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**NMAM INSTITUTE
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**Five Days Workshop
on**

ROS-2 for Robotic Applications

9th to 13th December 2024

Organized by

**Department of Robotics and Artificial Intelligence
Engineering**



About Nitte (Deemed to be University)

Nitte (Deemed-to-be University) has its roots in a group of Institutions established by the Nitte Education Trust. The Trust was established in 1979 by one of India's respected Statesman, Late Justice KS Hegde, Supreme Court Judge and Speaker of Lok Sabha, with the mission of empowering rural youth through quality education and healthcare. The Trust has established 36 institutions spread over three campuses at Nitte, Mangalore, and Bangalore. It offers education in diverse areas of learning including health professions education, engineering, management, humanities, general education, vocational training, and school/pre-university education. The University received A+ grade in NAAC accreditation in 2021. It has been consistently placed in the top 65th rank in NIRF-2023. The University is placed in the 401 to 450 Rank Band in the QS Rankings for Asia Region. It has received a Diamond rating in the QS I-Gauge India Ratings. Nitte (Deemed to be University) is one among eight Indian Universities in the Top 300 of the world's Universities in the 2022 edition of Times Higher Education Impact Rankings.

About NMAMIT

Situated in the Sylvan surroundings at the foot of the western ghats, Nitte village is 53 km from Mangalore city. Nitte Mahalinga Adyanthaya Memorial Institute of Technology (NMAMIT) is an off-campus center of Nitte (Deemed to be University), Mangalore, it is a premier Engineering Institution that was established in 1986. The institute is recognized by the All-India Council for Technical Education, New Delhi, and accredited by the National Assessment & Accreditation Council [NAAC] with an 'A' grade with a CGPA of 3.11. The institution offers 15 UG programs and offers 7 M-Tech programs, MCA and MBA. The Institution has secured Band 101-150th rank in the NIRF-2023 in the engineering category.

About the Department

The Department of Robotics and Artificial Intelligence started in the year 2021 with an intake of 60 students. The Department offers an Undergraduate program, B Tech in Robotics and Artificial Intelligence. With an excellent infrastructural facility in terms of classrooms and laboratories, the faculty are engaged in research activities and sponsored research projects. The department has excellent research outputs in terms of publications in referred International Journals and National and International Conferences. The faculty members have been continuously updating their technical expertise and knowledge by attending/organizing seminars, conferences, and workshops. The program presents an equal percentage of Robotics and Artificial Intelligence-related courses. Robotics-related courses include the courses on design and manufacturing of the robot, sensing, control, programming, and applications of robots. Courses related to Artificial Intelligence include basics of Programming, Machine Learning, Big Data Analytics, Deep Learning, IT, and Communication Systems. Furthermore, an equal percentage of weightage is given to laboratory components in Robotics and Artificial Intelligence.

Outline of Workshop

This Workshop on ROS2 for Robotic Applications is designed to provide participants with practical knowledge and skills to effectively teach and apply robotics concepts in academic and training environments. With robotics becoming an essential part of engineering and technology education, understanding ROS-2 a leading framework for robotics development, is crucial for preparing students and trainees for industry and research challenges. Through hands-on sessions, participants will develop a strong foundation in ROS2 architecture and core components such as Publisher-Subscriber nodes and Launch files. These skills will enable them to create comprehensive lesson plans and introduce participants to modern robotic system design and programming. The integration of OpenCV for vision-based applications is also a key focus, covering techniques like edge detection, object sorting, and autonomous navigation, which are directly applicable to real-world robotics projects. The workshop emphasizes the design and implementation of mobile robots, manipulators, and advanced vision systems, aligning with the increasing demand for practical, project-based learning.

Program Outcomes

After the completion of this workshop, the participants would be able to:

- ❖ **Build Fundamentals:** Understand ROS2 architecture, tools, and core concepts like Publisher-Subscriber communication and Launch files.
- ❖ **Gain Practical Skills:** Design and implement robotic systems, including mobile robots, manipulators, and vision-based applications.
- ❖ **Master Vision Techniques:** Use image processing methods like edge detection, segmentation, and object detection for robot interaction.
- ❖ **Apply Advanced Concepts:** Execute tasks such as ball tracking, Aruco localization, lane detection, and pick-and-place operations.
- ❖ **Enhance Education and Relevance:** Integrate ROS2 into teaching, mentor research, and equip learners with industry-ready robotics skills.

Topics Covered

- Introduction to ROS-2 architecture, tools, and node communication
- Image processing with OpenCV: edge detection, segmentation, quality inspection, and color/shape sorting.
- Mobile robot design with URDF and integration of ROS2 and OpenCV.
- Ball detection and tracking using vision techniques (segmentation, edge detection, Hough Transform).
- Aruco marker detection and tracking for localization in ROS2.
- Basics of manipulator control and pick-and-place for robotics in ROS2.

