PERANCANGAN MESIN CNC (*COMPUTER NUMERICAL CONTROL*) ROUTER DENGAN APLIKASI GRBL 0.9 CONTROL 3 AXIS SISTEM X,Y DAN Z



STANDAR OPERASI PROSEDUR (S.O.P)

Disusun Untuk Memenuhi Syarat Menyelesaikan Pendidikan Diploma III Pada Jurusan Teknik Elektro Program Studi Teknik Telekomunikasi

Politeknik Negeri Sriwijaya

Oleh :

M. HABIBURRAHMAN (0614 3033 0274)

POLITEKNIK NEGERI SRIWIJAYA

PALEMBANG

2017

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Mengetahui,

Palembang, Agustus 2017

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IDENTITAS MAHASISWA PEMBUAT ALAT TUGAS AKHIR

1. Judul Laporan Akhir	: Perancangan Mesin CNC (Computer
	Numerical Control) dengan Aplikasi
	GRBL 0.9 Control 3 Axis Sistem X, Y
	dan Z (Software)
2. Bidang Ilmu	: Teknik Telekomunikasi
3. Nama / NIM Mahasiswa	: M. Habiburrahman (061430330274)
4. Lokasi Pembuatan Alat	: Rumah dan Laboratorium Teknik
	Telekomunikasi Politeknik Negeri
	Sriwijaya
5. Lokasi Pengambilan Data	: Laboratorium Teknik Telekomunikasi
6. Waktu Yang Dibutuhkan	: ± 3 bulan

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BUKTI PENELITIAN MAHASISWA



Diagram Blok Perancangan Mesin CNC Router dengan Aplikasi GRBL 0.9

Sistem 3 Axis X, Y dan Z

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Tampilan Software GRBL



Tampilan Mesin CNC Router dengan Aplikasi GRBL 0.9 Control 3 Axis Sistem X, Y dan Z

Ketua Jurusan Teknik Elektro



Palembang, Agustus 2017

Inovator

M. Habiburruhman NIM. 061430330274

Cara Kerja Mesin CNC (Computer Numerical Control) Router dengan Aplikasi GRBL 0.9 Control 3 Axis Sistem X,Y dan Z

Prinsip kerja mesin CNC Router ini yaitu berdasarkan perintah yang diberikan melalui software GRBL. Sebelum melakukan pembuatan layout pada papan PCB, pengguna perlu mendesain layout terlebih dahulu pada *software* Eagle. Setelah itu, layout yang akan dibuat tersebut dirubah menjadi G-Code dengan menggunakan PCB-Gcode. Output dari PCB-Gcode tersebut dimasukkan ke dalam *Software* GRBL untuk diproses. Ketika kode tersebut diproses, mesin akan bergerak secara otomatis yaitu terjadinya pergerakan pada stepper motor sumbu X, Y, Z, spindle serta mata bor. Pergerakan tersebut sesuai dengan gambar layout yang akan dibuat pada PCB.

Cara instalasi Software EAGLE (Easily Applicable Graphical Layout Editor)

- Langkah 1

Download *Software* pada situs http://www.mediafire.com/file/kk4skz zn6c81 zuy/Cadsoft+Eagle+6.2.0+Full.zip



Tampilan Website Untuk Mendownload Software EAGLE

Buka Folder tempat menyimpan aplikasi Eagle yang telah didownload

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Tampilan eagle-win-6.2.0 pada folder installan software EAGLE

- Langkah 3

Jalankan eagle-win-6.2.0 application dan kemudian klik Setup



Tampilan Setup pada proses instalasi Software EAGLE

Kemudian akan muncul kotak dialog sebagai berikut.

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Tampilan proses instalasi Software EAGLE

- Langkah 5

Untuk melakukan Setup program, Klik Next



Tampilan Setup program Software EAGLE

Langkah 6

Kemudian akan muncul kotak dialog seperti berikut, Klik Yes



Tampilan licence agreement pada instalasi software EAGLE

- Langkah 7

Pilih tempat penyimpanan directory kemudian klik Next



Tampilan choose destination directory pada instalasi software EAGLE

Langkah 8

Kemudian akan muncul tampilan kotak dialog sebagai berikut, Klik Next



Tampilan pemindahan data pada instalasi software EAGLE

- Langkah 9

Tunggu hingga proses pemindahan data selesai



Tampilan proses pemindahan data pada instalasi software EAGLE

Setelah proses pemindahan selesai maka akan muncul kotak dialog sebagai berikut, Pilih *Run as Freeware* dan Klik *Next*



Tampilan EAGLE *License*

- Langkah 11

Proses instalasi telah selesai



Tampilan Proses instalasi software EAGLE selesai

Cara menginstall PCB-GCODE.

Berikut adalah cara penginstallan aplikasinya.

