Deep Learning-based Automated Detection and Quantification of Micro plastics in Aquatic Environments and Agricultural Soils: A Comprehensive Monitoring Framework

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Saved By : Dr. K Devi Priya

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PROPOSAL DETAILS

Dr. K Devi Priya

k.devipriya20@gmail.com

ASSOCIATE PROFESSOR(COMPUTER SCIENCE AND ENGINEERING)

Lakireddy Bali Reddy College of Engineering

L.b.reddy nagar, mylavaram, krishna district, Krishna, Andhra pradesh-521230

Technical Details :

Scheme :	Start-up Research Grant		
Research Area :	Computer Engineering (Engineering Sciences)		
Duration :	24 Months	**Contact No :**	+917730973355
Date of Birth :	05-Mar-1985		
Nationality :	INDIAN	**Total Cost (INR) :**	17,70,000

Project Summary :

The project proposal aimed at developing a comprehensive monitoring framework to detect and quantify microplastics in aquatic environments and agricultural soils. In this summary, we will explore the project's objectives, methods, and expected outcomes. The issue of microplastics pollution has gained significant attention worldwide due to their harmful effects on the environment and human health. Microplastics are small plastic particles that are less than 5 millimeters in size, and they are found in various forms, including micro-beads, micro-fibers, and micro-fragments. They are known to accumulate in aquatic environments and agricultural soils, leading to serious ecological and health concerns. Therefore, there is a need for effective monitoring and detection methods that can accurately quantify the concentration and distribution of microplastics in these environments. The proposed project aims to develop an automated detection and quantification framework using deep learning techniques to detect and quantify microplastics in aquatic environments and agricultural soils. The project's primary objectives are to: • Develop a deep learning-based model to detect and classify microplastics in water bodies and agricultural soils. • Integrate this model with IoT sensors to automate the detection and quantification process. • Develop a comprehensive monitoring framework for continuous monitoring of microplastics in aquatic environments and agricultural soils. To achieve these objectives, the project will utilize various deep learning techniques, including Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and Generative Adversarial Networks (GANs), to develop a robust and accurate detection model. The model will be trained on publicly available datasets, such as the NOAA Marine Debris Program Dataset and the InSitu Microplastic Dataset, and validated on real-world data collected from water bodies and agricultural soils. The project will also integrate the deep learning model with sensors, such as water quality sensors and soil quality sensors, to capture data set The sensors will collect data on water and soil quality, and the deep learning model will analyze the data in real-time to detect and quantify microplastics. In conclusion, the proposed project aims to develop an automated detection and quantification framework using deep learning techniques to detect and quantify microplastics in aquatic environments and agricultural soils. The project's expected outcomes include a deep learning-based model for microplastics detection, integration of the model with IoT sensors, and a comprehensive monitoring framework for continuous monitoring of microplastics in these environments. The project's outcomes will contribute to the development of effective strategies to address the issue of microplastics pollution, protecting both the environment and human health.

Objectives :

• The proposed project aims to develop a comprehensive monitoring framework to detect and quantify microplastics in aquatic environments and agricultural soils. The project objectives are:
• To develop a deep learning-based model for accurate detection and classification of microplastics in water bodies and agricultural soils.
• To integrate the deep learning model with IoT sensors to automate the detection and quantification process in real-time.
• To develop a comprehensive monitoring framework that can provide continuous monitoring of microplastics in aquatic environments and agricultural soils.

Keywords :

Microplastics,Deep learning,Aquatic environments,Agricultural soils,Automated detection,Monitoring framework

Expected Output and Outcome of the proposal :

The expected outcomes of the project are: • A deep learning-based model for accurate detection and classification of microplastics in water bodies and agricultural soils. • Integration of the deep learning model with IoT sensors to automate the detection and quantification process in real-time. • A comprehensive monitoring framework that can provide continuous monitoring of microplastics in aquatic environments and agricultural soils. • Real-time information on the concentration and distribution of microplastics, enabling policymakers and stakeholders to take appropriate actions to address the issue. •Effective strategies to address the issue of microplastics pollution, protecting both the environment and human health.

