ABSTRAK

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Judul Laporan	:	Rancang Bangun *Router CNC* 3 *Axis* Sebagai Penunjang Pembelajaran Di Jurusan Teknik Mesin (Proses Perawatan)

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Perawatan pada mesin Router CNC 3 Axis menjadi aspek penting dalam menjaga performa dan umur pakai mesin, terutama dalam lingkungan pendidikan seperti di Jurusan Teknik Mesin Politeknik Negeri Sriwijaya. Mesin ini terdiri dari berbagai komponen mekanik dan elektronik seperti motor stepper, spindle, poros, bantalan, serta sistem kendali berbasis GRBL yang memerlukan perhatian rutin agar berfungsi optimal. Dalam proses perawatan, langkah-langkah preventif dilakukan secara berkala, meliputi pembersihan debu dan sisa material pada poros dan rel linier, pengecekan kekencangan baut dan mur pada struktur rangka, serta pelumasan batang ulir dan ball screw untuk mencegah aus akibat gesekan. Selain itu, komponen elektronik seperti driver motor dan power supply juga diperiksa secara periodik untuk menghindari kerusakan akibat lonjakan arus atau koneksi longgar. Sistem pendingin spindle dan suhu kerja alat juga dimonitor agar tidak melebihi batas yang dapat merusak komponen. Hasil uji kinerja mesin menunjukkan bahwa dengan perawatan yang tepat, mesin mampu beroperasi dengan stabil, akurat, dan minim gangguan. Penerapan perawatan yang konsisten sangat diperlukan mengingat mesin digunakan secara berulang sebagai media pembelajaran praktikum. Penelitian ini tidak hanya menekankan aspek teknis perawatan, tetapi juga memberikan pemahaman kepada mahasiswa mengenai pentingnya disiplin pemeliharaan peralatan produksi. Dengan menerapkan prinsip perawatan dasar seperti inspeksi visual, pengujian fungsi, serta penggantian komponen aus secara tepat waktu, efektivitas penggunaan mesin dalam mendukung kegiatan akademik dapat terus terjaga. Oleh karena itu, aspek perawatan harus dipandang sebagai bagian integral dalam implementasi teknologi CNC di pendidikan vokasi, sehingga mampu mendukung keberlanjutan proses belajar, meningkatkan keterampilan mahasiswa, dan menumbuhkan budaya kerja yang mengutamakan keselamatan serta efisiensi.

Kata kunci: cnc router, 3 axis, rancang bangun, pembelajaran teknik mesin, grbl, aspire

ABSTRACT
Design Of 3 Axis Cnc Router as a Learning Support in Mechanical Engineering Departement
(Maintanance Process)

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Maintenance of the 3-Axis CNC Router is a crucial aspect in ensuring performance and extending the machine's service life, particularly in educational environments such as the Mechanical Engineering Department of Politeknik Negeri Sriwijaya. This machine consists of various mechanical and electronic components such as stepper motors, spindles, shafts, bearings, and a GRBL-based control system, all of which require regular attention to function optimally. Preventive maintenance includes routine cleaning of dust and material residues from shafts and linear rails, tightening bolts and nuts on the frame structure, and lubricating lead screws and ball screws to reduce wear caused by friction. In addition, electronic components such as motor drivers and power supplies are periodically inspected to prevent failures due to power surges or loose connections. The spindle cooling system and operating temperature are also monitored to avoid exceeding the limits that could damage the components. Performance testing results indicate that with proper maintenance, the machine operates stably, accurately, and with minimal disruption. Consistent maintenance is particularly important given the machine's repeated use as a practical learning medium. This study emphasizes not only the technical aspects of maintenance but also the importance of introducing students to disciplined equipment management practices. By applying fundamental maintenance principles such as visual inspections, functional testing, and timely replacement of worn components, the effectiveness of the machine in supporting academic activities can be sustained. Therefore, maintenance must be considered an integral part of CNC technology implementation in vocational education to ensure continuity of the learning process, enhance students' skills, and foster a working culture that prioritizes safety and efficiency.

Keywords: cnc router, 3 axis, design and development, mechanical engineering education, gbrl, aspire