- Langkah 1

Download PCB-Gcode pada situs http://pcbgcode.org/read.php?12,803

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Tampilan Website untuk Mendownload PCB-Gcode

- Langkah 2

Buka Software EAGLE



Tampilan Software EAGLE

- Langkah 3

Cari Folder Directory tempat data-data software disimpan



Tampilan Folder Directory software EAGLE

Buka Folder Directory tempat data-data software disimpan



Tampilan Folder Directory Software EAGLE

Cari Folder PCB-GCODE yang telah didownload kemudian copy folder tersebut

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Tampilan Folder PCB-GCODE

Langkah 6

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Pindahkan folder PCB-GCODE yang telah dicopy tadi ke dalam folder ULP yang terletak didalam folder directory *software* EAGLE tadi sebagai berikut.



Tampilan Folder PCB-GCODE didalam folder ULP Software EAGLE

Buka Software EAGLE kemudian pilih directories



Tampilan Directories pada Software EAGLE

- Langkah 8

Kemudian akan muncul tampilan kotak dialog sebagai berikut.

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Tampilan Directories pada tampilan software EAGLE

Buka Folder PCB-GCODE yang telah dicopy tadi seperti berikut kemudian salin alamat *directory*nya.



Tampilan Penyalinan alamat Directories

Langkah 10

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Letakkan tulisan yang telah dicopy tadi seperti berikut dan Klik OK.

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Tampilan Pemindahan alamat Directories

Penginstallan PCB-GCODE telah selesai.



Tampilan penginstallan PCB-GCODE telah selesai

Cara Menginstal Driver CH340SER

- Langkah 1

Buka folder yang yang berisi installan driver

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Tampilan Folder instalan driver CH340SER

Jalankan CH3S40SER application

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Tampilan CH3S40SER application

- Langkah 3

Kemudian akan muncul tampilan sebagai berikut.



Tampilan CH340SER application setelah dijalankan

Kemudian akan muncul tampilan kotak dialog *driver setup* sebagai berikut dan Klik *Install*

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Tampilan Install untuk driver CH3S40SER

- Langkah 5

Kemudian akan muncul tampilan kotak dialog seperti berikut, tunggu hingga prosesnya selesai.



Tampilan proses instalasi driver CH340SER

Proses instalasi Driver CH340SER selesai



Tampilan instalasi driver CH340SER telah selesai

Cara Menginstal Software GRBL 0.9

- Langkah 1

Buka folder tempat penyimpanan software GRBL 0.9

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Tampilan folder installan Software GRBL 0.9

Jalankan Grbl Control application

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Tampilan GRBL Control application

- Langkah 3

Aplikasi telah terinstall



Tampilan software GRBL 0.9 telah terinstall

Pemrograman Arduino

Pemrograman pada Arduino dapat menggunakan sebuah *software* khusus yaitu *Software* IDE (*Integrated Development Environment*). Program yang dibuat melalui *Software* IDE tersebut dapat dilihat pada gambar dibawah ini.



Pemrograman Arduino

Cara Merubah Gambar Layout Menjadi G-Code

1. Buka Design Layout yang akan dibuat pada PCB



2. Klik ULP



3. Pilih pcb-gcoed-setup.ulp



4. Pada Bottom Side, Ceklis pada bagian yang akan digunakan

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Units = Inches

Spin Up Time = 5

Feed Rates XY = 10; Feed Rates Z = 10

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6. Pada Gcode Options pilih profiles/generic.pp

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7. Klik Yes

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8. Buka kembali ULP dan Pilih pcb-gcode.ulp



9. Kemudian tampilan layout akan seperti gambar berikut



10. Pembuatan Gcode telah selesai



11. Untuk melihat Gcode yang telah dibuat buka file tersebut pada *Software* GRBL



CARA MENSETTING SOFTWARE GRBL

- 1. Buka Software GRBL
- 2. Pada bagian Console masukkan Program sebagai berikut:

[CTRL+X] < Grbl 0.8 ['\$' for help] F300S1000{0/0}ok (Tampilan Awal)

Masukkan \$\$ (Menampilkan Pengaturan Pada GRBL) \$\$ < \$0=10 (step pulse, usec) \$1=255 (step idle delay, msec) \$2=0 (step port invert mask:0000000) \$3=0 (dir port invert mask:0000000) \$4=0 (step enable invert, bool) \$5=0 (limit pins invert, bool) \$6=0 (probe pin invert, bool) \$10=3 (status report mask:00000011) \$11=0.010 (junction deviation, mm) \$12=0.020 (arc tolerance, mm) \$13=1 (report inches, bool) \$20=0 (soft limits, bool) \$21=0 (hard limits, bool) \$22=0 (homing cycle, bool) \$23=0 (homing dir invert mask:0000000) \$24=25.000 (homing feed, mm/min) \$25=500.000 (homing seek, mm/min) \$26=250 (homing debounce, msec) \$27=1.000 (homing pull-off, mm) \$100=720.000 (x, step/mm) \$101=720.000 (y, step/mm) \$102=720.000 (z, step/mm) \$110=1500.000 (x max rate, mm/min) \$111=1500.000 (y max rate, mm/min) \$112=1500.000 (z max rate, mm/min) \$120=1000.000 (x accel, mm/sec^2) \$121=1000.000 (y accel, mm/sec^2) \$122=1000.000 (z accel, mm/sec^2) \$130=200.000 (x max travel, mm) \$131=200.000 (y max travel, mm) \$132=200.000 (z max travel, mm) {0/0}ok

