Project Deliverable B: **Need Identification and Problem Statement**

GNG 1103 – Engineering Design

Faculty of Engineering – University of Ottawa

Problem Statement:

There is a need for an inverse kinematics program to pilot a robotic arm with 6 DOF and a need for end-effectors which can effectively carry out scanning, cleaning, and painting of navel surfaces while piloted by a single operator. This need entails the creation of a code for a 3 DOF arm as proof of concept (that can then be scaled up to 6 DOF) and the utilization of various innovated end effectors.

Needs:

Need	Priority Level (1 Lowest, 5 Highest)
Maneuver complicated spaces	5
End effectors must be easily removed and attached	3
Easily piloted and simple interface	5
Complete a 2-meter x 2-meter square in 4 hours	3
Weigh less than 20 lbs. or broken down into pieces less than 20 lbs. that are easy to carry.	4
Scan working area and compute the path and approach needed	4
Self-contained lighting on the camera end effector	3
Safe to be around	2
Water resistant	2
Piloted by one operator (Assume operator has no technological training)	4
Operate in an autonomous state once a task is set by the operator	3

Similar products:

- Artificial Neural Networks to solve Inverse Kinematics of a 3 DOF Robot Arm: https://medium.com/@kasunvimukthijayalath/building-ann-to-solve-inverse-kinematics-of-a-3-dof-robot-arm-2b1c3655a303
- Hull treatment Carrier (HTC) ship painting robots: https://www.hapag-lloyd.com/en/company/about-us/newsletter/2019/07/hapag-lloyd-tests-ship-painting-robots.html
- Advanced Robotic Laser Coating Removal System (ARLCRS): https://www.cmu.edu/homepage/computing/2012/fall/paint-stripping-robot.shtml

- Blastone Robotics for Sandblasting: https://www.blastone.com/product-category/blasting/robots-automation/
- Okibo autonomous plastering robot: https://www.okibo.com/
- Robotic Tank Inspection End Effector: https://www.dndkm.org/DOEKMDocuments/ITSR/Tank/Robotic_Tank_Inspection_End_Effector.pdf
- KUKA and Dürr's ready2_spray
- FANUC's PaintMate
- B+M Surface Systems
- ABB's FlexPainter
- VERTIDRIVE M7

Product reviews:

- KUKA and Dürr's ready2_spray "Provides all the necessary components for a painting robot."
- FANUC's PaintMate "Comes in a variety of sizes"
- ABB's FlexPainter "large work envelope"
- B+M Surface Systems "large range of choices"
- Cleaning: VERTIDRIVE M7 "smaller working radius, ensuring maximum maneuverability in narrow spaces."
- Hull Treatment Carrier (HTC) "Thanks to these robots, overspray is no longer an issue. The thickness of the applied layer of paint is also much more uniform."
- Okibo plastering robot: "Okibo requires minimum personal intervention to operate."