Deep Learning-based Automated Detection and Quantification of Micro plastics in Aquatic Environments and Agricultural Soils: A Comprehensive Monitoring Framework

Abstract: Microplastics have become a major environmental concern due to their widespread occurrence in aquatic environments and agricultural soils. Microplastics are small plastic particles that are less than 5 millimeters in size, and they are found in various forms, including micro-beads, micro-fibers, and micro-fragments. They are known to accumulate in aquatic environments and agricultural soils, leading to serious ecological and health concerns. Therefore, there is a need for effective monitoring and detection methods that can accurately quantify the concentration and distribution of microplastics in these environments. The current methods for detecting and quantifying microplastics are time-consuming and require skilled personnel. This proposal presents a comprehensive monitoring framework based on deep learning for automated detection and quantification of microplastics in aquatic environments and agricultural soils. The proposed methodology includes image acquisition, pre-processing, feature extraction, classification, and quantification on publicly available datasets and acquires the realtime data using sensor based and microscopyapproach. The objectives of this proposal are to develop an automated system for microplastic detection and quantification using advance deep learning algorithms and evaluate the expected outcomes. The proposed framework has the potential to enhance the monitoring of microplastics in aquatic environments and agricultural soils and contribute to effective management strategies.

Keywords: Microplastics,Deep learning,Aquatic environments,Agricultural soils,Automated detection,Monitoring framework

Introduction:

Micro plastics are small plastic particles, typically less than 5mm in size, that have become an increasing concern for the environment. They can be found in various ecosystems, such as oceans, freshwater bodies, and soils, and pose a threat to wildlife and human health [1-2]. The environmental impact of micro plastics is multifaceted. In aquatic ecosystems, micro plastics can be ingested by marine organisms, leading to physical harm, toxicity, and death [3]. Micro plastics can also accumulate in the food chain, potentially leading to harm for organisms at higher trophic levels, including humans. Additionally, micro plastics can transport harmful pollutants and pathogens, potentially spreading them throughout the environment [4]. In soils, micro plastics can negatively impact soil health and crop growth. They can alter the physical and chemical properties of the soil, affecting nutrient cycling and water retention. Micro plastics can also potentially harm soil organisms, leading to potential impacts on soil biodiversity and ecosystem functioning [5-6].

The widespread use of plastics in daily life has contributed to the increasing prevalence of micro plastics in the environment. Micro plastics can enter the environment through various sources, including plastic waste, textiles, and personal care products. Improper disposal of plastic waste, such as littering and dumping into water bodies or soil, can also contribute to the problem [7].

To mitigate the environmental impacts of micro plastics, various approaches have been proposed, including reducing plastic use, improving waste management practices, and developing innovative technologies for micro plastic detection and removal [8]. It is important to address the issue of micro plastics to protect the environment, human health, and the food chain. The current methods for micro plastic detection and quantification are time-consuming and require skilled personnel. The traditional methods involve visual inspection, filtration, and chemical analysis, which are labor-intensive and expensive. The development of an automated system for microplastic detection and quantification can potentially overcome these limitations.

Related Work:

Recent studies have proposed various methods for microplastic detection and quantification, including spectroscopy, microscopy, and chemical analysis. Spectroscopy-based methods include Raman spectroscopy and Fourier-transform infrared spectroscopy (FTIR) [9-10]. These methods can provide information on the chemical composition of microplastics but require skilled personnel and are time-consuming. Microscopy-based methods include optical microscopy and electron microscopy. These methods are commonly used for visual inspection and counting of microplastics. However, they are labor-intensive and require skilled personnel. Chemical analysis-based methods include gas chromatography-mass spectrometry (GC-MS) and liquid chromatography-mass spectrometry (LC-MS) [11-12]. These methods can provide information on the chemical composition and quantity of microplastics but require extensive sample preparation and are expensive.

