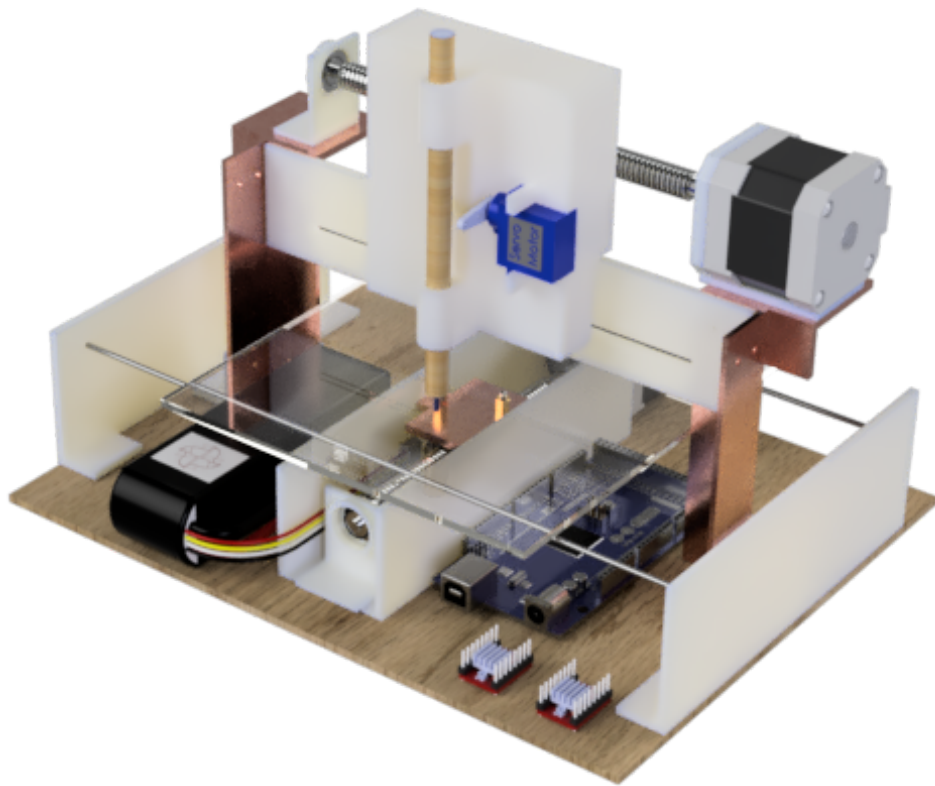# Ta 202 Project Report

CNC Printer v2

Group: 33

