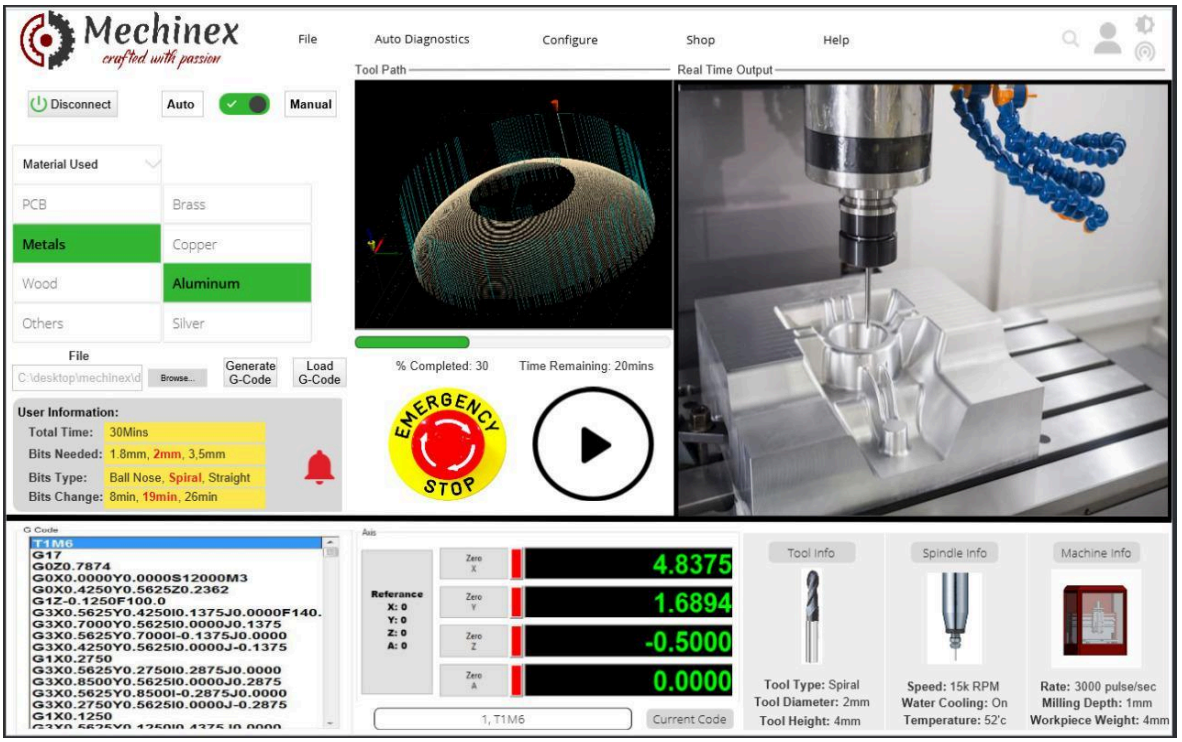
Micro, Small, and Medium Enterprises (MSMEs) in India form the backbone of the manufacturing ecosystem, yet they face persistent challenges in precision machining due to high dependency on skilled CNC programmers, sub-optimal cutting parameter selection, excessive tool wear, and inefficient energy utilization. In many MSME setups, machining decisions are experience-driven rather than data-driven, leading to inconsistent quality, higher rejection rates, increased power consumption, and reduced machine productivity. These inefficiencies directly impact competitiveness, sustainability, and profitability.

The proposed project aims to develop an AI-enabled semi-autonomous Vertical Machining Centre (VMC) platform by integrating the ProMill CNC hardware with the MillSoft intelligent machining optimization engine. The system will combine physics-based modeling, data-driven feed and speed optimization, and adaptive parameter recommendations to minimize manual intervention in programming and machining decisions. By embedding intelligence into the machining workflow, the platform will assist operators in selecting optimal cutting parameters, reduce dependency on highly skilled programmers, and improve overall process efficiency.

IMG 1: ProMill Machine



IMG 2: MillSoft UI

The project will focus on measurable improvements, including reduction in tool wear, lower specific energy consumption per job, and decreased programming time. Through structured industry–academia collaboration, experimental validation and benchmarking will be conducted to quantify improvements in energy efficiency, material utilization, and machining consistency. The outcome will be a scalable, sustainable manufacturing solution capable of advancing the technology readiness level from integrated prototype validation to pilot deployment in real MSME environments.

By enabling intelligent, energy-efficient machining, the proposed system contributes to sustainable industrial growth, improved resource utilization, and enhanced competitiveness of Tamil Nadu's manufacturing ecosystem.