Objectives:

The proposed project aims to develop a comprehensive monitoring framework to detect and quantify microplastics in aquatic environments and agricultural soils. The project objectives are:

1. To develop a deep learning-based model for accurate detection and classification of microplastics in water bodies and agricultural soils.
2. To integrate the deep learning model with IoT sensors to automate the detection and quantification process in real-time.
3. To develop a comprehensive monitoring framework that can provide continuous monitoring of microplastics in aquatic environments and agricultural soils.

The project outcomes will contribute to the development of effective strategies to address the issue of microplastics pollution, protecting both the environment and human health.

Proposed Methodology

The proposed methodology for automated detection and quantification of microplastics in aquatic environments and agricultural soils is based on deep learning. The framework includes the following steps and depicted in figure1:

Image Acquisition: The first step is to acquire images of microplastics from aquatic environments and agricultural soils. The images can be obtained using various techniques, including optical microscopy, electron microscopy, and spectroscopy and also uses publicly available datasets like NOAA Marine Debris Program Dataset and the InSitu Microplastic Dataset.

Pre-processing: The acquired images undergo pre-processing to enhance the image quality and remove noise. The pre-processing techniques include image filtering, image normalization, and image segmentation.

Feature Extraction: The pre-processed images are then used to extract relevant features using deep learning algorithms such as convolutional neural networks (CNNs). The CNNs can learn the features of microplastics, such as shape, size, and texture, which can be used for classification and quantification.

Classification: The extracted features are then used for microplastic classification. The classification can be performed using various deep learning algorithms including Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and Generative Adversarial Networks (GANs), to develop a robust and accurate detection model[13-15]. The model will be trained on publicly available datasets, such as the NOAA Marine Debris Program Dataset and the InSitu Microplastic Dataset, and validated on real-world data collected from water bodies and agricultural soils[6].

