MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE
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A Report on Industrial Visit to "ISTRAC/ISRO, Bengaluru" Organized by Department of CSE-(AI & ML) on 20.08.2026

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Introduction
An industrial visit provides students with an opportunity to move beyond the boundaries of the classroom and gain first-hand exposure to the practical application of their academic knowledge. With this objective, the Department of Computer Science and Engineering (AI and ML), Madanapalle Institute of Technology, Deemed to be University (MITS), Madanapalle, Andhra Pradesh, organized an industrial visit to the Indian Space Research Organisation (ISRO)/Indian Space Research Organisation Telemetry Tracking and Command Network (ISTRAC), Bengaluru, on 20th August 2026.

A group of B.Tech. II Year/I Semester – CSE (AI and ML) students participated in the visit. The primary objective was to provide students with practical exposure to India's space programme, satellite technology, launch vehicles, mission management, telemetry and tracking systems, and the applications of space technology for the benefit of society. The visit was not merely a tour of a renowned space organization. It provided students with an opportunity to understand the remarkable journey of India's space programme, observe the environment in which complex space missions are monitored, and gain insights into the role of advanced technologies, including Artificial Intelligence and Machine Learning, in modern space research. The experience was highly educational, inspiring, and memorable for all the participating students.

Objectives of the Visit
The major objectives of the industrial visit were:
- To understand the history, organizational structure, and achievements of ISRO.
- To gain practical knowledge of satellite systems and launch vehicles.
- To understand the functioning of mission control and satellite operations.
- To observe the role of telemetry, tracking, and command systems in space missions.
- To learn about India's major space missions and future programmes.
- To understand the applications of remote sensing and satellite data in society.
- To connect classroom concepts with real-world technological applications.
- To motivate students to pursue careers and research in advanced science and technology.

Arrival and Security Verification
The visit began with the necessary security verification procedures at the ISRO/ISTRAC premises. After completing the required security checks, the students and faculty members were guided to the seminar hall. Although it was the beginning of the visit, the atmosphere of the organization itself created a sense of excitement and curiosity among the students. Being inside an institution responsible for some of India's most significant space missions made the students realize the importance of scientific discipline, precision, teamwork, and technological innovation.

Overview of ISRO and Its Heritage

The introductory session began with an overview of the history and organizational structure of ISRO. Students were introduced to the remarkable journey of India's space programme and the people whose vision and dedication transformed India into a major space-faring nation.

Founder – Dr. Vikram Sarabhai

The session highlighted the contributions of Dr. Vikram Sarabhai, widely regarded as the father of the Indian space programme. A video presentation on his life and vision was shown to the students. His vision emphasized that space technology should not merely be used for exploring outer space but should also contribute to the social and economic development of the nation. His determination, scientific outlook, and belief in India's technological capabilities served as an inspiration to the students. The presentation reminded students that major technological achievements often begin with a simple but powerful vision supported by dedication, education, research, and perseverance.

Early Days of the Indian Space Programme

Students were introduced to the humble beginnings of India's space programme. Anecdotes about early rocket components being transported using bicycles and bullock carts illustrated how far India's space programme has progressed. The contrast between those early days and today's sophisticated launch vehicles, satellites, mission control systems, and deep-space missions demonstrated the importance of long-term scientific planning and technological self-reliance.

Organizational Scale

The presentation also provided an overview of ISRO's organizational scale, workforce, budget, and major centres involved in India's space activities. Students were introduced to the roles of several important ISRO centres located across the country.

Major ISRO Centres

- Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram: Primarily involved in the design and development of launch vehicles.
- Liquid Propulsion Systems Centre (LPSC), Thiruvananthapuram and Bengaluru: Develops liquid and cryogenic propulsion systems.
- Satish Dhawan Space Centre (SDSC-SHAR), Sriharikota: India's principal spaceport and the centre responsible for launch operations.
- U R Rao Satellite Centre (URSC), Bengaluru: Responsible for satellite design and development.
- Space Applications Centre (SAC), Ahmedabad: Focuses on space-based applications and related technologies.
- National Remote Sensing Centre (NRSC), Hyderabad: Handles remote-sensing data and applications.

Understanding the functions of these centres helped students appreciate how large-scale space missions depend on the coordinated efforts of scientists, engineers, researchers, and technical teams working across different locations.

Evolution of India's Launch Vehicles

A significant part of the technical session focused on the development and evolution of India's launch vehicle technology. Students learned how India gradually developed its capabilities to design and operate increasingly sophisticated launch vehicles.

PSLV – Polar Satellite Launch Vehicle

The Polar Satellite Launch Vehicle (PSLV) was discussed as one of ISRO's most successful and reliable launch vehicles. It has played an important role in launching Earth-observation, scientific, and other satellites.
The PSLV has been associated with several landmark missions, including:

- Chandrayaan-1
- Mars Orbiter Mission (Mangalyaan)
- The launch of 104 satellites in a single mission

The discussion demonstrated how the PSLV became a dependable workhorse of India's space programme.

