbial interactions and potential hazards to human health, enhances its importance in thoroughly tackling this environmental problem. The proposed research project aligns with several of the United Nations Sustainable Development Goals (SDGs), primarily focusing on Goal 6: Clean Water and Sanitation, Goal 12: Responsible Consumption and Production, Goal 14: Life Below Water, and Goal 15: Life on Land. By studying microplastic pollution in the Krishna River Basin, the research contributes to ensuring the availability and sustainable management of water resources (Goal 6).

Objectives :

• Source Identification and Distribution Mapping: With a focus on the Krishna River, this study aims to investigate the origins, migration routes, and distribution of microplastics in river water ecosystems.
• Seasonal and Diurnal Impact Analysis: Using established methodologies (WHO, IS, etc.), determine how different water physicochemical factors affect the composition and dispersion of microplastic hazards.
• Deep Learning Model Development: The goal of this project is to create a model that uses deep learning to identify and categorize microplastics in aerial photos of the Krishna River.
• Integration of Phsico-Chemical Analysis and Deep Learning predictions The goal of this study is to better understand and manage microplastic contamination in water bodies by combining physico-chemical analysis with deep learning predictions.
• Assessment of Microplastics Impact on Human Health and the Environment: To evaluate the possible dangers of microplastics in the Krishna River, with a focus on the ecological and health concerns.

Keywords :

Microplastic pollution,Krishna River Basin,Deep learning,Chemical analysis,Source identification, Human health risks

Expected Output and Outcome of the proposal :

• In-depth information and maps showing where microplastics in the River Krishna come from and how they make their way to different locations.
• Determine which physicochemical factors are associated with microplastics in the water of the River Krishna.
• Building a strong deep learning model for reliable microplastic classification and detection.
• Integration and analysis of diverse datasets and methods to provide a comprehensive understanding of microplastics pollution in the River Krishna.
• Thorough reporting on a regular basis detailing findings on microplastic levels and environmental factors.
• Effective strategies to address the issue of microplastics pollution, protecting both the environment and human health. Benefits
• Setting up a helpful resource for environmental researchers, policymakers, and stakeholders to use in making decisions based on evidence and planning for the future.
• Better knowledge of microplastics' effects on ecosystems and human health, which can inform public health and legislative efforts.
• Using this information, we can craft mitigation strategies that can help local governments tackle microplastic contamination at its source.
• The project's support for the Sustainable Development Goals (SDGs) shows that it will contribute to worldwide sustainability initiatives, especially in the areas of water quality, urban sustainability, responsible consumerism, and marine life.

Any other relevant information:

The proposed

Suitability of the proposed work in major national initiatives of the Government:

Swachh Bharat, Smart Cities

Theme of Proposed Work:

Environment, Water

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