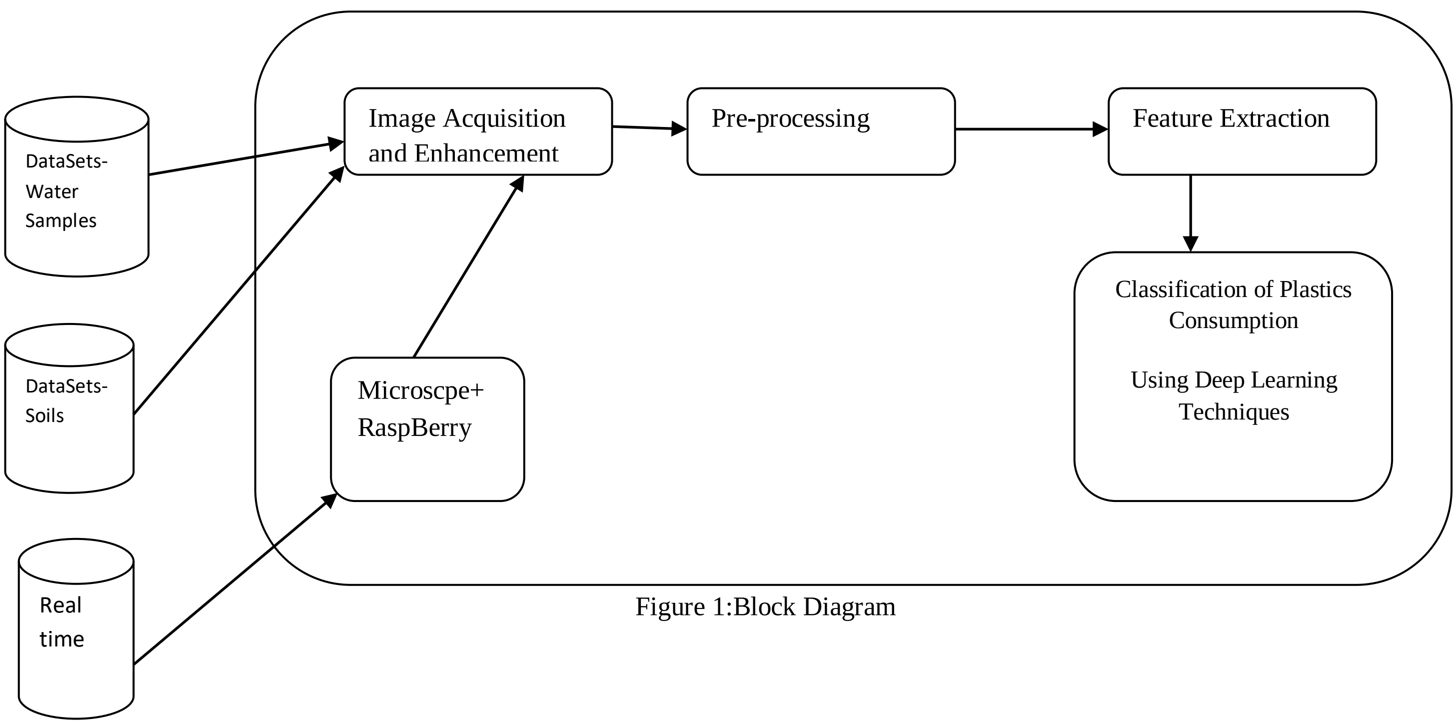

Figure 1:Block Diagram

publicly available datasets: NOAA Marine Debris Program Dataset and the InSitu Microplastic Dataset.

The project will also integrate the deep learning model with IoT sensors, such as water quality sensors and soil quality sensors, to automate the detection and quantification process. The sensors will collect data on water and soil quality, and the deep learning model will analyze the data in real-time to detect and quantify microplastics.

Finally, the project will develop a comprehensive monitoring framework for continuous monitoring of microplastics in aquatic environments and agricultural soils. The framework will include the integration of the deep learning model with IoT sensors, data storage, and analysis, and visualization tools. The framework will provide real-time information on the concentration and distribution of microplastics, enabling policymakers and stakeholders to take appropriate actions to address the issue.

Expected Outcomes:

The expected outcomes of the project are:

- A deep learning-based model for accurate detection and classification of microplastics in water bodies and agricultural soils.
- Integration of the deep learning model with IoT sensors to automate the detection and quantification process in real-time.
- A comprehensive monitoring framework that can provide continuous monitoring of microplastics in aquatic environments and agricultural soils.
- Real-time information on the concentration and distribution of microplastics, enabling policymakers and stakeholders to take appropriate actions to address the issue.
- Effective strategies to address the issue of microplastics pollution, protecting both the environment and human health.

Conclusion

In conclusion, the proposed project aims to develop an automated detection and quantification framework using deep learning techniques to detect and quantify microplastics in aquatic environments and agricultural soils. The project's expected outcomes include a deep learning-based model for microplastics detection, integration of the model with IoT sensors, and a comprehensive monitoring framework for continuous monitoring of microplastics in these environments. The project's outcomes will contribute to the development of effective strategies to address the issue of microplastics pollution, protecting both the environment and human health.

Estimated Budget in Rs.:

SI.	Items	Project Cost (Own share in Lakh)
i.	Outsourcing charges for R&D/Design Engg./Consultancy/Testing/Expert cost-Laboratory analysis, MicroScope,Data Collection etc.,	10L
ii.	Raw materials/consumables/spares-Water Sensors, Agriculture Sensors, Data Servers,GPU	5L
iii.	Fabrication/synthesis charges of working model or process	1.5L
iv.	Business travel and event participation Fees -Conferences (Ceiling of 10% of approved project cost)	1.5L
v.	Patent Filing Cost (PCT- Ceiling of 10% of approved project cost)	1L

vi.	Contingency (Ceiling of 10% of approved project cost)	1L
vii.	Total Cost	20L

References

[1] John, Juliana, et al. "Microplastics in mangroves and coral reef ecosystems: a review." Environmental Chemistry Letters (2022): 1-20.

[2] Priya, A. K., et al. "Microplastics in the environment: recent developments in characteristic, occurrence, identification and ecological risk." Chemosphere (2022): 134161.

