Alva's Institute of Engineering and Technology

Internal Quality Assurance Cell (IQAC),

Geoinformatics Research Lab,

AIET IEEE Student Branch Chapter

(STB60215368)

&

Institute Innovation Council – AIET

Jointly Organises

Five-Days workshop on

Innovative Tools and Methods for Satellite Image Processing

30th October 2023 to 4th November 2023

Venue: DS Lab, Dept of AI & ML
AIET, Mijar, Moodbidri

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Internal Quality Assurance Cell (IQAC)
Geoinformatics Research Lab
IEEE- Student Branch Chapter – AIET (STB60215368)
Institute Innovation Council – AIET

Alva's Institute of Engineering and Technology (AIET),
Mijar, Moodbidri, Dakshina Kannada

Organises a five-day hands-on workshop on "Innovative Tools and Methods for Satellite Image Processing"

The workshop aimed to enhance the skills with knowledge in the domain of Remote Sensing amongst the young minds using state of the art tools focused on AI, ML, Image Processing.

About Geoinformatics Research Lab

Geoinformatics Research Lab aims to leverage geospatial technology and data to solve complex spatial problems, contribute to scientific research, inform policy decisions, and enhance the knowledge of interconnectedness of natural and human systems on a geographic scale.

With an immediate vision of Monitoring the Fragile Western Ghats Ecosystems using geospatial technologies involving multidisciplinary approaches to promote sustainability, conservation and management.

This involves mapping visualizing and simulating the land use and land cover changes, its associated processes in the Western Ghats and Coastline using geospatial tools and disseminating the information to public, researchers, decision makers though web portals (WebGIS) and mobile applications (Mobile GIS), etc.

GIS lab is responsible for training budding researchers, teachers across domain for integrating the geospatial data.

Alva's Institute of Engineering and Technology

Alva's Institute of Engineering and Technology in Moodbidri stands as a testament to the pursuit of academic excellence and holistic development.

Established with the aim of fostering academic excellence and holistic development in 2008, the institute is affiliated to Visvesvaraya Technological

University, Belagavi. Through its comprehensive programs, dedicated faculty, infrastructure and commitments towards innovation, the institute plays a significant role in shaping the future decisionmakers, technologists and engineers of India.

Located in Moodbidri, the Institute has continually focused on providing quality engineering and technical education to its students and to support them both in academic and extracurricular activities.

AIET is associates with numerous Government, Non-Government and Private Organisations with a focus on research and consultancy projects. AIET currently has MoU's with reputed national level organizations viz., ISRO, NRSC, NIAS, NAL, RRSC, IIT, NIT and many more.

Day 1. **Inauguration**

The five-day workshop on "Innovative Tools and Methods for Satellite Image Processing" was held between 30th October and 4th November 2023 at DS lab, Dept of AI and ML. The workshop began at 9:30 AM with lighting of lamps. Dr. Majunath Kotari, HoD CSE and IEEE-faculty coordinator- AIET welcomed the gathering and addressed the need for Geospatial tools in the digital world. Dr. Vinay S, highlighted the applications of GIS, Remote Sensing and need of interdisciplinary research and studies for addressing real world problems. He also highlighted about the contents deliverable in the workshop. The speech underscored the importance of GIS in promoting innovation, sustainability, and informed decision-making across various industries. The audience gained valuable insights into the practical applications of GIS and its significant impact on addressing real-world challenges.

Dr. Dattathreya, Dean Planning and IQAC main Coordinator, expressed his thoughts and need geospatial tools. He elaborated on how ISRO, NRSC and AIET have collaborated worked in the past as a result, AIET is a testament for developing skills of student.

Dr. Peter Fernandes, Principal AIET, in his presidential address indicated the role of Remote Sensing in the growing world and its importance in decision making. He emphasized on how GIS has been extensively used across multiple domains. He emphasized the importance of conducting multidisciplinary research and urged the students to think beyond the box to comprehend and resolve real-world issues. He appreciated the move of inducing the students as resource persons for the event.