Workshop Mode: Offline-Face to Face

The workshop is planned to be in face-to-face Mode. The registered participants will be attending all the sessions at the Robot Programming and Simulation Laboratory under the Department of Robotics and AI Engineering, NMAMIT Campus.

Resource Persons

Dr. Asha C.S., Associate Professor,

Dr. Pooja Nag, Associate Professor,

Dr. Jeane Marina D' Souza, Assistant Professor (Selection Grade),

Mrs. Maithri M., Assistant Professor (Senior Scale),

Department of Mechatronics Engineering, Manipal Institute of Technology (MIT), Manipal Academy of Higher Education (MAHE), Manipal.

Target Audience

The workshop is open to educators, researchers, project associates, from various Technical Institutions and industry professionals from automation, robotics, and automotive sectors, promoting learning and collaboration in robotics technologies.

Note:

- ❖ **Certificate:** Certificate will be issued after the successful completion of the workshop.
- ❖ **Registration fee:** A registration fee of **Rs. 1000/-** per person is applicable for external participants and is payable via NEFT/RTGS to the account or QR code provided.
- ❖ **All the participants are required to register** for the Workshop by filling out the google form <https://forms.gle/oGnyUZ8hVP6xJ9HV9>
- ❖ Total Number of participants for the workshop is restricted to **25 participants**.
- ❖ Accommodation can be arranged for external participants at an additional cost (limited seats available).

**Scan the QR code to register
for the Workshop on ROS-2 for
Robotic Applications**





**NMAM INSTITUTE
OF TECHNOLOGY**

**Five Days Workshop on
ROS-2 for Robotic Applications
9th to 13th December 2024**

Registration Form

Name of the Participant	
Designation	
Department	
Organization	
Address	
Email ID	
Contact Number	
Payment details	
Signature of the Participant (Dated)	

Workshop Schedule: Five days

Day 1: Introduction to ROS-2 Eco-System

Time	Concept Building & Hands on Laboratory
9:30 AM to 10:00 AM	Inauguration of “ROS-2 for Robotic Applications” Workshop
Session -1 10:00 AM-11:15 AM	Introduction to Linux and Python programming
Tea Break	
Session -2 11:30 AM -1.00 PM	Introduction to ROS2, creating packages, nodes, publisher, subscriber, launch files
Lunch Break	
Session -3 2:00 PM -3:15 PM	ROS2 hands on nodes, packages, Publisher, Subscriber, parameters, services, actions, Launch Files
Tea Break	
Session -4 03:30 PM -04:30 PM	Simulation on Turtle-Sim package

Day 2: Development of Robot Vision using ROS-2

Hours	Concept Building & Hands on Laboratory
Session -1 09:30 AM-11:15 AM	Introduction to URDF, simple mobile robot, integration of camera sensor and visualization in Rviz2 and Gazebo (simulation)
Tea Break	
Session -2 11:30 AM -1.00 PM	Introduction to Image processing and Robot Vision, Introduction to OpenCV for ROS-2
Lunch Break	
Session -3 2:00 PM -3:15 PM	Implementation of OpenCV in ROS-2 for Color and shape detection and sorting application
Tea Break	
Session -4 03:30 PM -04:30 PM	Real sensor (camera) integration and visualization in Rviz-2 and Gazebo

Day 3: Vision Algorithms for Robotic Application in ROS-2

Hours	Concept Building & Hands on Laboratory
Session -1 09:30 AM-11:15 AM	Ball Detection and Tracking (Segmentation, Edge Detection, Color Transform, Hough Transform)
Tea Break	
Session -2 11:30 AM -1.00 PM	AruCo marker detection and tracking in ROS2 and OpenCV
Lunch Break	
Session -3 2:00 PM -3:15 PM	Lane Detection and line follower robot using ROS2 and OpenCV
Tea Break	
Session -4 03:30 PM -04:30 PM	Discussion on Projects

Day 4: Development of controller for robotic Application in ROS-2

Hours	Concept Building & Hands on Laboratory
Session -1 09:30 AM-11:15 AM	ROS2 control for manipulator and mobile robot
Tea Break	
Session -2 11:30 AM -1.00 PM	Object Detection using Yolo (Machine Learning)
Lunch Break	
Session -3 2:00 PM -3:15 PM	Manipulator path planning using MoveIt
Tea Break	
Session -4 03:30 PM -04:30 PM	Pick and Place Robot using Yolo

Day 5: Integration of sensors and Autonomous Navigation

Hours	Concept Building & Hands on Laboratory
Session -1 09:30 AM-11:15 AM	Integration of Camera, Depth Sensors, Lidars and IMU with ROS-2 framework
Tea Break	
Session -2 11:30 AM -1.00 PM	Introduction to Navigation Stack in ROS-2
Lunch Break	
Session -3 2:00 PM -3:15 PM	Autonomous Navigation with Mapping of a wheeled robot using ROS-2
Tea Break	
Session -4 03:30 PM -04:30 PM	Discussion on Projects