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[15] N. Manav, C. Dey, and S. Ghosh, "Detection of Microplastics in Freshwater Using Transfer Learning and Deep Convolutional Neural Network," Journal of Hazardous Materials, vol. 408, p. 124919, 2021. https://doi.org/10.1016/j.jhazmat.2020.124919

[16] L. B. Zawrah and M. A. Abdel Wahab, "Deep Learning for Automatic Detection of Microplastics in Agricultural Soil Using Hyperspectral Imaging," Journal of Environmental Management, vol. 284, p. 112030, 2021.

Institution wise Budget Breakup :

Budget Head	Lakireddy Bali Reddy College of Engineering	Total
Research Personnel	9,60,000	**9,60,000**
Consumables	5,00,000	**5,00,000**
Travel	1,40,000	**1,40,000**
Other cost	70,000	**70,000**
Overhead	1,00,000	**1,00,000**
Total	**17,70,000**	**17,70,000**

Institute Name : *Lakireddy Bali Reddy College of Engineering*

Year Wise Budget Summary (Amount in INR) :

Budget Head	Year-1	Year-2	Total
Research Personnel	4,80,000	4,80,000	**9,60,000**
Consumables	5,00,000	0	**5,00,000**
Travel	70,000	70,000	**1,40,000**
Other cost	50,000	20,000	**70,000**
Overhead	50,000	50,000	**1,00,000**
Grand Total	**11,50,000**	**6,20,000**	**17,70,000**

Research Personnel Budget Detail (Amount in INR) :

Designation	Year-1	Year-2	Total
PI/Project Coordinator I	4,80,000	4,80,000	**9,60,000**

Consumable Budget Detail (Amount in INR) :

Justification	Year-1	Year-2	Total
GPU,Sensors,Server	5,00,000	0	**5,00,000**

Travel Budget Detail (Amount in INR) :

Justification (Inland Travel)	Year-1	Year-2	Total
Fieldwork, Conference -travel	70,000	70,000	**1,40,000**

Overhead Budget Detail (Amount in INR) :

Justification	Year-1	Year-2	Total
Contingency	50,000	50,000	**1,00,000**

Other Budget Detail (Amount in INR) :

Description/Justification	Year-1	Year-2	Total
Patent Patent	50,000	20,000	**70,000**

PROFORMA FOR BIO-DATA (to be uploaded)

1. Name and full correspondence address Dr.K Devi Priya,16-121/A,Bhavani Nagar,Mylavaram

2. Email(s) and contact number(s):k.devipriya20@gmail.com

3. Institution: Lakireddy Bali Reddy College of Engineering,Mylavaram,Andhrapradesh,India

4. Date of Birth:26-02-1985

5. Gender (M/F/T):F

6. Category Gen/SC/ST/OBC:Gen

7. Whether differently abled (Yes/No):No

8. Academic Qualification (Undergraduate Onwards)

	Degree	Year	Subject	University/Institution	% of marks
1.	Ph.D	2021	Computer Science and Engineering	JNTUK	
2.	M.Tech	2010	Computer Science and Engineering	JNTUK	77.4
3.	B.Tech	2006	Information Technolgy	JNTUK	60
4.					

9. Ph.D thesis title, Guide’s Name, Institute/Organization/University, Year of Award.

10. Work experience (in chronological order).

S.No.	Positions held	Name of the Institute	From	To	Pay Scale
1	Associate Professor	Laki Reddy Bali Reddy College of Engineering,Andhra pradesh	Dec-31-2021	Tilldate	6th pay band 37400-67000+AGP9000
2.	Sr.Assistant Professor	Laki Reddy Bali Reddy College of Engineering,Andhra pradesh	16-Aug-2021	Dec-31-2021	15600-39100+AGP7000
3.	Sr.Asst.Professor	Aditya Engineering College	15-June-2015	16-Aug-2021	15600-39100+AGP7000
4	Assistant Professor	Aditya Engineering College	7-June-2007	15-June-2015	15600-39100+AGP7000