The vote of thanks was given by Mr. Neerav Patel, Chairman of IEEE-Student Branch Chapter. He expressed our gratitude to the organisation, principal, deans and faculty, students, and IEEE for their support.

Fig: Welcoming the Gathering – Dr. Majunath Kotari

Fig: Lighting of Lamps

Fig: About the Workshop – Dr Vinay S

Fig: Presidential Address – Dr. Peter Fernandes

Introduction to Remote Sensing

Dr. Vinay S introduces the very basics of remote sensing, providing a comprehensive understanding on the domain. He introduced the key components of remote sensing, principal, the physics behind it and explained their significance and future prospects. The session covered topics viz., energy interactions in the atmosphere, (including the different types of reflection,

such as specular and diffuse reflection); remote sensing platforms; Spectral reflection curves; Resolutions (Spatial, spectral, temporal, radiometric). The session also included an in-depth analysis of remote sensing satellite images, deliberated on how to interpret and analyze the satellite images.

Fig: Participants

Digital Image Processing

Mr. Vedanth conducted a highly effective and detailed session on image processing. He explained the basics of image processing, starting with introduction to images, resolution, and aspect ratio. He also provided insights on using various libraries and tools in Python for image processing. The importance of image processing, including image compression, restoration, and denoising, was also discussed in detail. We also installed PyCharm, which is a crucial tool for image processing. The session concluded with a group quiz based on the topic of image processing, which was fun and effective way to reinforce our learning.

Fig: Digital Image Processing – Mr. Vedanth

Day 2: Artificial Intelligence and Machine Learning

Mr. Satyam systematically elucidated the concepts and components of AI and ML, commencing with an overview of what AI is and the genesis of its formation. He highlighted AI's role in automating routine tasks, such as image classification and pattern recognition, while intermediate AI delves into more complex functions like predictive analysis and route optimization. The advanced applications of AI in GIS incorporate machine learning, deep learning, and neural networks, enabling sophisticated spatial analysis and decision-making.

Spatial data analysis in GIS involves scrutinizing geographic data to derive meaningful insights. Automated feature recognition utilizes AI to identify and classify objects in maps or imagery. Predictive analysis in GIS anticipates future trends or events based on historical spatial data. Routing and navigation tools optimize travel routes and offer real-time directions. Spatial clustering and pattern recognition assist in detecting spatial relationships and groupings in geographic data, facilitating decision-making and problem-solving.

During the afternoon session, the speaker delved into Convolutional Neural Networks (CNN), a deep learning model primarily used for image analysis. Three types of machine learning were discussed: supervised, unsupervised, and reinforcement learning. Supervised learning entails training a model on labeled data to predict outcomes, with regression predicting continuous outcomes and various algorithms like decision trees, random forests, and K-Nearest Neighbors (KNN). Challenges such as overfitting and underfitting were highlighted in supervised learning.

Unsupervised learning involves algorithms extracting patterns from unlabeled data, including K-means clustering and Principal Component Analysis (PCA). In GIS, backpropagation in neural networks optimizes spatial analysis and decision-making processes by refining models through iterative learning and adjustments based on error minimization.

Fig: Introducing AI and ML to the participants – Mr. Satyam

Fig: Introducing AI and ML to the participants – Mr. Satyam

Day 3:

Open-Source Software's

During the session with Mr. Neerav, he expounded on the concept of Open Source Software (OSS). This term encompasses software that is freely accessible to the public, allowing users the freedom to modify, distribute, and enhance the software. In contrast to closed-source proprietary software, open source promotes collaboration and transparency, providing users with freedoms such as the ability to study, modify, and distribute the software. The operational framework of open source follows a community-driven model, where users actively contribute to the development and improvement of the software.

Free and Open-Source Software (FOSS) is a categorization of software that endows users with the freedoms of using, studying, modifying, and distributing the source code. FOSS is further subdivided into various categories, including copyleft licenses (e.g., GPL), permissive licenses (e.g., MIT), and public domain licenses (e.g., CC0), each governing usage and distribution terms.

