



ENPM808X: Software Development for Robotics

Final Project Proposal

Author 1: Tarun Trilokesh
UID: 118450766

Author 2: Sai Surya Sriramoju
UID: 119224113

Overview

Acme Robotics is exploring the potential of robotics in quality assurance and maintenance. This proposal outlines the development of an Inspection/Rework Robot designed to navigate and inspect structures or assemblies for anomalies, using advanced sensing and image processing techniques.

Project Code Name

InspectorBot

Component Overview

InspectorBot will be equipped with high-resolution cameras and sensors to navigate and inspect various structures. Utilizing computer vision algorithms, the robot will identify anomalies, log their locations, and provide detailed reports on detected irregularities.

Design and Implementation Strategy

The project will be managed using Agile development practices, allowing for rapid iteration and adaptability. System architecture and workflows will be illustrated through UML diagrams to visualize component interactions and data flow.

Technologies and Tools

- Programming Language: Python
- Computer Vision Library: OpenCV
- Simulation Environment: Gazebo
- Robot Operating System (ROS) for control and navigation
- Version Control: Git with GitHub
- Continuous Integration: GitHub Actions
- Unit Testing: pytest for Python, Google Test for C++
- Static Code Analysis: Pylint and cppcheck
- Documentation: Doxygen for code documentation, codecov for coverage reporting

External Libraries and Packages

- ROS packages for sensor integration and robot navigation
- Image processing libraries compatible with OpenCV

All selected libraries are open-source, ensuring easy integration and compliance with legal requirements.

Algorithms and Approaches

- Image Processing: Algorithms for anomaly detection based on visual characteristics
- Navigation: Path planning and obstacle avoidance for efficient inspection routines
- Data Logging: Recording the locations and details of detected anomalies

Challenges and Solutions

- Accurate Anomaly Detection: Continual refinement of image processing algorithms to enhance detection accuracy.
- Efficient Navigation: Implementing advanced path planning techniques to optimize inspection routes.
- Handling Varied Environments: Adapting sensor configurations to work effectively in diverse settings.

Key Deliverables

- A fully functional Inspection/Rework Robot with integrated sensing and processing capabilities
- Detailed UML diagrams and system documentation
- A GitHub repository with all source code, testing frameworks, and CI configurations
- Comprehensive documentation for developers and end-users
- A 5-minute technical presentation and demonstration video showcasing the robot's capabilities

Team Collaboration

The project will leverage pair programming to ensure high code quality and efficient problem-solving. Agile methodologies, including regular sprint reviews, will guide the development process, aligning with Acme Robotics' strategic objectives.

This proposal aims to advance Acme Robotics' portfolio with a cutting-edge inspection and rework solution, underscoring the company's commitment to innovation in robotic technologies.