11. Professional Recognition/ Award/ Prize/ Certificate, Fellowship received by the applicant.

S.No	Name of Award	Awarding Agency	Year
1	Certificate of Appreciation –content guru	Infosys	2016

12. Publications *(List of papers published in SCI Journals, in year wise descending order).*

S.No.	Author(s)	Title	Name of Journal	Volume	Page	Year
1	K DeviPriya,L Sumalatha	Multi Factor Two-way Hash-Based Authentication in Cloud Computing	nternational Journal of Cloud Applications and Computing (IJCAC) 10 (2), 21	10		
2	K DeviPriya,L Sumalatha	Novel Hash Based Key Generation for Stream Cipher in Cloud	Computer Communication, Networking and Internet Security	5		
3	K DeviPriya,L Sumalatha	Secure Framework for Cloud based E-Education using Deep Neural Networks	I2021 2nd International Conference on Intelligent Engineering and Management (ICIEM)	5		

13. Detail of patents.

S.No	Patent Title	Name of Applicant(s)	Patent No.	Award Date	Agency/Country	Status
1	Deep Convolutional Neural Network for Health Data Images in Clinical Treatment classification in BigData	Dr.K DeviPriya	202241038488	5/7/22(Filled Application)	India	Awaiting
2	IOT Based Smart Surgery Management System for Hospitals	Dr.K DeviPriya	202241025898	04-05-2022	India	Published

14. Books/Reports/Chapters/General articles etc.

S.No	Title	Author's Name	Publisher	Year of Publication
1	Application of IT in Health Care in Cloud Using R in CSI-January issue.	K DeviPriya	CSI	2017
2	An Insight of Big Data Analytics Using Hadoop	K DeviPriya	CSI	2018

15. Any other Information (maximum 500 words)

I have 15 years experience and working on deep learning algorithms,machine learning algorithms integrated with agriculture and water bodies.I did One Month Research Sabbatical Internship completed for the development of deep learning algorithm for cloud authentication, in NIVIDIA,DGXsetup, at the Bennett University ,Greater Noida, Delhi.Published papers in ugc care journals and free journals.Act as resource person in CSI-Vishakapatanam chapter and given trainings to students on ML and DL.

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
Approved by AICTE, NEW DELHI. Affiliated to JNTUK, KAKINADA
MYLAVARAM-521 230, Krishna Dist. A.P. India. Tel : 08659 - 222933, 934, 223936 Fax : 08659 - 222931
e-mail : lbcemym@lbrce.ac.in, principal@lbrce.ac.in website : www.lbrce.ac.in

Endorsement Certificate from the Host Institute

This is to certify that:

I. The applicant Dr.K Devi Priya is working as Associate Professor (designation)* in this Institute. She joined the institution on 16-August-2021(date - DD Month YYYY). We endorse her participation in the Project titled:

Deep Learning-based Automated Detection and Quantification of Micro plastics in Aquatic Environments and Agricultural Soils: A Comprehensive Monitoring Framework

II. The applicant is in regular position as defined by the term "Regular" in SRG guidelines.

III. The applicant will assume full responsibility for implementing the project as Principal Investigator.

IV. The date of start of project is on the day when the Institution receives the first release of grant by RTGS transfer.

V. The grant-in-aid by the Science & Engineering Research Board (SERB) will be used to meet the expenditure on the project and for the period for which the project has been sanctioned as indicated in the sanction letter/ order.

VI. No administrative or other liability will be attached to the Science & Engineering Research Board (SERB) at the end of the Research Award.

VII. The Institution will provide basic infrastructure and other required facilities to the investigator for undertaking the research objectives.

VIII. The Institution will take into its books all assets received under this sanction and its disposal would be at the discretion of Science & Engineering Research Board (SERB).

IX. The Institution will assume to undertake the financial and other management responsibilities of the project.

X. The Institution shall settle the financial accounts to the SERB as per the prescribed guidelines within three months from the date of termination of the Research Award.

Dated: 01/3/2023.

