

Ref. CC/MRSP/Nor/19/53/58

Date 0.9 - Seb - 2019

NOTICE

This is to inform all the Students that a workshop on Workshop Robotics in Motion: Mastering Path Defined Robots for Industrial Applications will be organized on 12.9.2019 from 9:30 AM to 5:30 PM in the auditorium of Catalyst College.

The workshop is completely free, and no money will be charged for the Training or Certification.

Interested students are instructed to meet the Activity In-Charge / Class Coordinator for more details and their registration.

By the order of

Principal / Principal ALYST COTTGE C-16(P) Patliputra and Area



Plot No.-C-16(P), Patliputra Industrial Area Patliputra, Patna - 800013 Phone - 7250767676 E-mail : megha@cimage.in



Date: 12-09-2019

Workshop Title

Robotics in Motion: Mastering Path-Defined Robots for Industrial Applications

Number of Students Participated: 56

Objective:

This workshop is designed to provide a deep dive into the world of path-defined robotics and their applications in industrial automation. Participants will explore the principles behind path planning, control algorithms, and the integration of robots into manufacturing and production environments. By the end of the workshop, attendees will gain hands-on experience in programming and controlling pathdefined robots, which are essential for tasks like material handling, assembly, welding, and packaging in various industries.

Through interactive discussions, practical demonstrations, and real-time programming exercises, participants will be equipped with the knowledge and tools to implement robotics solutions that can enhance productivity and precision in industrial settings.

Model 1. Welcome & Introduction to Robotics in Industry

- Welcome Remarks: Brief introduction to the workshop's objectives and importance in the modern industrial landscape.
- Overview of Path-Defined Robots:
 - What is path-defined robots and why are they crucial for industrial applications?
 - A brief introduction to common industrial robots (e.g., articulated, SCARA, delta robots) and their applications in various sectors like automotive, electronics, pharmaceuticals, and logistics.



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- Importance of Motion Control in Robotics:
 - Understanding how robots move: Basic concepts of kinematics, trajectory, and path planning.
 - Differences between point-to-point and continuous path motion in industrial applications.

Model 2. Fundamentals of Path-Defined Robotics

- Robot Kinematics:
 - Overview of robot kinematics: Forward and inverse kinematics.
 - How to calculate positions and orientations of a robot arm for path planning.
- Coordinate Systems in Robotics:
 - Understanding Cartesian, joint, and tool coordinate frames.
 - Using coordinate transformations for precise path control.
- Path Planning in Robotics:
- Trajectory Generation:
 - How to generate smooth and accurate trajectories for industrial tasks.
 Velocity, acceleration, and jerk control in trajectory planning.

Model 3. Motion Control Techniques for Path-Defined Robots

- Types of Motion Control:
 - Point-to-point motion control vs. continuous path motion. Joint-space
 - vs. Cartesian-space motion control.



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- PID Control in Robotics:
 - Introduction to PID (Proportional, Integral, Derivative) control for robot motion.

 How PID control works in regulating robot speed, position, and direction.
- Advanced Motion Control Methods:
 - Model Predictive Control (MPC) for optimizing motion in dynamic environments.

 Admittance Control: Controlling robot response based on external forces (e.g., for assembly tasks).
- Real-Time Motion Control:
 - Techniques for achieving high-precision control in real-time applications.

 Ensuring robot motion synchronization and avoiding errors due to delays or disturbances.

Model 4. Programming Path-Defined Robots for Industrial Applications

- Robot Programming Languages:
 - Introduction to programming languages used for robotic control (e.g., URScript for Universal Robots, RAPID for ABB robots, KRL for KUKA robots).
 - Basics of writing programs to move robots along a predefined path.
- Hands-on Programming Exercise:
 - Programming a robot to follow a linear path from one point to another using a simple robot arm simulator.