In the realm of GIS, FOSS tools like QGIS, GRASS GIS, and GeoServer, in conjunction with organizations such as OSGeo, advocate for the development and utilization of open-source geospatial software. Platforms like Mapbox offer mapping services, while protocols like Web Map Service (WMS), Web Feature Service (WFS), and Web Coverage Service (WCS) facilitate data sharing and interoperability within GIS. FOSS in GIS finds applications across diverse fields, including environmental monitoring, urban planning, disaster management, and public health, providing cost-effective and customizable solutions for spatial data analysis and visualization.

UNET Demonstration

Mr. Satyam elucidated that the U-Net architecture, one of the widely employed convolutional neural network for image segmentation/classification tasks. Within the domain of GIS, this architecture is harnessed for object detection and classification in satellite or aerial imagery. The code typically encompasses data preprocessing, model training, and evaluation, utilizing annotated datasets to identify and categorize objects in geographical imagery.

The application of U-Net in GIS facilitates detailed and precise identification of various objects, including buildings, roads, or vegetation. This capability proves invaluable for tasks such as land use mapping, disaster response, and urban planning. Leveraging the network's capacity to discern unique features and patterns, the implementation of the code enables accurate spatial classification within geographical data. This, in turn, simplifies the process of making well-informed decisions and analyzing geographic information systems.

GRASS GIS – Hands on

During the afternoon session under the guidance of Dr. Vinay S., participants successfully installed GRASS GIS and imported geographical data into the software. They acquired a fundamental understanding of navigating the GRASS interface, managing spatial datasets, and initiating GIS workflows. This hands-on experience provided them with the necessary foundation to leverage GRASS for geographic analysis and laid the groundwork for further exploration of the tool's capabilities in spatial data management and analysis. Processes such as land cover analysis, land use analysis were focused during the session. Overall, the session proved to be a valuable introduction to the installation of GRASS GIS and the initial steps of data importation. It empowered the participants to embark on their journey in utilizing this powerful tool for geographic analysis and geospatial modeling.

Day 4:

Mobile GIS for Field Data Collection

Under the guidance of Dr. Vinay S., the GIS field visit constituted a comprehensive effort to collect detailed spatial data on various elements of the ecosystem, including medicinal plants, butterflies, birds, and land use. To achieve this objective, four teams, each consisting of 10 members, utilized the Epicollect5 app and GitHub to ensure efficient and organized data collection, storage, and sharing. Each team was assigned a specific task, encompassing gathering information on medicinal plant species, documenting butterfly sightings, assessing bird diversity, and analyzing land use patterns. The teams collected GPS coordinates, captured photographs, and provided detailed descriptions of observed flora, fauna, and land use characteristics using the Epicollect5 app.

All team members received training in using the app for data collection, ensuring standardized data formats and GPS accuracy. Following data

collection, they uploaded the information to a GitHub repository for organized and collaborative data management. Despite challenges such as GPS accuracy, data synchronization, and varying field conditions, the teams effectively mitigated these issues.

The GIS field visit successfully gathered significant data, now serving as a valuable resource for ecological research, conservation planning, and future GIS analysis. The collected data will contribute to understanding the dynamics of the ecosystem, its components, and their interactions. This information can be instrumental in developing strategies for the conservation and management of the ecosystem.