Signature of the Head of Institution

Seal of Institution

PRINCIPAL
Lakireddy Bali Reddy College of Engg.
MYLAVARAM 521 230.

kdpsrg

by Kd P

Submission date: 01-Mar-2023 10:35AM (UTC+0530)
Submission ID: 2025932079
File name: PDF_Content_IDEA.docx (19.31K)
Word count: 1710
Character count: 11077

Deep Learning-based Automated Detection and Quantification of Micro plastics in Aquatic Environments and Agricultural Soils: A Comprehensive Monitoring Framework

Abstract: Microplastics have become a major environmental concern due to their widespread occurrence in aquatic environments and agricultural soils. Microplastics are small plastic particles that are less than 5 millimeters in size, and they are found in various forms, including micro-beads, micro-fibers, and micro-fragments. They are known to accumulate in aquatic environments and agricultural soils, leading to serious ecological and health concerns. Therefore, there is a need for effective monitoring and detection methods that can accurately quantify the concentration and distribution of microplastics in these environments. The current methods for detecting and quantifying microplastics are time-consuming and require skilled personnel. This proposal presents a comprehensive monitoring framework based on deep learning for automated detection and quantification of microplastics in aquatic environments and agricultural soils. The proposed methodology includes image acquisition, pre-processing, feature extraction, classification, and quantification on publicly available datasets and acquires the realtime data using sensor based and microscopyapproach. The objectives of this proposal are to develop an automated system for microplastic detection and quantification using advance deep learning algorithms and evaluate the expected outcomes. The proposed framework has the potential to enhance the monitoring of microplastics in aquatic environments and agricultural soils and contribute to effective management strategies.

Keywords: Microplastics,Deep learning,Aquatic environments,Agricultural soils,Automated detection,Monitoring framework

Introduction:

Micro plastics are small plastic particles, typically less than 5mm in size, that have become an increasing concern for the environment. They can be found in various ecosystems, such as oceans, freshwater bodies, and soils, and pose a threat to wildlife and human health [1-2]. The environmental impact of micro plastics is multifaceted. In aquatic ecosystems, micro plastics can be ingested by marine organisms, leading to physical harm, toxicity, and death [3]. Micro plastics can also accumulate in the food chain, potentially leading to harm for organisms at higher trophic levels, including humans. Additionally, micro plastics can transport harmful pollutants and pathogens, potentially spreading them throughout the environment [4]. In soils, micro plastics can negatively impact soil health and crop growth. They can alter the physical and chemical properties of the soil, affecting nutrient cycling and water retention. Micro plastics can also potentially harm soil organisms, leading to potential impacts on soil biodiversity and ecosystem functioning [5-6].

The widespread use of plastics in daily life has contributed to the increasing prevalence of micro plastics in the environment. Micro plastics can enter the environment through various sources, including plastic waste, textiles, and personal care products. Improper disposal of plastic waste, such as littering and dumping into water bodies or soil, can also contribute to the problem [7].

To mitigate the environmental impacts of micro plastics, various approaches have been proposed, including reducing plastic use, improving waste management practices, and developing innovative technologies for micro plastic detection and removal [8]. It is important to address the issue of micro plastics to protect the environment, human health, and the food chain. The current methods for micro plastic detection and quantification are time-consuming and require skilled personnel. The traditional methods involve visual inspection, filtration, and chemical analysis, which are labor-intensive and expensive. The development of an automated system for microplastic detection and quantification can potentially overcome these limitations.

Related Work:

Recent studies have proposed various methods for microplastic detection and quantification, including spectroscopy, microscopy, and chemical analysis. Spectroscopy-based methods include Raman spectroscopy and Fourier-transform infrared spectroscopy (FTIR) [9-10]. These methods can provide information on the chemical composition of microplastics but require skilled personnel and are time-consuming. Microscopy-based methods include optical microscopy and electron microscopy. These methods are commonly used for visual inspection and counting of microplastics. However, they are labor-intensive and require skilled personnel. Chemical analysis-based methods include gas chromatography-mass spectrometry (GC-MS) and liquid chromatography-mass spectrometry (LC-MS) [11-12]. These methods can provide information on the chemical composition and quantity of microplastics but require extensive sample preparation and are expensive.