 Creating a path with multiple waypoints and incorporating speed control for smooth motion.
- Handling Obstacles and Complex Paths:
 - Using path planning algorithms to avoid obstacles.
 - Modifying robot motion in real-time in response to unexpected changes in the environment (e.g., object detection and avoidance).
- Integrating Sensors for Enhanced Path Control:



Principal CATALYST COLLEGE Plot No.: C-16(P) Patliputra Industrial Area Patliputra, Patna-13 How sensors like vision systems, LIDAR, and force sensors improve path planning and execution.

 Case studies on using robots with integrated sensors for quality control and assembly tasks.

Model 5. Industrial Applications of Path-Defined Robotics

- Material Handling and Pick-and-Place Operations:
 - How path-defined robots are used for automating material handling, packaging, and assembly.

 Programming robots to pick and place objects based on predefined paths.
- Welding, Painting, and Assembly:
 - The role of path-defined robots in precision welding, painting, and assembly processes.
 - Ensuring accuracy and repeatability in tasks such as robotic welding, spray painting, and gluing.
- Robot Path Optimization for Manufacturing:
 - Techniques to optimize robot paths for faster and more efficient operations.
 - Case studies of companies using robotics to reduce cycle time and improve throughput.
- Collaborative Robots (Cobots) in Path-Defined Applications:
 - The rise of cobots in manufacturing environments and how they work alongside humans.
 - Programming and path-planning challenges in collaborative robotics.

Model 6. Simulation and Testing of Path-Defined Robot Motion

- Simulation Software for Robotics:
 - Introduction to robot simulation tools (e.g., VREP, Gazebo, RobotStudio).

• How to simulate and test robot motions before deploying them in realworld environments.



- Simulating Path-Defined Robots:
 - Creating and testing robot paths using simulation software.

 Analyzing and optimizing robot motions for efficiency and safety in industrial tasks.
- Validating Performance:
 - Techniques for measuring robot accuracy and repeatability in simulation.

 How to test robot paths for collision avoidance, energy efficiency, and task completion.

Model 7. Industrial Case Study and Use Case Implementation

- Case Study:
 - Real-world example of a company implementing path-defined robots in a production line (e.g., automotive assembly, electronics manufacturing).
 Challenges faced and solutions implemented in programming, controlling, and optimizing robot motion.
- Hands-on Application:
 - Applying the concepts learned by programming a robot to perform a specific industrial task (e.g., assembly line task, pick-and-place operation).

 Troubleshooting common issues such as path deviations, speed optimization, and obstacle avoidance.

Model 8. Future Trends and Innovations in Path-Defined Robotics

- Robotics in the Future of Industry 4.0:
 - How path-defined robots are evolving with Industry 4.0 technologies like AI, machine learning, and IoT.
 The role of autonomous mobile robots (AMRs) and cobots in future manufacturing environments.
- Upcoming Robotics Trends:



Principal CATALYST COLLEGE Plot No.- C-16(P) Patliputra Industrial Area Patliputra, Patna-13 Trends like multi-robot systems, soft robotics, and robot learning.
 How future path planning and motion control systems will be influenced by advances in AI and data analytics.

Key Takeaways:

- Path Planning Mastery: Understanding how to create, optimize, and execute complex robot paths for industrial tasks.
- Motion Control Skills: Gaining hands-on experience with motion control algorithms and real-time robot programming.
- Industrial Applications: Knowledge of how robots are used in material handling, assembly, welding, and other industrial processes.
- Simulation and Testing: Ability to simulate, test, and validate robot motion before deployment in real-world environments.
- Future Trends: Awareness of emerging trends and technologies in robotics, such as collaborative robots, machine learning, and Industry 4.0 integration.

Robotics in Motion: Mastering Path-Defined Robots for Industrial Applications



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Robotics in Motion: Mastering Path-Defined Robots for Industrial Applications



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Registration

For Workshops/Seminars/Conferences during Academic Year 2018-2019

Workshop on R Programming by IIT Bombay

(12 September 2019)

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44	445-7027	Anish Raj	Anith Pain
45	445-7345	Avinash Kumar	Alizash Kimar
46	445-7384	Deeplal Ram	Deeplad Kein
47	445-7392	Kajal Kumari	Kajal Kumani
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Course Coordinator