Masukkan \$C \$C < [Enabled] (Menampilkan Mode Check Gcode)

{0/0}ok \$C < [Disabled] {0/0}ok Grbl 0.8 ['\$' for help] F300S1000{0/0}ok	
Masukkan \$L=0 \$L=0 < [JJ=0] {0/0}ok	(\$L Menampilkan Mode Laser) (Mode Laser Dinonaktifkan)
Masukkan \$100 = 720 \$100=720 < {0/0}ok	(Merubah nilai x, step/mm)
Masukkan \$101 = 720 \$101=720 < {0/0}ok Masukkan \$102 = 720 \$102=720 < {0/0}ok	(Merubah nilai y, step/mm) (Merubah nilai z, step/mm)
Masukkan \$13 = 1 \$13=1 < {0/0}ok	(Parameter inch aktif)

3. Settingan selesai.

Cara Pengoperasian Alat

- 1. Hubungkan adaptor pada GRBL Board mesin CNC Router
- 2. Hubungkan kabel USB dari Arduino Nano pada GRBL Board ke Laptop
- 3. Untuk menyalakan Mesin, tekan Push Button Pada GRBL Board



4. Buka Software GRBL pada Laptop

5. Klik File - > Open

Push Button

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6. Buka File yang akan diproses kemudian klik open

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7. Setelah File tersebut terbuka Atur posisi Sumbu Z pada papan PCB dengan menggunakan *software* GRBL



Keterangan :

- 1) Pergerakan sumbu X ke arah Kanan
- 2) Pergerakan Sumbu X ke Arah Kiri
- 3) Pergerakan Sumbu Y ke arah Belakang
- 4) Pergerakan Sumbu Y ke arah Depan
- 5) Pergerakan Sumbu Z ke Bawah
- 6) Pergerakan Sumbu Z ke Atas
- 7) Untuk menentukan titik koordinat 0 pada sumbu XY
- 8) Untuk menentukan titik koordinat 0 pada sumbu Z
- 8. Untuk memproses gcode yang telah dibuat, klik Send

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9. Ketika proses pembuatan layout telah selesai, akan muncul pemberitahuan sebagai berikut

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- 10. Untuk mengakhiri proses pengoperasian alat, klik tombol close (X) pada software GRBL.
- 11. Kemudian cabut kabel USB yang menghubungkan Laptop dengan Arduino Nano pada GRBL Board serta kabel adaptor pada GRBL Board.

Palembang, Juni 2017

Kepada Yth, Kepala Laboratorium Teknik Telekomunikasi Di Tempat

2

layu yang bertanda ta	ngan dibawah ini :
šama	: M.Habiburrahman
€PM	: 0614 3033 0274
Celas	:6 TB
ludul Laporan Akhir	: Perancangan Mesin CNC (Computer Numerical Control) Router Dengan Aplikasi GRBI. 0.9 Control 3 Axis Sistem X, Y dan Z
	(Saftware)
embimbing 1	: Hj. Adewasti, S.T., M.Kom
embimbing 2	· Rouita Febriani, S.T., M.Kom

Dengan ini mengajukan perinohonan untuk menggunakan laboratorium serta meminjam beberapa peralatan praktikum yang tersedia di laboratorium, diantaranya :

- 1. Osiloskop Dual Trace
- 2. Multimeter Digital
- 3. Dan alat lainnya.

Peralatan tersebut digunakan sebagai alat untuk membuat alat serta pengambilan data tersebut guna untuk menyelesaikan laporan akhir Pendidikan Diploma III Jurusan Teknik Elektro Program Studi Teknik Telekomunikasi. Untuk kepentingan pengambilan data mohon kesediaan Bapak/Ibu pembimbing bersedia mendampingi. Demikianlah permohonan ini saya buat dengan sebenar-benarnya. Atas perhatian Bapak/Ibu saya ucapakan terima kasih.

Mengetahui Pembimbing I/II

(POSITA PERMANI M KOM) NIP.

Yang Bersangkutan TERAI IN NUMAN 000

M. Habiburnhman NIM. 061430330274





Pada hari ini Rahu..... tanggul 16. balan Aguertur tahun 2017, telah diserahkan soperangkat karyu/rancang hungun kepada Jurusan Teknik Elektro Program Studi Teknik Telekomunikasi (D-III) di Politzknik Negeri Sriwijaya,

Nama Perangicat		Spesifikasi	
Perancangan Numerical Contro GRBL 0.9 Contro	Mesin CNC (Computer of) Router dengan Aplikasi 13 Axis Sistem X, Y dan Z	Modul GRBL Board (terdiri dari Mikrokontroller Arduino Nano, Driver Motor A4988), 3 Buah Stepper Motor, Spindle, Mata Bor dan Adaptor 12 Volt	

Hasil karya/rancmg bangun dari,

Nama	NIM	Name Pembinbing
M.I.era Apriadi	0614 3033 0273	Hj. Adewasti, S.T., M.Kom
M.Habiburruhman		Rosma Febrinni, S.T., M.Kom.

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16 2017

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