



Integrating Robotics and Computer Vision

Introduction

"Integrated Robotics Workshop" is your gateway to the exciting intersection of robotics and computer vision. In this workshop, we'll embark on a fascinating journey to explore how these two fields come together to create intelligent and autonomous systems. Whether you're a robotics enthusiast, a budding engineer, or someone passionate about cutting-edge technology, this workshop offers a unique opportunity to dive into the world of integrated robotics.

Abstract

The "Integrated Robotics Workshop" is designed to provide participants with a deep understanding of robotics and the crucial role of computer vision in the field. Over the course of this workshop, you'll delve into mechanics, path planning, controls, electronics, image processing, and advanced techniques like the YOLO algorithm. Through practical sessions and hands-on projects, you'll gain the skills needed for concepts in robotics and computer vision. The workshop concludes with the integration of these modules into final simulations, ensuring you're well-prepared to contribute to developments in integrated robotics.

Duration

1 Day, 2 Sessions: 3 hours each

Session 1	<ol style="list-style-type: none">1) Mechanics - Forward Kinematics, Inverse Kinematics2) Path Planning3) Controls - State Space Methods, PID Controls4) Electronics - Actuators & Controls, Power Electronics, Basic Embedded System
Session 2	<ol style="list-style-type: none">1) Basic Image Processing - Image Transformations, Edge Detection2) YOLO Algorithm3) Object Detection, Pose Estimation, Semantic Segmentation4) Final Simulations - Integrating all the Modules

Pre-requisites

Basic Python Knowledge, Preferably using Miniconda, Basic Linear Algebra

SESSION 1

1) Mechanics and Control

- Categorization of Manipulators and Analyzing Architectural Structures
- Denavit-Hartenberg Parameters and Homogeneous Matrix in Robotics
- Forward Kinematics to Establish Object POSE
- Basics of Path Planning Techniques
- Understanding and Applying Inverse Kinematics over different Manipulators
- Control: Transfer Function, PID Control, and Introduction of State Space Methods.

2) Electronics

- Types of Actuators and Sensors in Manipulator Design.
- Power Management: Voltage Conversion and Regulation.
- Microcontrollers: Key Modules and Actuator Control.

SESSION 2

1) Computer Vision

- Basic Image Processing techniques and Image transformations
- YOLO Algorithm - Intuition and Coding
- Using YOLO to perform object detection
- Semantic segmentation using U-Net architecture
- Pose estimation through edge detection