Objectives:

The proposed project aims to develop a comprehensive monitoring framework to detect and quantify microplastics in aquatic environments and agricultural soils. The project objectives are:

1. To develop a deep learning-based model for accurate detection and classification of microplastics in water bodies and agricultural soils.
2. To integrate the deep learning model with IoT sensors to automate the detection and quantification process in real-time.
3. To develop a comprehensive monitoring framework that can provide continuous monitoring of microplastics in aquatic environments and agricultural soils.

The project outcomes will contribute to the development of effective strategies to address the issue of microplastics pollution, protecting both the environment and human health.

Proposed Methodology

The proposed methodology for automated detection and quantification of microplastics in aquatic environments and agricultural soils is based on deep learning. The framework includes the following steps:

Image Acquisition: The first step is to acquire images of microplastics from aquatic environments and agricultural soils. The images can be obtained using various techniques, including optical microscopy, electron microscopy, and spectroscopy and also uses publicly available datasets like NOAA Marine Debris Program Dataset and the InSitu Microplastic Dataset.

Pre-processing: The acquired images undergo pre-processing to enhance the image quality and remove noise. The pre-processing techniques include image filtering, image normalization, and image segmentation.

Feature Extraction: The pre-processed images are then used to extract relevant features using deep learning algorithms such as convolutional neural networks (CNNs). The CNNs can learn the features of microplastics, such as shape, size, and texture, which can be used for classification and quantification.

Classification: The extracted features are then used for microplastic classification. The classification can be performed using various deep learning algorithms including Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and Generative Adversarial Networks (GANs), to develop a robust and accurate detection model[13-15]. The model will be trained on publicly available datasets, such as the NOAA Marine Debris Program Dataset and the InSitu Microplastic Dataset, and validated on real-world data collected from water bodies and agricultural soils[6].

The project will also integrate the deep learning model with IoT sensors, such as water quality sensors and soil quality sensors, to automate the detection and quantification process. The sensors will collect data on water and soil quality, and the deep learning model will analyze the data in real-time to detect and quantify microplastics.

Finally, the project will develop a comprehensive monitoring framework for continuous monitoring of microplastics in aquatic environments and agricultural soils. The framework will include the integration of the deep learning model with IoT sensors, data storage, and analysis, and visualization tools. The framework will provide real-time information on the concentration and distribution of microplastics, enabling policymakers and stakeholders to take appropriate actions to address the issue.

Expected Outcomes:

The expected outcomes of the project are:

- A deep learning-based model for accurate detection and classification of microplastics in water bodies and agricultural soils.
- Integration of the deep learning model with IoT sensors to automate the detection and quantification process in real-time.
- A comprehensive monitoring framework that can provide continuous monitoring of microplastics in aquatic environments and agricultural soils.
- Real-time information on the concentration and distribution of microplastics, enabling policymakers and stakeholders to take appropriate actions to address the issue.
- Effective strategies to address the issue of microplastics pollution, protecting both the environment and human health.

Conclusion

In conclusion, the proposed project aims to develop an automated detection and quantification framework using deep learning techniques to detect and quantify microplastics in aquatic environments and agricultural soils. The project's expected outcomes include a deep learning-based model for microplastics detection, integration of the model with IoT sensors, and a comprehensive monitoring framework for continuous monitoring of microplastics in these environments. The project's outcomes will contribute to the development of effective strategies to address the issue of microplastics pollution, protecting both the environment and human health.

References

[1] John, Juliana, et al. "Microplastics in mangroves and coral reef ecosystems: a review." Environmental Chemistry Letters (2022): 1-20.

[2] Priya, A. K., et al. "Microplastics in the environment: recent developments in characteristic, occurrence, identification and ecological risk." Chemosphere (2022): 134161.

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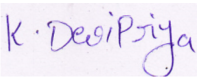
Dr.K DeviPriya, 

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