



ENGINEERING
INDUSTRIAL TECHNOLOGY
REAL IMPACT

NIS PFE BOOK 2026-2027

Final-Year Engineering Projects Robotics, Vision and Automation



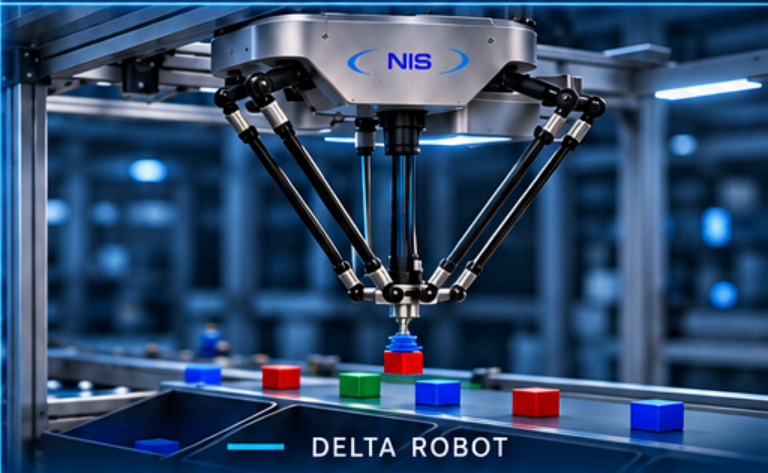
INDUSTRIAL AMR



AGRICULTURAL AMR



AGRICULTURAL DRONE



DELTA ROBOT



CITRUS SORTING MACHINE

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Robotics, vision and automation.

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HOW TO APPLY

Send your CV, portfolio (if available) and a short motivation letter.

contact@nistunisia.com

Internship – Mechanical Design and Simulation of an Industrial AMR

Join NIS and contribute to the development of a real industrial robotics platform, from mechanical design to simulation. Turn your engineering skills into real-world impact.



DESIGN
SIMULATE
INNOVATE

THE PROJECT

Design a compact, robust and industrial-grade autonomous mobile robot intended for material transportation in professional environments. The focus of the internship is the mechanical design, validation and simulation of one AMR platform, from concept to a simulation-ready model.

KEY OBJECTIVE

Develop a complete 3D CAD model of the AMR, perform the necessary mechanical calculations and prepare the robot for simulation. The final model must be ready for integration with ROS 2 and Gazebo.

MAIN TASKS

- Study existing industrial AMR solutions
- Define the mechanical architecture and dimensions
- Select wheels, motors, gearboxes and key components
- Perform payload, torque and structural calculations
- Create the complete 3D CAD model (Fusion 360 preferred)
- Prepare engineering drawings and technical documentation
- Develop a simulation-ready URDF/Xacro model
- Integrate and test the robot in ROS 2 and Gazebo
- Validate basic movement and behavior in simulation
- Provide a final report with design choices and recommendations

PROFILE

- Engineering student in Mechanical Engineering, Mechatronics, Robotics or a related field
- Strong interest in robotics and industrial applications
- Autonomous, motivated and curious
- Good problem-solving skills

EXPECTED DELIVERABLES

- Complete 3D CAD model
- Technical drawings and main specifications
- Mechanical calculations (payload, torque, structure, etc.)
- URDF/Xacro model
- Gazebo simulation environment
- Demonstration of the robot in simulation
- Final technical report

PREFERRED SKILLS

- Fusion 360 (preferred) or similar CAD software
- Mechanical design and basic structural analysis
- ROS 2 and Gazebo
- URDF / Xacro
- Basic robot kinematics and dynamics
- Python or C++ (an advantage)

ABOUT NIS

NIS is an engineering and industrial technology company combining decades of industrial experience with automation, robotics, artificial intelligence and computer vision. We develop innovative solutions for real industrial needs.



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Internship – Mechanical Design and Simulation of an Agricultural AMR

Join NIS to develop a mobile robot for plant monitoring. Design a robust platform for agricultural environments, from mechanical concept to simulation.