Prof Mohit Law

360Degree View.
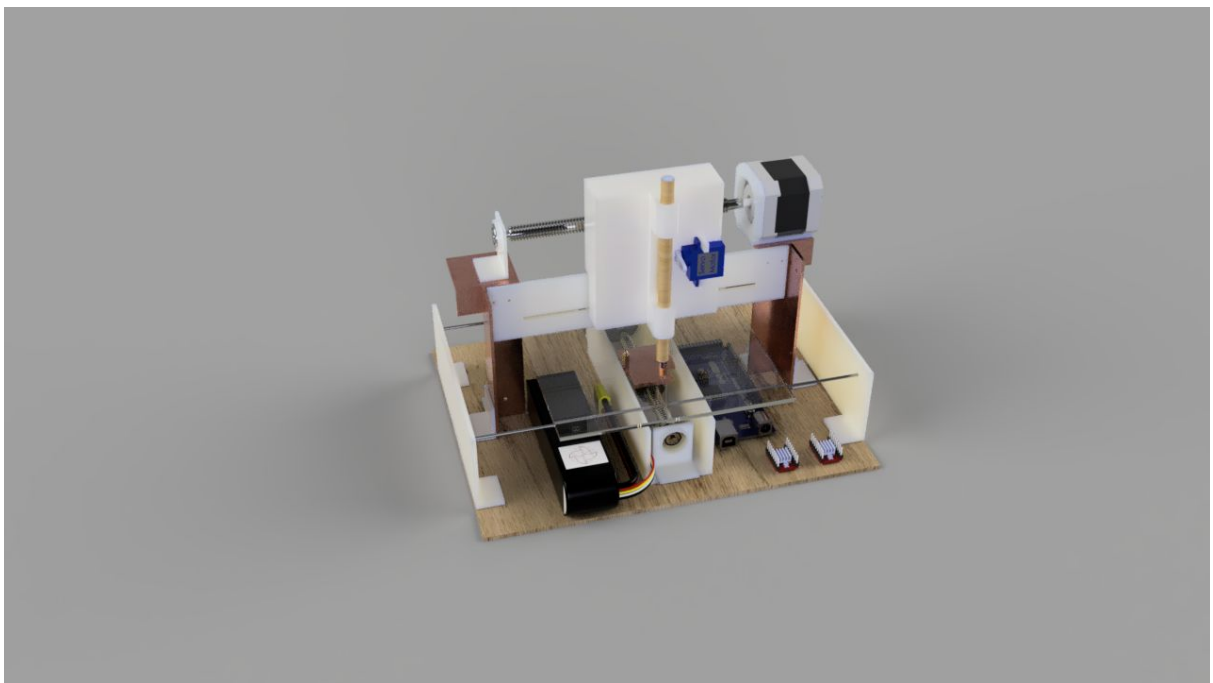