Report on Karyashala on AI/ML-Enabled Remote Sensing and Drone Technologies for Climate Resilience – 2026

Date & Time: 02nd to 6th February 2026, from 11:30 AM to 05:45 PM

Venue: A-2 Conference Hall, Gujarat Technological University, Nr. Visat Three Road, Visat Gandhinagar Road, Chandkheda, Ahmedabad- 382424

1. Introduction

1.1 Purpose:

The Karyashala aimed to provide participants with fundamental as well as practical knowledge in advanced remote sensing, and drone technologies addressing climate resilience.

1.2 Overview:

Gujarat Technological University (GTU), and Indian Institute of Information Technology Vadodara (IIIT Vadodara), jointly organized a five-day Karyashala on AI/ML-Enabled Remote Sensing and Drone Technologies for Climate Resilience from 02 February 2026 to 06 February 2026.

2. Objective of the Karyashala

The main objectives of the Karyashala were:

- To develop a comprehensive understanding of remote sensing, hyperspectral, and LiDAR-based data acquisition techniques for climate resilience applications.

- To equip participants with skills in geospatial data analysis using ML/DL methods, GIS tools, and decision support models.

- To provide practical exposure to drone technologies, including UAV design, swarm drones, and LiDAR enabled drone surveys through real-world applications.

- To strengthen the teaching, research, and application capabilities of faculty members and research scholars in advanced geospatial and drone-based technologies

Day 1

Inaugural Ceremony session: (11.00 AM – 11.30 AM)

The inaugural session began with Saraswati Pooja and lighting of the lamp, followed by the felicitation of invited guests and delegates. Dr. Jignesh Amin, Professor GTU SET welcomed the participants to the five-day Karyashala and highlighted the objectives of Karyashala 2026, emphasizing the relevance of climate change and its impact on society. The Registrar of IIITV, Col. Ravi Chugh, addressed the gathering, stressing the importance of learning emerging technologies to meet future challenges. Chief Guest Dr. Dharmendra Singh, Director IIITV, spoke on aligning learning and technology with the vision of Atmanirbhar Bharat – Viksit Bharat – Shreshth Bharat, and emphasized the role of mathematical modelling in AI/ML education. The Hon'ble Vice Chancellor of GTU, Dr. Rajul Gajjar, delivered the presidential address, encouraging students to adopt an interdisciplinary approach, gain practical exposure, and collaborate with domain experts while applying AI/ML with appropriate real-time accuracy. The inaugural ceremony ended with a Vote of Thanks by Dr. Komal Borisagar, Associate Professor GTU-SET.

Session 1 (11.30 AM – 01.30 PM): Hyper-Spectral Remote Sensing

Speaker: Dr. Jignesh Bhatt, Associate Professor, IIIT Vadodara

Dr. Jignesh Bhatt delivered an insightful session on Hyper-Spectral Remote

Sensing, focusing on the fundamental
principles of active and passive remote sensing systems. He explained how passive sensing measures reflected solar energy from Earth's surface, while active sensing systems such as RADAR emit their own energy. The concept of imaging spectroscopy was introduced, where reflectance information is captured across 242 spectral bands to analyse material properties with 30 meter resolution in detail. The session covered hyperspectral image data, spectral signatures of minerals and vegetation, linear mixing models, and hyperspectral subspace analysis. Practical applications such as mineral mapping, planetary exploration, and spectral library development were also discussed, providing participants with a strong understanding of hyperspectral data analysis.