DESIGN
SIMULATE
INNOVATE

THE PROJECT

Design an agricultural Autonomous Mobile Robot (AMR) for camera-based plant monitoring. The platform will support future analysis of crop health and signs of possible nutrient deficiencies, helping identify areas that may need attention. The internship focuses on the robot's mechanical design and simulation.

KEY OBJECTIVE

Develop the complete 3D CAD model, perform the mechanical calculations and validate the platform in Gazebo. Provide a ROS 2-compatible model with camera mounts and space for electronics. AI-based crop analysis will be developed separately.

MAIN TASKS

- Study terrain, crop-row spacing and ground clearance
- Define the chassis and drivetrain architecture
- Size motors and wheels; calculate torque and traction
- Check chassis strength, stability and sensor payload
- Design camera mounts and cable routing
- Plan battery space, electronics and weather protection
- Create the complete CAD model (Fusion 360 preferred)
- Prepare technical drawings and a bill of materials
- Build a ROS 2-compatible URDF/Xacro model
- Validate basic motion on representative terrain in Gazebo

PROFILE

- Engineering student in Mechanical Engineering, Mechatronics, Robotics or a related field
- Interest in mobile robotics and agricultural technology
- Autonomous, motivated and curious
- Good problem-solving skills

EXPECTED DELIVERABLES

- Complete 3D CAD model
- Technical drawings and bill of materials
- Mechanical calculations and component selection
- ROS 2-compatible URDF/Xacro model
- Gazebo simulation environment
- Robot motion demonstration in simulation
- Final technical report and handover documentation

PREFERRED SKILLS

- Fusion 360 (preferred) or similar CAD software
- Mechanical design and basic structural analysis
- ROS 2 and Gazebo
- URDF / Xacro
- Basic robot kinematics and dynamics
- Python or C++ (an advantage)

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INTERNSHIP OPPORTUNITY

Internship – Autonomous Agricultural Drone: Design, Simulation and Prototyping

Join NIS to develop an autonomous drone for smart crop monitoring and inspection, from Gazebo simulation to an integrated prototype.



DESIGN
SIMULATE
PROTOTYPE

THE PROJECT

Develop an autonomous drone system for agricultural monitoring and inspection. The drone will follow field coverage routes, collect geolocated camera data, return to base and land on a docking station. The project combines Gazebo simulation, mechanical design, hardware integration and prototyping.

KEY OBJECTIVE

Build a ROS 2 and PX4 workflow from simulation to a physical prototype using a PX4-compatible drone platform. Demonstrate basic crop monitoring, autonomous return, precision landing and a docking/low-power charging proof of concept. Advanced crop-analysis AI is outside the internship scope.

MAIN TASKS

- Set up PX4 SITL, ROS 2 and modern Gazebo
- Develop field coverage and camera capture missions
- Add geofencing, failsafes and low-battery return
- Implement vision-assisted precision landing
- Design camera mounts, landing gear and docking parts
- Calculate mass, balance, thrust and flight endurance
- 3D print parts and integrate sensors and electronics
- Prototype docking contacts and low-power charging
- Build a basic crop-monitoring demonstration
- Run simulation and supervised prototype tests

PROFILE

- Engineering student in Robotics, Mechatronics, Embedded Systems or a related engineering field
- Python and/or C++; Linux and Git
- Basics of robotics, control, electronics and CAD
- Strong problem-solving and hands-on interest

EXPECTED DELIVERABLES

- Gazebo farm environment and autonomous mission
- ROS 2 / PX4 software and configuration
- Mechanical CAD, drawings and bill of materials
- Engineering calculations and selected printed parts
- Integrated drone and docking-station prototypes
- Basic monitoring and precision-landing demos
- Docking and low-power charging proof of concept
- Test results, technical report and final demonstration

PREFERRED SKILLS

- ROS 2, Gazebo and PX4 or ArduPilot
- Fusion 360 (preferred) or SolidWorks; 3D printing
- UAV flight controllers and sensor integration
- OpenCV and vision-based pose estimation
- Path planning and autonomous navigation
- Embedded Linux and companion computers

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Internship – Delta Robot for Vision-Based Object Sorting

Design, Simulation and Control

Join NIS to build a robotic sorting system combining mechanical design, computer vision and motion control, from simulation to potential prototype integration.