GSLV – Geosynchronous Satellite Launch Vehicle

The Geosynchronous Satellite Launch Vehicle (GSLV) was introduced as a launch vehicle designed primarily to place heavier communication satellites into geosynchronous and geostationary orbits. Students were introduced to the importance of advanced propulsion systems, particularly cryogenic technology, in achieving such missions.

LVM3 – Launch Vehicle Mark-3

The Launch Vehicle Mark-3 (LVM3), formerly known as GSLV Mk III, was presented as India's heavy-lift launch vehicle. Its major achievements include its association with the Chandrayaan-3 mission, which successfully demonstrated India's capability to perform a soft landing on the Moon.

Evolution and Future Launch Vehicles

The presentation included a timeline illustrating the evolution of India's launch vehicle technology, from early launch systems to modern vehicles such as PSLV, GSLV, LVM3, and SSLV. Students were also introduced to the Small Satellite Launch Vehicle (SSLV), designed to provide a more flexible and cost-effective launch option for smaller satellites. The future direction of India's launch vehicle programme was also discussed, including the development of the Next Generation Launch Vehicle (NGLV). This evolution clearly demonstrated how continuous research, experimentation, engineering innovation, and technological self-reliance have strengthened India's capabilities in space transportation.

Understanding Satellites and Their Applications

The interactive session with the ISRO scientist introduced students to different types of satellites and their purposes. Students learned that satellites are designed according to specific mission requirements. They can support applications such as:

- Communication
- Weather monitoring
- Navigation
- Earth observation
- Remote sensing
- Scientific research
- Disaster management
- Environmental monitoring

The scientist explained the basic working principles of satellites, including how they collect information, process data, transmit signals to ground stations, and support applications on Earth.

The discussion helped students understand how technologies that are often taken for granted in daily life — such as communication, navigation, weather forecasting, and digital mapping — are closely connected with satellite systems.

Visit to the Mission Control Centre

One of the most exciting and memorable parts of the industrial visit was the opportunity to observe the Mission Control Centre. Entering the control-room environment gave students a first-hand impression of the highly technical and disciplined atmosphere in which space missions are monitored and controlled. The students observed the screens and technical systems used in monitoring space-related activities. They were also shown videos related to various ISRO missions and satellite operations.

The experience helped students understand that successful space missions require continuous monitoring, precise communication, real-time decision-making, data analysis, and coordination among multiple teams. The visit made theoretical concepts related to communication systems, computer networks, data processing, control systems, and artificial intelligence more meaningful by connecting them with real-world applications.

ISTRAC and Mission Operations

The students were introduced to the role of ISTRAC – ISRO Telemetry, Tracking and Command Network.

ISTRAC plays an important role in providing telemetry, tracking, and command support for ISRO's satellite and launch vehicle missions.

Telemetry, Tracking and Command

Students learned the significance of:

- Telemetry: Receiving and monitoring information transmitted by spacecraft.
- Tracking: Determining and monitoring the position and movement of spacecraft.
- Command: Sending instructions to spacecraft from ground stations.

These functions are essential for maintaining communication with spacecraft and ensuring that missions operate safely and according to plan.

Ground Station Network

The students were introduced to the extensive network of ground stations that supports India's space missions and enables communication with spacecraft. This helped students understand how ground infrastructure works together with satellites, communication links, data-processing systems, and mission-control facilities.

Basic Concepts of Spaceflight and Orbital Mechanics

The technical presentation also introduced students to several fundamental concepts related to spaceflight and Escape Velocity. Students learned about the concept of escape velocity, approximately 11.2 km/s for Earth, which represents the minimum theoretical speed required for an object to escape Earth's gravitational influence without further propulsion.

Common Orbits

The students were introduced to different types of orbits, including:

- Low Earth Orbit (LEO): Commonly used for Earth-observation and other satellite missions.

- Geostationary Orbit (GEO): Located approximately 36,000 km above Earth's equator and widely used for communication and meteorological satellites.

Celestial Distances

The session also discussed the enormous distances involved in space missions, including the approximate distance between Earth and the Moon and the much greater distance to Mars. These concepts helped students appreciate the engineering challenges involved in planning and operating space missions.

Major ISRO Missions and Future Programmes

The students were introduced to several landmark missions and ambitious future programmes.

Chandrayaan-3

A detailed animation of the Chandrayaan-3 lunar landing was shown.

The students observed the sequence involving the lander, deployment of the ramp, activation of the rover, and the rover's movement onto the lunar surface. The successful mission represented a significant achievement for India's space programme and demonstrated the country's ability to perform a controlled soft landing on the Moon. The landing site was highlighted as Shiv Shakti Point.

Gaganyaan Programme

The students were introduced to the Gaganyaan Programme, India's ambitious human-spaceflight programme. The discussion provided an understanding of the complexity involved in human spaceflight, including crew safety, spacecraft systems, launch vehicles, mission control, communication, and recovery operations.

