

INTISARI

RANCANG BANGUN SISTEM PENGENDALI *MINI CNC 6040* SEBAGAI *PCB MAKER* BERBASIS MIKROKONTROLER *ATMEGA328*

Ulin Nuha Akbar

21/473029/SV/18798

Mini CNC Router 6040 banyak digunakan sebagai PCB Maker melalui proses *milling* karena lebih praktis dan ramah lingkungan dibandingkan metode etching kimia. Namun, sistem pengendali standar berbasis komputer personal memiliki keterbatasan dari sisi stabilitas, keselamatan, dan fleksibilitas pengoperasian. Proyek akhir ini bertujuan merancang dan membangun sistem pengendali Mini CNC 6040 berbasis mikrokontroler *Atmega328* dengan *firmware* GRBL 1.1h.

Sistem direalisasikan dalam bentuk dua papan PCB utama, yaitu mainboard sebagai pusat kendali dan driver motor tiga sumbu. Sistem dilengkapi fitur *auto leveling* berbasis *probing* sumbu Z, *limit switch* pada sumbu X dan Y, sistem monitoring visual berbasis ESP32-CAM, serta rangkaian Catu daya OR-ing untuk menjaga kestabilan catu daya. Metode penelitian meliputi perancangan, pembuatan purwarupa, dan pengujian kinerja melalui pencetakan PCB uji dan PCB fungsional.

Hasil pengujian menunjukkan bahwa sistem mampu menghasilkan pergerakan sumbu yang presisi, meningkatkan kualitas hasil PCB, serta meningkatkan keselamatan dan keandalan operasi. Sistem yang dirancang layak digunakan sebagai PCB Maker untuk lingkungan pendidikan dan UKM.

Kata kunci: Mini CNC 6040, PCB Maker, *Atmega328*, GRBL, *Auto leveling*

ABSTRACT

Design and Development of an ATmega328-Based Control System for a Mini CNC 6040 as a PCB Maker

Ulin Nuha Akbar

21/473029/SV/18798

The 6040 Mini CNC Router is widely used as a PCB maker through the milling process because it is more practical and environmentally friendly compared to chemical etching methods. However, the standard control system based on personal computers has limitations in terms of stability, safety, and operational flexibility. This final project aims to design and build a 6040 Mini CNC control system based on the Atmega328 microcontroller with GRBL 1.1h firmware. The system is realized in the form of three main PCBs, namely the mainboard as the control center and a three-axis motor driver.

The system is equipped with features such as Z-axis probing-based auto leveling, limit switches on the X and Y axes, visual monitoring system based on ESP32-CAM, as well as an Catu daya OR-ing circuit to maintain power stability. The research method includes design, prototype development, and performance testing through test PCB and functional PCB printing.

Test results show that the system is capable of producing precise axis movements, improving PCB output quality, as well as enhancing operational safety and reliability. The designed system is feasible to be used as a PCB Maker for educational environments and SMEs.

Keywords: *Mini CNC 6040, PCB Maker, Atmega328, GRBL, Auto leveling*