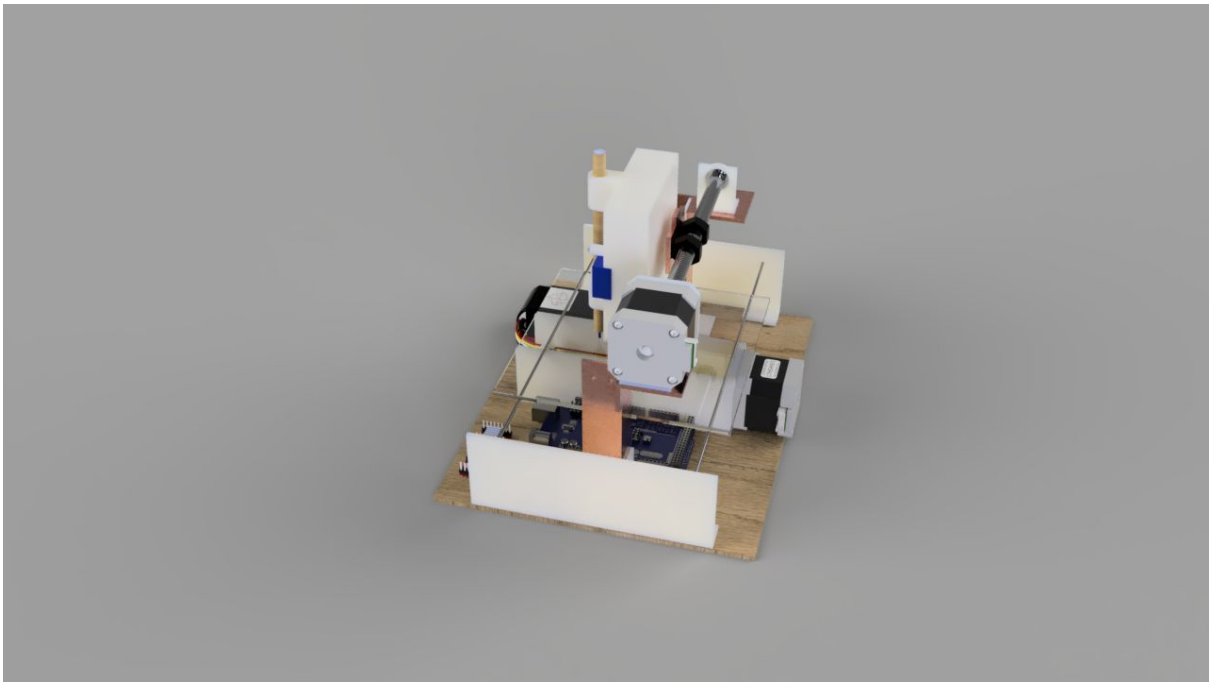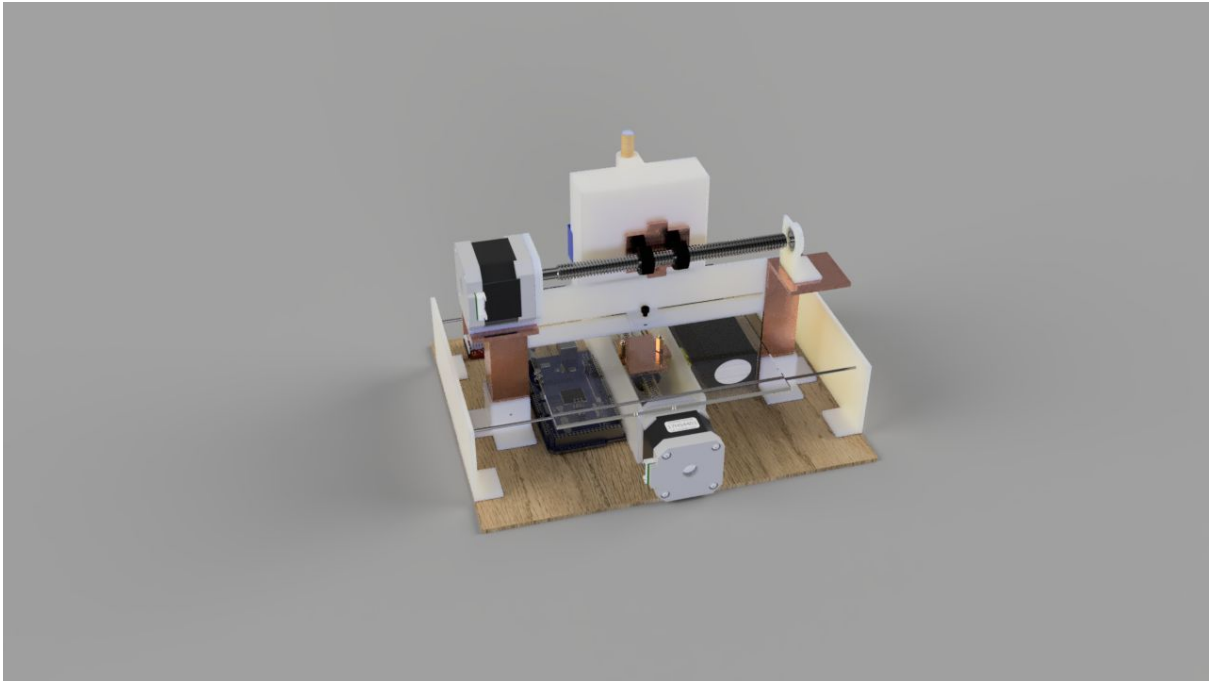
Manufactured Parts Table

