



Under the aegis of Vijayam Educational Trust

CATALYST COLLEGE

(A Unit of CIMAGE Group of Institutions)

Institution approved by Education Department, Government of Bihar, Affiliated to Patliputra University, Patna.



Ref...CC/WRSP/NOT/19/53/58

Date 09 - Sep - 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

[Signature]
Principal
CATALYST COLLEGE
C-16(P) Patliputra Industrial Area
Patliputra, Patna

Plot No.-C-16(P), Patliputra Industrial Area
Patliputra, Patna - 800013

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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.



- 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.
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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:
 - What is path planning and why is it important for industrial robots? ◦ Types of paths: Linear, circular, spline, and complex trajectories. ◦ Path planning algorithms and how they are used to guide robots along predefined paths.
 - Trajectory Generation:
 - How to generate smooth and accurate trajectories for industrial tasks. ◦ Velocity, acceleration, and jerk control in trajectory planning.
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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.



- 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.
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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:



- 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.
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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.
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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:



- 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.

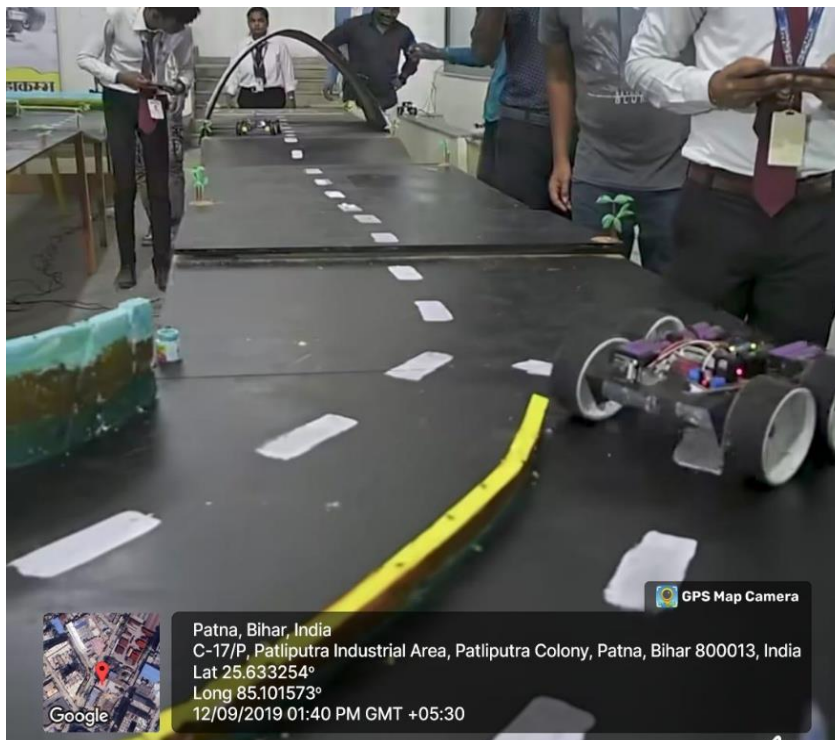
Key Takeaways:

- **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



Date:12/09/2019



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CATALYST COLLEGE
Plot No.- C-16(P) Patliputra Industrial Area
Patliputra, Patna-13

Registration

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

Workshop on R Programming by IIT Bombay

(12 September 2019)

S. No.	ID	Name of the student	Student's Signature
1	445-6981	Aditya Kumar Sahni	Aditya Kumar Sahni
2	445-6762	Akshay Verma	Akshay Verma
3	445-6915	Aman Kumar Gupta	Aman Kr Gupta
4	445-7272	Amit Kumar Thakur	AK Thakur
5	445-7443	Ashutosh Kumar	Ashutosh Kumar
6	445-6725	Bipul Kumar	Bipul Kumar
7	445-6767	Gautam Kumar Solanki	Gautam Kr Solanki
8	445-6951	Golu Kumar	Golu Kumar
9	445-6928	Harsh Raj	Harsh Raj
10	445-6937	Kamya Rani	Kamya Rani
11	445-6939	Karishma Kumari	Karishma Kuni
12	445-6750	Komal Kumari	Komal Kumari
13	445-7390	Krishn Mohan Kumar	Krish Mohan Kr
14	445-7250	Manish Kumar	Manish Kumar
15	445-6977	Nur Alam	Nur Alam
16	445-6862	Prakash Raj	Prakash Raj
17	445-6853	Prashant Kumar	Prashant Kumar
18	445-6974	Prince Kumar Singh	Prince Kumar Singh
19	445-6730	Raghav Raman Choudhary	Raghav Raman
20	445-6747	Ranjeet Kumar Yadav	Ranjeet Kr Yadav
21	445-6733	Raunak Rani	Raunak Rani
22	445-6854	Sanjeev Kumar	Sanjeev Kumar
23	445-7423	Satish Kumar	Satish Kumar
24	445-6883	Saurav Kumar	Saurav Kumar
25	445-6761	Shankar Kumar	Shankar Kumar
26	445-6993	Shiv Jee Kumar Yadav	Shiv Jee K yadav
27	445-6728	Shivam Shekhr	Shivam Shekher
28	445-7029	Sonal Kumar Singh	Sonal Kumar Singh
29	445-6770	Subham Kumar	Subham Kr
30	445-6742	Subham Shankar	Subham Shankar
31	445-7604	Tanuja	Tanuja
32	445-6991	Ujval Kumar Verma	Ujval Kr Verma



33	445-7001	Vikash Kumar	Vikash Kumar
34	445-7023	Vikash Kumar	Vikash Kumar
35	445-6739	Vinayak Gupta	Vinayak Gupta
36	445-6759	Vishal Pandey	Vishal Pandey
37	45-7432	Bolbam Kumar	Bolbam Kumar
38	445-6741	Kanish Kumar	Kanish Kumar
39	445-6948	Manish Raj	Manish Raj
40	445-6737	Manisha Kumari	Manisha Kumari
41	445-6933	Ravnaak Kumar	Ravnaak Kumar
42	445-7275	Aaseen Alam	Aaseen Alam
43	445-7343	Akshat Raj	AKSHAT RAJ
44	445-7027	Anish Raj	Anish Raj
45	445-7345	Avinash Kumar	Avinash Kumar
46	445-7384	Deeplal Ram	Deeplal Ram
47	445-7392	Kajal Kumari	Kajal Kumari
48	445-7033	Kajal Kumari	Kajal Kumari
49	445-6886	Kamlesh Kumar Singh	Kamlesh Kumar Singh
50	445-7377	Kundan Kumar	Kundan Kumar
51	445-7039	Manish Kumar	Manish Kumar
52	445-7483	Md Arbaz Ansari	Md. Arbaz Ansari
53	445-7252	Md Faizan	Md. Faizan
54	445-7430	Mukesh Kumar Jha	Mukesh Kumar Jha
55	445-7469	Nitish Kumar	Nitish Kumar
56	445-7379	Pankaj Kumar	Pankaj Kumar



(Sign.)

Course Coordinator