Fig: Data collection using MobileGIS at Bird Park

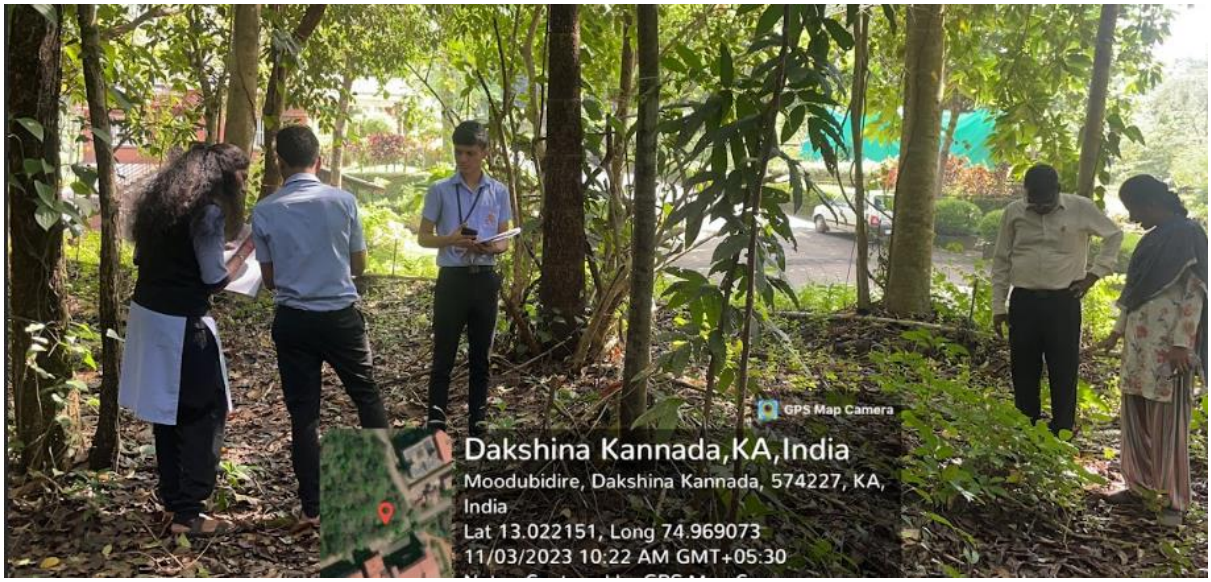

Fig: Data collection using MobileGIS at Shobhavana

Expert Lecture – Dr. Prakash P S

During the afternoon session, Dr. Prakash, a distinguished speaker from Irish Centre for High-End Computing ICHEC, delivered an informative presentation on the multidisciplinary field of remote sensing and geospatial technologies. He explained the process of remote sensing and highlighted the crucial role of sensors in capturing remote sensing images. The presentation showcased remote sensing images obtained through ISRO and detailed a wide range of remote sensing applications, from environmental monitoring to natural resource exploration.

Dr. Prakash also discussed related technologies such as photogrammetry, drones, GPS, and GIS. He emphasized the interplay of geospatial technologies in relation with new age tools viz., AI and ML, depicting how they contribute to terrain modeling, high-resolution mapping, accurate positioning, and data integration and analysis.

Fig: Guest Lecture by Dr. Prakash

Day 5

GRASS GIS - Hands on

During the hands-on session hosted by Dr. Vinay S., participants learned how to utilize GRASS GIS (Geographic Resources Analysis Support System) for the importation, processing, and analysis of satellite data. The session encompassed various tasks, including importing vector boundaries, converting vectors to rasters, integrating folders into the GIS system, importing satellite imagery, developing signatures, and performing supervised classification.

The session commenced with the importation of vector boundaries into GRASS, followed by their conversion into a raster format suitable for subsequent analysis. Participants acquired skills in organizing and importing

diverse datasets from local directories into GRASS, as well as incorporating and visualizing satellite images within the GIS platform. The latter part of the session focused on developing signatures from the imported satellite data. Participants were instructed in the process of identifying and extracting significant features or classes from the imagery. Additionally, they were introduced to supervised classification techniques, demonstrating how to classify or categorize different land cover types within the satellite imagery.

Overall, this hands-on session provided participants with practical exposure to various functionalities of GRASS GIS. It equipped them with the skills required to manipulate and extract meaningful information from satellite data, enhancing their ability to conduct geospatial analyses and land cover classifications within the GRASS GIS platform.

Fig: Participants working with GRASS GIS

Valedictory Session

The IEEE-organized workshop marked a significant milestone in the field of Geographic Information Systems (GIS) at AIET. The event featured certificate distribution to participants, along with speeches from Dr. Dattathreya, the chief guest, and Dr. Vinay S, the resource person. Both speakers emphasized the importance of GIS in the modern technological landscape and its pivotal role in decision-making processes.