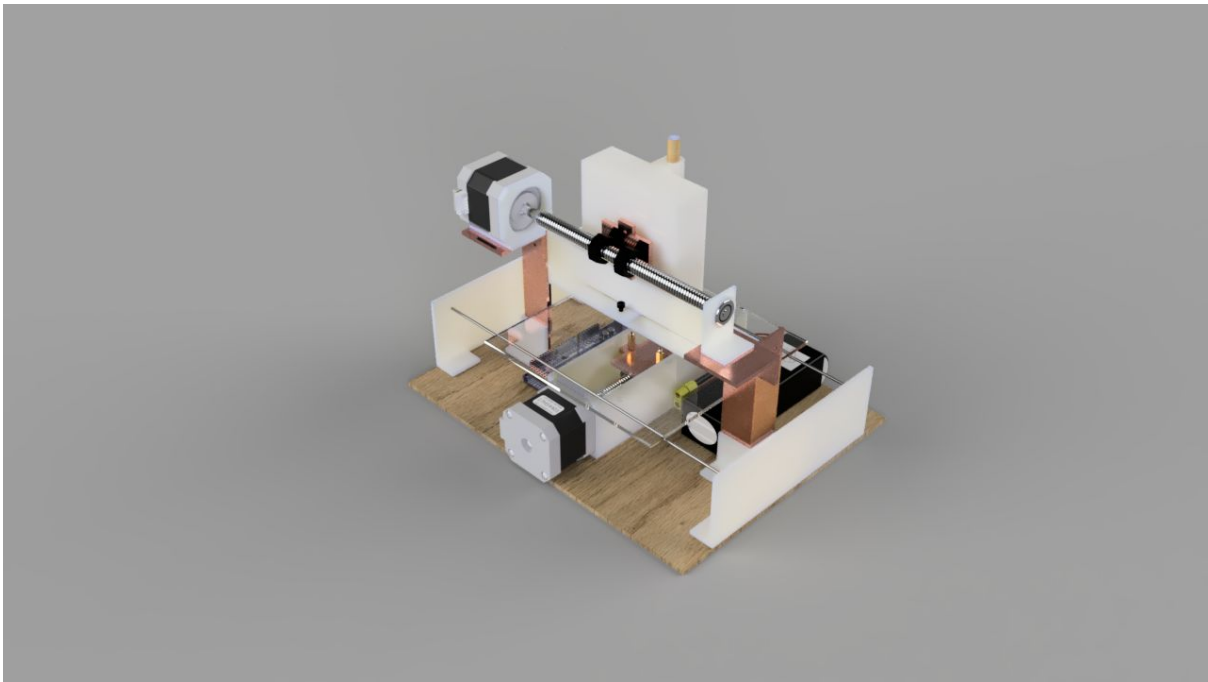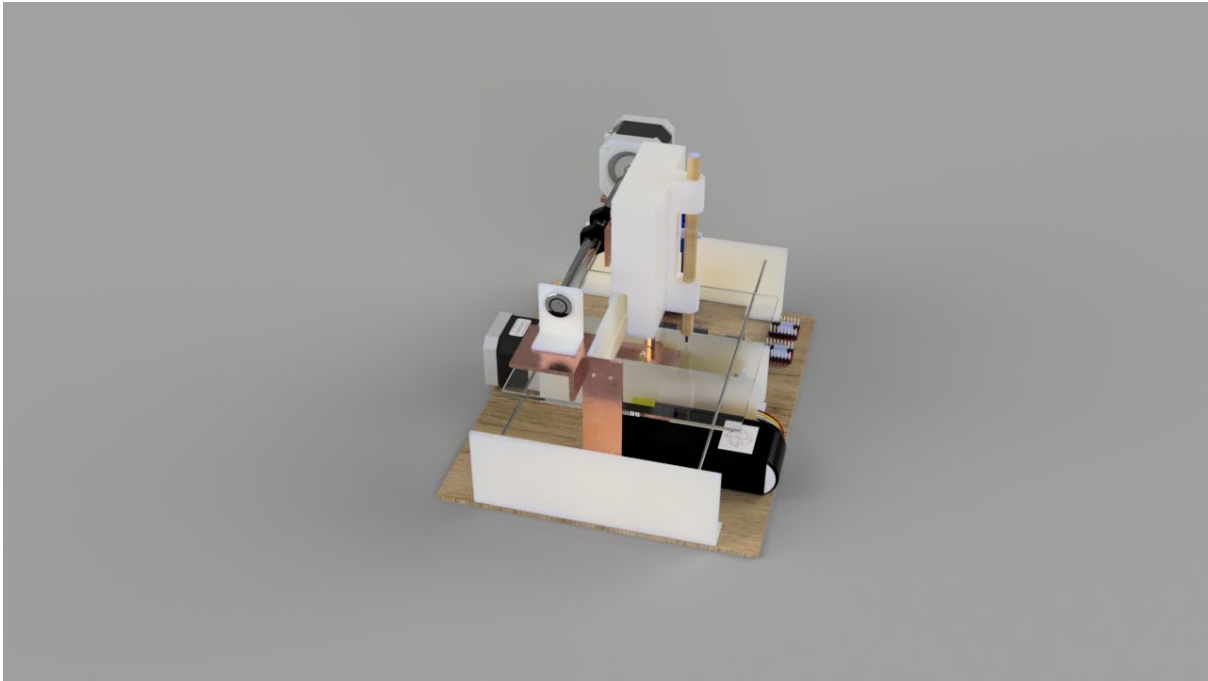| Name	Qty	Material	Manufacturing
Base	1	Wood	Bandsaw + drilling
Lower bracket	1	ABS/PLA	3D printing
Lower bearing mount	1	ABS/PLA	3D printing
Lower nut	1	Mild steel	Bandsaw, welding
Table	1	Acrylic	Laser-cut
L clamps	2	ABS/PLA	3D printing
MS angles	2	Mild steel	Bandsaw + drilling
Cross-Bar	1	ABS/PLA	3D printing
Pencil holder system	1	ABS/PLA	3D printing
Upper motor mount	1	ABS/PLA	3D printing
Upper bearing mount	1	ABS/PLA	3D printing
Upper nut	1	Mild steel	Bandsaw, welding
Upper supports	2	Mild Steel	Bandsaw, drilling
Side supports	2	ABS/PLA	3D printing
Lead screw	2	Stainless Steel	Turning on Lathe