DESIGN
SIMULATE
CONTROL

THE PROJECT

Design and simulate a Delta parallel robot that sorts small objects by color. An overhead RGB camera will detect objects and locate them in the workspace. The robot will pick each object and place it in the matching bin through a complete automated sorting cycle.

KEY OBJECTIVE

Deliver an integrated ROS 2 and Gazebo system combining mechanical design, forward/inverse kinematics, camera calibration, OpenCV perception and motion control. Validate sorting in simulation first. Transfer the workflow to a physical prototype if hardware is available.

MAIN TASKS

- Size the geometry, actuators and end-effector
- Create CAD and complete mechanical calculations
- Implement kinematics, workspace and reachability checks
- Model parallel links and closed-loop constraints
- Build the ROS 2/Gazebo scene and virtual camera
- Detect object colors and positions with OpenCV
- Calibrate image-to-robot coordinates with ROS TF
- Plan smooth motion with speed/acceleration limits
- Coordinate detection, gripping, transfer and sorting
- Validate sorting accuracy, cycle time and repeatability

PROFILE

- Engineering student in Robotics, Mechatronics or a related mechanical, control or computing field
- Python and/or C++; Linux and Git
- Knowledge of kinematics and basic control systems
- Interest in mechanical design, vision and integration

EXPECTED DELIVERABLES

- CAD model, drawings and mechanical calculations
- ROS 2 packages, URDF/Xacro and simulation assets
- Forward and inverse kinematics implementation
- OpenCV color detection and camera calibration
- Pick-and-place and sorting controllers
- Complete Gazebo sorting demonstration
- Source code, demo video and technical report
- Prototype integration, if hardware is available

SKILLS AND TOOLS

- ROS 2, Gazebo, URDF/Xacro and RViz
- OpenCV, color detection and camera calibration
- Fusion 360 (preferred) or SolidWorks; 3D printing
- Robot kinematics and trajectory generation
- Motor drivers, encoders and microcontrollers (a plus)
- micro-ROS or industrial automation (a plus)

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INTERNSHIP OPPORTUNITY

Internship – Continuous Citrus Sorting Machine

Mechanical Design, Fabrication and Automation

Turn a complete machine concept into a working prototype, from fruit feeding to controlled sorting outlets.



THE PROJECT

Design and build a compact continuous citrus sorter covering the complete mechanics, fabrication, electrical system and automation. Include fruit feeding, presentation and rotation. Cameras, lighting, image processing and AI are excluded.

KEY OBJECTIVE

Deliver a one-lane prototype with three controlled outlets and terminal recovery. Validate carrier tracking and gentle ejection. Destinations are simulated or entered on the HMI; prepare an interface for future vision integration.

MAIN TASKS

- Define the architecture, dimensions and operating cycle
- Design feeding, singulation, carriers and fruit rotation
- Engineer the continuous drive and gentle ejection system
- Select motors, transmissions, sensors and actuators
- Produce CAD, calculations, drawings and a bill of materials
- Fabricate, assemble and adjust the complete prototype
- Design and wire the electrical system and safety functions
- Program carrier tracking, outlet timing and the HMI
- Test routing, tracking accuracy and fruit handling

PROFILE

- Final-year student in Mechatronics, Mechanical Engineering, Automation or a related field
- Interest in machine building and hands-on prototyping
- Rigorous, autonomous and strong problem-solving skills

EXPECTED DELIVERABLES

- Complete CAD model, drawings and calculations
- Assembled single-lane sorting prototype
- Three controlled outlets plus terminal recovery
- Electrical schematics, wiring and automation code
- HMI with manual or simulated destination inputs
- Defined interface for future vision integration
- Test results, demonstration and technical report

PREFERRED SKILLS

- Fusion 360, SolidWorks or equivalent CAD
- Mechanisms, motor sizing and manufacturing
- Electrical wiring, sensors, encoders and actuators
- PLC programming, sequential control and HMI
- Fabrication, assembly and commissioning

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