**Research Proposal – SRIP**

It would not be challenging when a second-grade child tries to draw a simple curve, such as a parabola, for the first time (assuming she knows how to draw simple strokes). The same child when asked to draw the same curve in a different scale or orientation after she has been taught how to draw that particular curve, should be easy like the previous task. But when the same tasks are given to a robot it is difficult and the algorithms used now by industries are very basic and rudimentary.

Our research addresses this challenge by focusing on the concept of generalization in robotics. Generalization refers to a robot’s ability to apply learned skills or knowledge to new tasks, situations, or environments that it has not previously encountered. Achieving generalization in robotics is a significant challenge due to the complexity and variability of real-world environments. However, it is a crucial step toward creating robots that can operate effectively in a wide range of tasks and settings.

We propose to develop a more advanced generalization algorithm for a 2R manipulator, a robotic arm that is one of the most versatile special purpose machines (SPMs) used in industries. This algorithm will enable the 2R manipulator to cut shapes out of given materials, such as wood, metal, or Styrofoam sheets, in any orientation and dimension once it has been taught to cut a specific shape in a particular dimension and orientation.

To conserve resources, we will first build and simulate the algorithm in a software environment using NVIDIA Isaac Sim. This extensible robotics simulation platform provides a faster, better way to design, test, and train AI-based robots. Once the simulation is successful for simple geometrical shapes, we will implement it on the 2R manipulator using the Robot Operating System (ROS), a flexible framework of tools, libraries, and software that aids robot software development. This implementation will require knowledge of Python and, occasionally, C++ programming languages.

The successful implementation of this research will revolutionize industries by saving significant amounts of capital, energy, money, and time. It will enable robots to perform tasks with the same ease as a child drawing a curve, thereby bringing us one step closer to creating robots that can operate effectively in a wide range of tasks and settings. This research proposal serves as a roadmap for this exciting journey towards achieving generalization in robotics. We look forward to the potential breakthroughs and contributions this research will bring to the field of robotics and beyond.

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