

**SMART CNC ENGRAVING SYSTEM FOR PCB FABRICATION USING
MKS DLC**

By

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STATEMENT BY THE AUTHOR

I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in the thesis.



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ABSTRACT

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Printed Circuit Board (PCB) is a crucial part in most technology that require an electronics side. PCB fabrication is commonly performed using chemical etching processes that involve hazardous materials and raise safety and environmental concerns. To address these issues, this research proposes a Smart CNC Engraving System for PCB fabrication as an alternative to chemical-based etching. The developed system employs a CNC engraving machine controlled by an MKS DLC controller and integrated with a local WiFi-based web user interface, enabling real-time operation and monitoring without the need for a dedicated computer. System performance was evaluated through axis calibration approach almost 100% accuracy, movement accuracy testing, engraving parameter optimization using endmill and V-bit tools, analysis of engraving results and process duration, and PCB quality testing with 0% error. In addition, an Arduino Mega-based automatic PCB Quality Control system was implemented to detect short circuits. Experimental results show that the system achieves high motion accuracy, stable engraving performance, and reliable PCB quality while significantly improving operational safety through the use of a protective enclosure and interlock mechanism. The proposed system demonstrates a practical, safe, and chemical-free solution for PCB prototyping.

Keywords: CNC Engraving, PCB Fabrication, MKS DLC, Web-Based Control, Quality Control.



DEDICATION

I dedicate this works for the future of education and research.



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