Session 2 (02.30 PM – 04.30 PM): Agriculture Information System

Speaker: Dr. Pratik P. Shah, Associate Professor, IIIT Vadodara

Dr. Pratik P. Shah presented a comprehensive session on Agriculture Information Systems, emphasizing the role of remote sensing and satellite data in modern agriculture. He explained how tools such as Sentinel satellite data, Google Earth Engine, and vegetation indices like NDVI are used to monitor crop health and agricultural conditions. The session highlighted crop monitoring, yield estimation, and the importance of data-driven decision-making in agriculture. Dr. Shah also discussed how remote sensing

supports sustainable and climate-resilient farming practices by enabling

timely and accurate agricultural assessments

Session 3 (04.45 PM – 05.45 PM): Swarm Drone for defence Applications

Speaker: Dr. Kamal K. Jha, Associate Professor, IIIT Vadodara

Dr. Kamal K. Jha conducted an engaging lecture on Swarm Drone Technology for Defence Applications. He explained the fundamental components of drones, including the frame, motors, propellers, electronic speed controllers, flight controllers, sensors, batteries, and cameras. The concept of swarm drones, where multiple drones operate in coordination, was discussed in detail. The session covered defence and surveillance applications, as well as the use of swarm drones in search and rescue missions and logistics. This session helped participants understand how coordinated drone systems enhance operational efficiency in defence scenarios.

Day 2

Session 4 (11.30 AM – 01.30 PM): Types of Data and Its Sources in Remote Sensing

Speaker: Dr. Komal Borisagar, Associate Professor, GTU SET

Dr. Komal Borisagar delivered a detailed session on the types of data and sources used in remote sensing. She explained remote sensing as the science of acquiring and interpreting information about Earth's surface through electromagnetic radiation without physical contact. The session covered the historical development of remote sensing, from early aerial photography to modern satellite systems. She explained electromagnetic radiation, its interaction with Earth features, and the concept of spectral reflectance and spectral signatures. The session also discussed active and passive remote sensing, different platforms such as ground-based, aerial, and satellite systems, and the four types of resolution as spatial, spectral, radiometric, and temporal, providing a strong conceptual foundation.

Session 5 (02.30 PM – 04.30 PM): Application of ML/DL Algorithms for Preprocessing and Feature Extraction

Speaker: Dr. Aanal Raval, Assistant Professor, GTU SET

Dr. Aanal Raval conducted an informative session on the application of Machine Learning and Deep Learning algorithms in remote sensing. She explained the motivation for using intelligent methods due to the large volume, complexity, and non-linearity of remote sensing data. The session highlighted automatic feature learning, multimodal data fusion involving optical, SAR, LiDAR, and temporal data, and the reduction of human bias in analysis. She explained the spatial nature of remote sensing data, spectral bands, and the importance of Near Infrared data for vegetation analysis. The
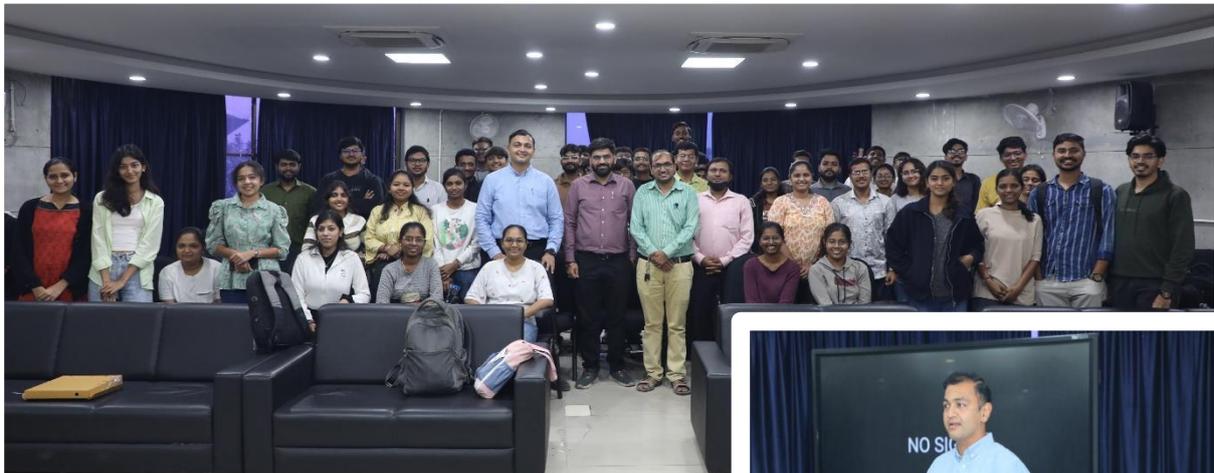
session emphasized how ML and DL techniques support real-time decision-making in geospatial applications.