In his speech, Dr. Dattathreya spoke about the advancements and potential applications of GIS in various industries, highlighting its significance in

diverse domains, from urban planning to environmental monitoring. Dr. Vinay S, the distinguished resource person, demonstrated the practical aspects of GIS, showcasing its implementation in real-world scenarios. His presentation illustrated how GIS technologies aid in spatial analysis, cartography, and data visualization, unveiling the power of geographic information in solving complex problems.

The ceremony also recognized the efforts of participants who completed workshops in GIS by distributing certificates. It served as a platform for knowledge sharing and recognition of the dedication and commitment of the participants in advancing their GIS proficiency.

Fig: Valedictory Session

Workshop Outcomes

The workshop focused on introducing the students to concepts of Remote Sensing, Digital Image Processing, AI and ML with both theory and hands on session. The participants were able to Develop Indices for extracting natural features. The use of Google Colab opened a new dimension in the thought processes for the participants. The participants were able to work on the basic steps for evaluating Land use of Moodbidri using Landsat 9 data. The participants had a flavor of Remote Sensing using classical and advanced methods using FOSS.

Acknowledgement

We would like to thank the efforts made by the young IEEE brains for organizing and conducting the workshop. We would like to express out sincere gratitude to the resource persons Mr. Vedant, Mr. Satyam, Mr. Neerav, Dr. Prakash for introducing them to diverse topic beyond the syllabi. We are extremely thankful to the Management, Principal, Deans, Heads and faculties for their kind support.

Dr. Vinay S
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Geoinformatics Research Lab
Associate Professor,
Dept of Civil
AIET, Mijar

Dr. Manjunath Kotari
IEEE Member
Professor, Dept of CSE
AIET, Mijar

Dr. Dattathreya
Dean Planning
IQAC Main Coordinator
Professor, Dept of ECE
AIET, Mijar

Dr. Peter Fernandes
Principal &
IQAC Chairman
AIET, Mijar

.

ANNEXURE

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

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Approved by AICTE, New Delhi & Recognized by Government of Karnataka
Accredited by NAAC with A+ & NBA (CSE & ECE)

Ref.No.: AIET/IQAC/2022-23/ 13/10/2023

Internal Quality Assurance Cell (IQAC)
Geoinformatics Research Lab
IEEE Student Branch Chapter, AIET (STB60215368)
Institution's Innovation Council

To,

Dr. Peter Fernandes
IQAC Chairman
AIET, MIJAR

Subject: Request permission to conduct Hands on Workshop on Satellite Image Processing

Respected Sir,

We are pleased to inform you that AIET-IQAC, Geoinformatics Research Lab, IEEE student branch chapter (STB60215368) & IIC, AIET are planning to organize a hands-on workshop between 30th October to 4th November 2023. The meeting will be conducted focusing on innovative tools and methods for analysis of Satellite images using Digital Image Processing techniques (AI/ML) with focus on Western Ghats and Coastal Ecosystems. Target audience would be interested students and teaching fraternity across all Engineering branches from AIET (2nd, 3rd and 4th year) and Degree College with an upper limit of 50 participants. The workshop will be conducted at Machine Learning Lab.

We would request you to kindly permit us to proceed with the activities planned. Your valuable suggestions and support in this endeavor would be greatly appreciated.

Thank you for your consideration.

Dr. Dattathreya
IQAC Main Coordinator
AIET, MIJAR, Moodbidri

13/10/2023
Dr. Vinay S
Geoinformatics Research Lab,
AIET, MIJAR, Moodbidri

13/10/23
Dr. Manjunath Kotari
IEEE Faculty Counselor
AIET, MIJAR, Moodbidri

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ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

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Ref.No.: AIET/IQAC/2022-23/ 13/10/2023

CIRCULAR

It is hereby informed that hands on training workshop on Innovative tools and methods for Satellite image processing for monitoring Western Ghats and Coastal Ecosystems is organized by IQAC, Geoinformatics Research Lab & IEEE student branch chapter between 30 October and 4th November 2023, venue being Machine Learning Lab between 9:30 AM and 5:00 PM. In this regards all HOD's (Agri, AIML, Civil, CSE, CSD, ECE, ISE) are requested to kindly be present for the inaugural and depute select faculty and interested students from the department.