NISAR Mission

The NASA-ISRO Synthetic Aperture Radar (NISAR) mission was highlighted as an important international collaboration between NASA and ISRO. The mission demonstrates how satellite-based Earth observation can support scientific research and monitoring of changes on Earth's surface and environment.

Bharatiya Antariksha Station

The students were also introduced to India's vision for the Bharatiya Antariksha Station (BAS).

Videos demonstrating docking and undocking operations were shown, giving students an insight into the complexity of future human spaceflight and space-station missions. The programme represents India's long-term ambitions in human space exploration and orbital infrastructure.

Space Technology and Societal Applications

One of the most important aspects of the visit was learning how India's space technology is translated into practical benefits for society. The presentation demonstrated that space research is not limited to rockets and satellites but has applications in agriculture, fisheries, disaster management, environmental monitoring, communication, weather forecasting, mapping, and national development.

Remote Sensing and Earth Observation

Students learned about the role of Indian remote-sensing satellites in collecting information about Earth's surface.

Satellite data can support:

- Forest-fire detection
- Cyclone monitoring
- Weather and environmental studies
- Agricultural applications
- Land-use mapping
- Disaster management
- Resource monitoring

The session demonstrated how remotely sensed data can be transformed into useful information for government agencies, researchers, industries, and the general public.

Search and Rescue Services

The students were introduced to India's satellite-based Search and Rescue (SAR) services. The Indian Mission Control Centre supports the detection of distress signals and contributes to search-and-rescue operations. This demonstrated how satellite technology can directly contribute to saving human lives during emergencies.

Services for Fishermen

Another interesting application discussed was the provision of Potential Fishing Zone (PFZ) advisories. Satellite observations involving parameters such as:

- Chlorophyll concentration
- Sea-surface temperature
- Ocean conditions and winds can be used to provide useful information to fishermen.

Such applications demonstrate how advanced space technology can contribute directly to livelihoods, safety, and economic activity.

Space Science Data Management

The students were also introduced to the importance of space-science data archives and dissemination systems. Large volumes of data generated by scientific missions need to be collected, stored, processed, managed, and made accessible to researchers. This provided a valuable connection to concepts in Artificial Intelligence, Machine Learning, databases, cloud computing, data analytics, and information management.

Relevance to Artificial Intelligence and Machine Learning

As the visiting students belonged to the CSE (AI and ML) programme, the visit provided particularly valuable insights into the growing role of Artificial Intelligence and Machine Learning in the space sector. Students understood that modern space missions generate enormous quantities of data requiring efficient processing and analysis.
AI and ML techniques can contribute to areas such as:

- Satellite-image analysis
- Remote-sensing data classification
- Object and pattern detection
- Weather and environmental monitoring
- Disaster prediction and assessment
- Anomaly detection in spacecraft systems
- Autonomous spacecraft operations
- Mission planning and optimization
- Signal and telemetry analysis
- Space-science data processing

The visit helped students understand that the concepts they study in programming, machine learning, data science, computer vision, and artificial intelligence have direct applications in advanced scientific and engineering domains.

Key Learnings from the Visit

The industrial visit provided students with knowledge and experiences that cannot be fully obtained through classroom learning alone.
The major learnings included:

1. Understanding of India's Space Programme: Students gained a broader understanding of the history, achievements, organizational structure, and future direction of ISRO.
2. Practical Exposure to Space Technology: Students learned about launch vehicles, satellites, propulsion systems, communication systems, and mission operations.
3. Mission Control Experience: Observing the control-room environment helped students understand how space missions are monitored and managed.
4. Understanding of Satellite Applications: Students learned how satellite technology supports communication, navigation, weather forecasting, agriculture, disaster management, fisheries, and environmental monitoring.
5. Awareness of Data Management: Students understood the importance of collecting, processing, storing, and analysing large volumes of space-science data.
6. AI and ML Applications: The visit helped students identify opportunities to apply Artificial Intelligence and Machine Learning techniques to space research and satellite data.
7. Scientific Inspiration: The story of Dr. Vikram Sarabhai and the achievements of ISRO scientists encouraged students to develop curiosity, perseverance, and a research-oriented mindset.
8. Connection Between Theory and Practice: Concepts learned in classrooms became more meaningful when students observed their real-world applications.

Outcomes of the Industrial Visit

1. Students enhanced their understanding of space technology and its applications.
2. Students gained exposure to mission-control environments and satellite data-management systems.
3. Students developed awareness of India's major space achievements and future missions.
4. Students understood the importance of telemetry, tracking, and command systems in space missions.
5. Students gained awareness of Artificial Intelligence and Machine Learning applications in space research.
6. Students developed a greater appreciation for scientific research, innovation, teamwork, and technological self-reliance.
7. The visit motivated students to explore higher education, research, innovation, and career opportunities in advanced technology domains.
8. Students developed a stronger understanding of how space technology contributes to national development and societal welfare.

UN-SDG Mapping

SDG 4 – Quality Education
SDG 8 – Decent Work and Economic Growth
SDG 9 – Industry, Innovation, and Infrastructure
SDG 13 – Climate Action
SDG 14 – Life Below Water