Session 6 (04.45 PM – 05.45 PM): Geo Data Management

Speaker: Mr. Parin Shah, Center cum Practice Head, Tech Mahindra

Mr. Parin Shah delivered a practical session on Geo Data Management with an industry-oriented approach. He explained how geospatial data is

managed using GIS in sectors such as oil and gas. The session covered data sources across exploration, drilling, production, and downstream operations. He discussed typical workflows of geo data management systems and shared real-world case studies on document digitization. The use of well log digitization and OCR technology for extracting text from hard copy documents was explained, giving participants valuable insight into professional geospatial data handling practices.

Day 3

Session 7 (11.30 AM – 01.30 PM): LIDAR-Based Data Capturing Techniques

Speaker: Mr. Sachin Patel, Technical Head, 3D Points

Mr. Sachin Patel conducted a technical session on LIDAR-based data capturing techniques. He explained LIDAR as an advanced remote sensing technology that uses laser pulses to measure distances with high accuracy. Different types of LIDAR systems, including airborne, terrestrial, SLAM-based, and bathymetric LIDAR, were discussed. The speakers explained how LIDAR systems generate dense 3D point clouds using drone-mounted sensors. The session also covered core drone data components, positioning techniques such as RTK and PPK, ground control points, and mission planning strategies, providing participants with a strong technical understanding of LIDAR data acquisition.
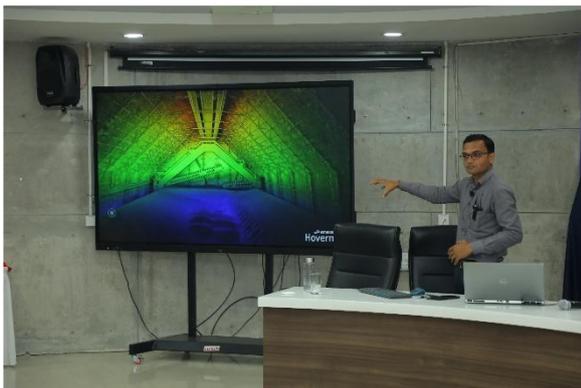
Session 8 (02.30 PM – 04.30 PM): Interpretation of Data & Data Processing of LIDAR-Based Drone

Speaker: Mr. Sachin Patel, Technical Head, 3D Points

Mr. Sachin Patel conducted a hands-on session focused on the interpretation and processing of LIDAR-based drone data. He introduced SLAM-based devices and explained their working principles along with their advantages and limitations. Selected students were given practical exposure to operate the SLAM device and capture real-time data. Participants learned how to generate 3D building models using SLAM data. This practical session

enhanced participants' confidence in handling advanced LIDAR equipment and understanding real-world data collection challenges.

Session 9 (04.45 PM – 05.45 PM): Case Study – LIDAR-Based Drone Survey Applications in the Field

Speaker: Mr. Sachin Patel, Technical Head, 3D Points

In this session, Mr. Sachin Patel presented real-world case studies related to LIDAR-based drone surveys. He explained the complete workflow from raw data acquisition to final output generation. Mr. Sachin has used his office PC system of 192 GB RAM for processing of the captured LIDAR data of GTU Main Building front face. The session demonstrated data processing and visualization using professional software tools such as Aura, Emesent, and Navisworks. Participants were

shown actual 3D outputs and point cloud visualizations, along with their applications in infrastructure inspection, environmental monitoring, and field surveys.