Please note: Faculty are required to be present full time once registered

Dr. Peter Fernandes
Principal & IQAC Chairman
AIET Mijar, Moodbidri

To

Principal Alva's Degree College, All Deans and Heads, AIET

M- N.R. Shetty
ISE - N.R.S.
CSE - T. HP
CSD
AML
MBA
ECE
ME - T. HP
CIVL
AG
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Dean (SA) 13/10/23

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IEEE AIET

Date	9:30 to 11:00	11:00 to 12:30	12:30 to 1:30	1:30 to 3:00	3:30 to 5:00
30 October 2023	Inauguration	Introduction to Remote Sensing (Dr. Vinay)	LUNCH	Digital Image Processing (Mr. Vedant)	Satellite and Data Sources (Dr. Vinay)
31 October 2023	AI and ML for Beginners (Mr. Satyam)			Hands on session – Python for image processing (Mr. Vedant/ Mr. Satyam)	
2 November 2023	Open-Source Tools (Mr. Neerav)	GRASS GIS Hands on (Dr. Vinay)		GRASS GIS Hands on (Dr. Vinay)	
3 November 2023	GRASS GIS Hands on (Dr. Vinay)			Mini Project	
4 November 2023	Mini Project + Presentation	Valedictory and Certificate Distribution			

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Registration List of Week Workshop on Innovative Tools &Techniques in Satellite Image Processing (30th Oct-4th Nov,2023)

Sl No	Name	Member Id	Signature
1.	Akshatha Hebbar	99490549	
2.	Abhishek B K	99496050	
3.	Archana Hublikar	99473663	
4.	Gayatri C Bhagavantnavar	99408977	
5.	Naveesh Kumar	99496077	
6.	Nikisha Krishna Nagesh Poojari	99473931	
7.	Priyanka D	99494027	
8.	Tejaswini Venkatesh Gudigar	99483672	
9.	Kamma Puspuri Madhavi	99494382	
10.	Reshna Nandipi	99474505	
11.	Shetty Balija Deepthi	99494335	
12.	Sansitha Rajesh	99495546	
13.	Toshif Husen Patil	99495745	
14.	Shrishanth S Shetty	-	
15.	Saneesha Prashanth Kadam	-	
16.	Yashwanth R	-	
17.	Gururagavendra Paluri	-	
18.	D Chandan Lagubigi	-	
19.	Bhavish	-	
20.	Jhanavi V	-	
21.	Darshan Rai	-	
22.	Harshith D M	-	
23.	Shetty Yash Chandrashekar	-	
24.	Kagwade Abhishek Shashank	-	
25.	Abhay Gowda M K	-	
26.	Bhagyashree Shyam Naik	-	
27.	Venkatesh Hanamanta Hulasad	-	
28.	Ganesh	-	
29.	Sudarshan T Bhat	-	
30.	Lakshan	-	
31.	Rakshith	-	
32.	Mohammed Rihan	-	
33.	Arvinkanth Suuvarna	-	
34.	Moammed Adil	-	
35.	Anirudh Kamath K	-	
36.	Muhammed Yamin Sharfuddin	-	
37.	Syed Saleha	-	
38.	Krupashree R.	-	
39.	Chaitra S Koddaddi	-	
40.	Vedanth V	-	

41.	Laya R	-	
42.	Abhiram H. A.	-	
43.	Abhishek Pandit	-	
44.	Jyothi B.	-	
45.	Abhishek P.	-	
46.	Varshini K. L.	-	
47.	Mohammed Sharfuddin	-	
48.	Satyam Pawale	-	
49.	Manjunath M. Sajjan	-	
50.	A. Bhoomika Reddy	-	
51.	Chaitra	-	
52.	Dr Bramha Prakash H P	99627377	
53.	Neerav V Patel	99494129	

