Presentation of pilot course: EE 399A: Introduction to Robotics

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Overview

- **Problem:**
  - The current ECE curriculum lacks courses at the junior level under the control systems pathway.
  - Students are not exposed to control systems until their senior-level course (ECE 447).
  - ECE 447 is mostly theoretical and lacks hands-on experience.
  - Students choosing the control systems pathway don't get hands-on controls engineering experience until the ENGINE capstone.
- **Solution:**
  - Introduction of a new junior-level course in the control systems pathway.
  - The course will include hands-on lab exercises to acquaint students with basic methodologies and tools in robotics research and applications.
  - Students will work in teams to design, model, and create a variety of controllers for an educational-based robotic kit.
  - The course aims to expose students to the basics of robotic control using popular development environments, such as ROS, Python, and MATLAB.

ECE 399 – Introduction to Robotics

Week	Topic
1	Introduction to MechArm Pi and Basic Blockly Programming
2	Simple Pick and Place Operations with Blockly
3	Introduction to the Robotic Operating System (ROS)
4	Basic Robot Control using Python and ROS
5	Overview of Path Planning Concepts
6	Introduction to MATLAB for Robotics
7	Basic Use of Simulink for Robot Control
8	Introduction to Speed Planning with MATLAB and Simulink
9	Introduction to the Final Project: Basic Robot Control
10	Completion of the Final Project: Simple Maze Navigation and Pick and Place Operations

ECE 399 – Introduction to Robotics

Week	Topic
1-2	Lab 1: Introduction to Robot Arm Manipulation
3-5	Lab 2: Introduction to Robotic Operating System and Control Library
6-8	Lab 3: Introduction to MATLAB and Simulink
9-10	Lab 4: Advanced Robot Control: Final Project

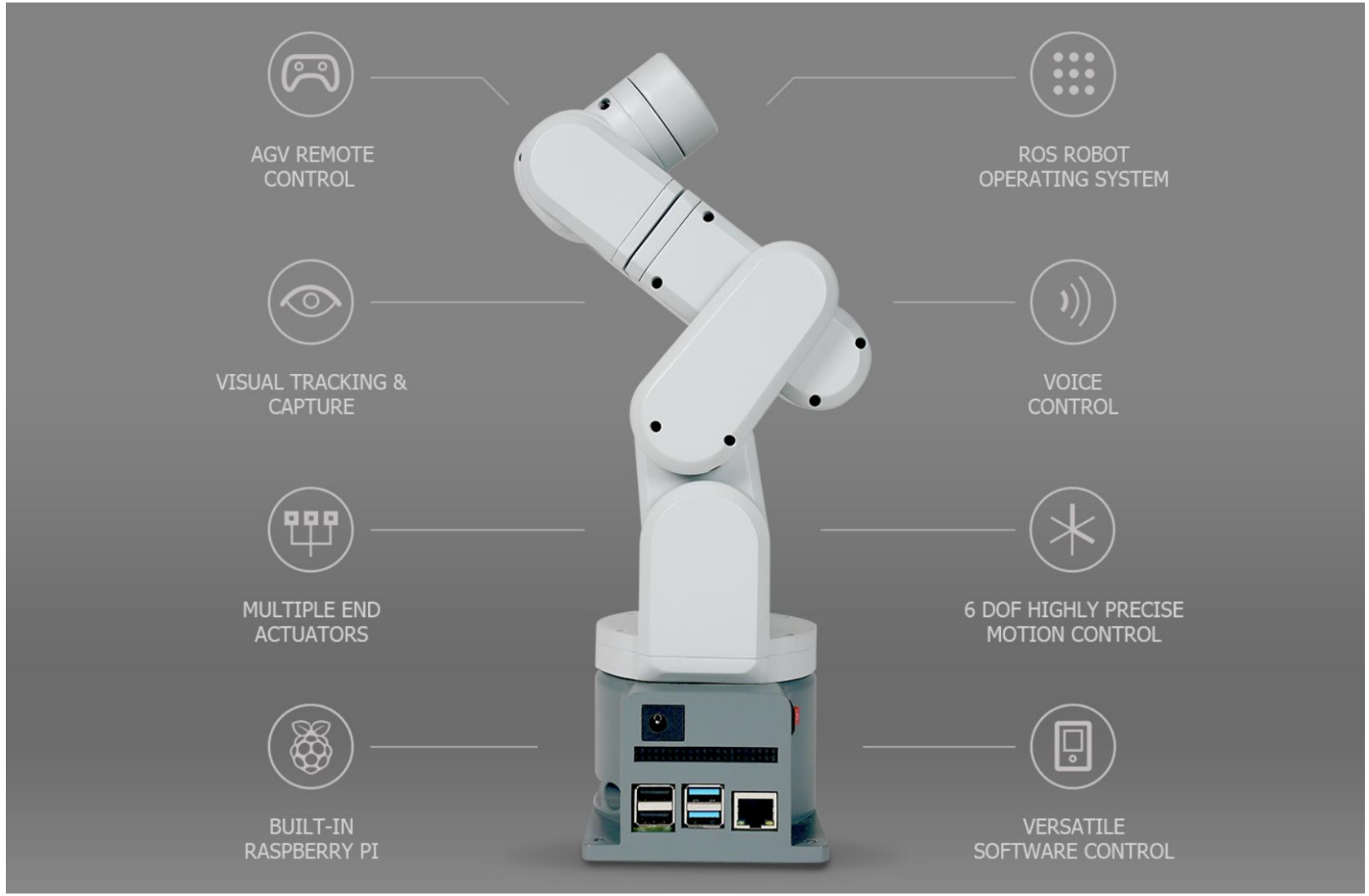
Key Concepts Across 4 Labs:

Concept Category	Details
Software Tools	Matlab+Simulink, Control Library (Python)
Mathematical Concepts	Jacobian, State Space Transformation, Linear Algebra, Transfer Function
Control Concepts	Feedback, PID, Localization, Sensors, Computer Vision, Actuators, Optimization

Key Numbers:

Item	Quantity
Students per group	3-4
Total groups	8-10
Arms with gripper assembly	4-5
Arms with suction assembly	4-5
myAGV rovers	4-5

MechArm Pi: 6-Axis Robot Arm



大象机器人
Elephant Robotics

MyAGV: Autonomous Navigation Smart 4-Wheel Drive Vehicle

Undergraduate Robotics Lab

Undergraduate Robotics Lab

Undergraduate Robotics Lab

Challenges

- Space is the main issue for creating an undergraduate robotics lab.
- Room ECE 137 is not an option due to its high traffic.
- Converting half of the room ECE 365 into a robotics lab would result in overcrowding, as it is currently used for three courses (ECE 469, 271, and 371).
- Sharing room ECE 345 with ECE 474 students is also not ideal, as it may lead to scheduling conflicts and space constraints.