Day 4

Session 10 (11.30 AM – 01.30 PM): Design of Drone and Its Components

Speaker: Mr. Yaksh Patel, Senior Application Engineer, Airotor

Mr. Yaksh Patel and Mr. Monik Patel conducted a session on the design of drones and their components. They explained different types of drones, including fixed-wing, multi-rotor, and hybrid VTOL drones, along with drone movement concepts such as roll, pitch, and yaw. The session covered major components such as flight controllers, motors, ESCs, propellers, GPS and RTK systems, batteries, radio controllers, and advanced sensors. Real drone components were shown to students, helping them gain a clear understanding of drone hardware.

Session 11 (02.30 PM – 04.30 PM): Design of Drone and Its Components (Industry Practices)

Speaker: Mr. Monik Patel, Senior Application Engineer, Airotor

This session focused on real-world and industry-level drone development practices. The speakers explained how drones are designed, assembled, coded, and tested in professional environments. They discussed the importance of simulation before actual flight to avoid failures and introduced software tools used for drone simulation. The role of coding in navigation, stability, and autonomous drone operation was explained, providing participants with a clear understanding of end-to-end drone development workflows.

Session 12 (04.45 PM – 05.45 PM): Multi-Criteria Decision-Making Model Integration with GIS for Site Suitability Study

Speaker: Prof. Mridul S. Seth, Assistant Professor, GTU SET

Prof. Mridul S. Seth delivered an insightful session on integrating Multi-Criteria Decision-Making models with GIS using Weighted Overlay Analysis for site suitability analysis. He explained how multiple environmental, physical, and infrastructural criteria are combined using weighted overlay analysis to support decision-making. The session covered GIS-based analysis, spectral signatures, image processing, and the difference between remote sensing and GIS. Real-world case studies on site suitability and potential zone mapping were presented. He has discussed the concept Explainable AI (XAI) and its integration in GIS based image processing for the Multi Criteria Decision Making model.

Day 5

Session 13 (11.30 AM – 01.30 PM): Legacy of Survey of India and Its Products for RS & GIS Applications

Speaker: Dr. Shivangi Suthar, Officer Surveyor, Survey of India

Dr. Shivangi Suthar provided detailed insights into the legacy and role of the Survey of India in RS and GIS applications. She explained its organizational structure, responsibilities as the national mapping agency, and its role in maintaining geodetic and geospatial data. The session covered various maps and datasets produced by SOI, geodetic reference systems, and national projects such as SVAMITVA, AMRUT, and Digital Twin initiatives. Applications in drone navigation, hazard monitoring, autonomous vehicles, and disaster management were also discussed.

Session 14 (02.30 PM – 04.30 PM): Urban Heat Islands and Land Surface Temperature Effects – Current Status, Impact, and Mitigation Strategies

Speaker: Prof. Rasik V. Makwana, Assistant Professor, GTU SET

Prof. Rasik V. Makwana delivered an in-depth lecture on Urban Heat Islands and Land Surface Temperature effects. He explained the types of UHIs, their causes, and their impact on urban environments. The session covered LST concepts, remote sensing-based measurement techniques, data sources such as MODIS, and environmental and public health impacts. Mitigation strategies including nature-based solutions, policy interventions, and urban

planning approaches were discussed, highlighting the role of remote sensing in climate resilience.

Conclusion

The 5 days of Karyashala-2026 were highly informative and enriching in Remote Sensing through AI-ML for climate resilience. A total of 84 participants across Gujarat from different institutes and domains have participated. The expert sessions delivered by various industry experts and renowned faculty members successfully bridged theoretical concepts with real time practical applications. This knowledge shared during the sessions will motivate participants to explore a new AI era for advanced research and application areas in remote sensing and drone technologies for climate resilience.

Note: Assessment of the students were conducted from 04.45 PM– 05.45 PM followed by certificate distribution. Participants have provided positive feedback and a nice experience for the 5 days Karyashala 2026.

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