**ABSTRACT**

In modern industrial environments, repetitive material handling tasks remain labor-intensive, error-prone, and inefficient, especially for small and medium enterprises that lack access to advanced automation due to high costs and system complexity. Traditional robotic systems heavily rely on electrical components, leading to maintenance challenges, higher energy consumption, and increased operational risks in industrial setups. Addressing these limitations, this project presents a cost-effective pneumatic industrial robot capable of performing pick-and-place operations through air-powered linear and rotary motion, minimizing electrical dependency and simplifying control mechanisms.

The robot features a four-axis linear motion system powered by double-acting pneumatic cylinders and controlled using a Delta PLC programmed in WPLSoft with ladder logic. Its structure, designed and validated in AutoCAD Mechanical, ensures proper alignment and durability under operational stress. Equipped with 5/2 solenoid-actuated directional control valves and a stable power supply, the system delivers precise and responsive actuation. Its modular and scalable design supports easy customization and future integration of sensor feedback, machine vision, and IoT-based monitoring—making it a smart, efficient, and cost-effective solution for automating repetitive industrial tasks.