IEEE Student Branch Chair

IEEE Faculty Councellor

CERTIFICATE

Of Appreciation

THIS IS TO CERTIFY THAT

Vedanth V

In recognition of his/her amazing performance and great efforts during the Workshop on Innovative tools and Methods for Satellite Image Processing

Dr Vinay S
Faculty Member
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Dr Peter Fernandis
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Bhavish

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Jahnavi V

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Mohammed Rihan

In recognition for his/her active participation and great efforts during the workshop on innovative tools and methods for satellite image processing

Dr Vinay S
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Dr Manjunath Kotari
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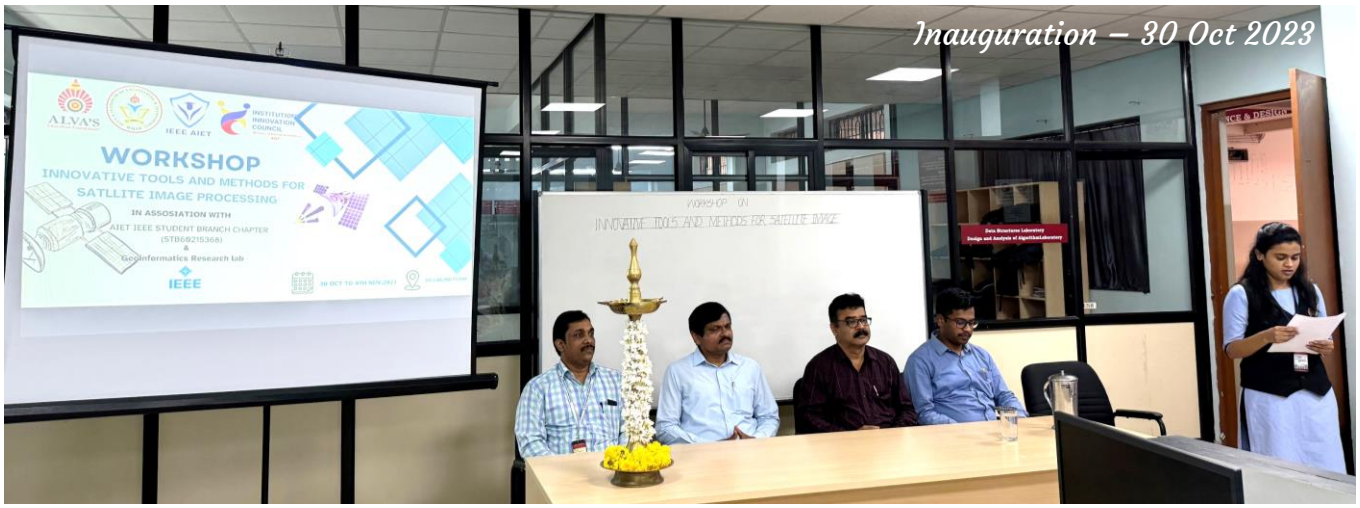

Inauguration – 30 Oct 2023

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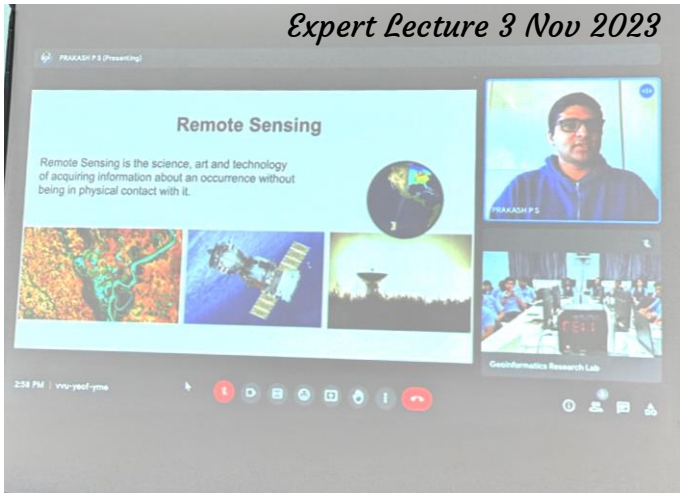

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