Acquired Parts Table

Name	Qty	Material	Description
Standoffs	2	Brass	M3, 10mm, M to F
Motors	2		NEMA 17 Stepper motor, 5.5 Kgm
A4988	2		Stepper motor driver, phase current 1 A
Microcontroller	1		Arduino Mega
Shafts for support	2	ss	2 mm (|) shaft
Battery	1		3 cell Lipo
Servo motor	1		Sg90 basic servo
Ball bearings	2	ss	4MM ID, 16 OD, cylindrical ball bearing.
Nuts, Bolts, and washers	24	SS	M3, 8 mm
Cable ties (to secure pen)	5		Medium size
Nuts	4	SS	M10
Sd card shield	1		To read nc code

Lead screw calculations

Size	= M10
Pitch	= 2mm
Speed ratio	= 1:1
Lead	=2mm
Moment of inertia	= 0.00027 Kg cm^2

Lower screw

Max travel	= 100mm-6 mm =94 mm
Max Rev	= 47

Upper screw

Max travel	= 150mm-6 mm =144 mm
Max Rev	= 72

Minimum rotation
 of stepper motor   = 1.8 deg **(single-phase operation only)**

Minimum Travel   = 2mm/ 360 *1.8   = **0.01 mm**

Default angular vel   = 10* 2pi /2   = **10pi /sec = 300 RPM**

NC Codes Supported

M03   : Pen Down

M05   : Pen Up

G31   : **Incremental approach only.**

M71   : **Metric units only**

F   : Feed (default = 10 mm/sec [**600**],
                       Max   = 20 mm / sec [**1200**])

G01   : Linear interpolation

G02/03   *: circular interpolation:* **reinterpreted in the form of G01 (unicorn)**

M30   : program end

Notes:

- G code file must be saved as 'NC.txt' in the attached sd card. Or can be entered incrementally using the serial monitor.
- **G code can be most easily generated using Inkscape: save as g code.**
- The pen moves to 0,0 (front right end) at the start of the program.
- Xmax =144 mm Xmin =0.01 mm
- Ymax = 94 mm Ymin =0.01 mm
- It is advisable not to run at peak rpm (feed) for long durations (limitation of motor driver) run at default rpm only.
- Use Normalizefeed() to set to default feed line by line, (optional) commented out in main.ino

Attachments

- Model files, .step, f3d
- Project report file
- Video of exploded view. Assembly, 360-degree view
- Checker.ino,   : checks if given gcode is supported
- Main.ino   : Runs code from NC.txt
- Seq.ino   : Runs Code from serial monitor
- Decoder.h   : Header file for translation
- Normalizefeed.h   : contains the normalized feed function
- myCNC2dprinter.h   : Header file for motor functions and tests

Future possibilities

- Adding onboard computer with display for user-friendly selection or editing of programs, reading from sd card.
- Adding time of flight sensors for active feedback on table and pen position as well as correction overtime
- Addition of Keypad for manual entry of coordinate points
- Addition of vertical leadscrews and conversion into full 3d printer
- Weight reduction and complete switching to 3d printed parts.
- Upgrade of the motor driver for faster printing