International Conference on Science, Technology & Education (ICSTE 2018)
Bangkok, Thailand
September 6-8, 2018

Product Design and Development for Two Dimensional mini CNC

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Abstract: The purpose of this research was to develop a machine mini CNC control system and to determine the efficiency of computer machine mode by using the control Arduino package that control the speed and movement of the pen head structure includes aluminum. Use stepper motor control header .The efficiency of using the random experiment and the statistical data of 9 pieces and each piece 3 time and serve. Two Digital Microscope measuring error from the measurement value a mistake in the movement of the head holding a pen and table move the workpiece. The statistical analysis is percentage mean in the form of two dimensional drawing with edge field examination. Examination by drawing cover square cloth size 80 x 60 mm triangle size 80 x 60 mm and circle diameter 60 mm. The results showed that the percentage error motion in the draw axis square X is valuable 0.121 percent .The accuracy of drawing with least error percentage of Y axis is an image circle with the 0.183. The expected movement axis Y X less than this it can be concluded that knowledge in drawing the squares in metropolis. That the precision of the motion of the axis X then axis Y performance parts mechanical machine mini CNC control system two dimensional drawing is a treatment area on the table in the X Y Z and in 100 x 80 x 60 mm respectively which is ideal for a small body and simulation of the machine.

Keywords: Digital Microscope Machine ; Drawing ; MINI CNC Machine ; Stepping Motor

1. Introduction

At present, the technology is used in the form of automatic machinery. Also called. CNC Machine (Computer Numerical Controller) This machine is a computer-controlled machine. To be able to input data into the system and to process data, then take the results to control the machine again. Because machines controlled by computers are relatively high priced, they are imported from abroad. Therefore, it has responded to the needs of small industrial plants, which have developed into small machines controlled by computers. Also called. Mini CNC machine (MINI CNC). The X-axis motors, Y-axis and Z axis allow the machine to move in the desired position and direction. [1]

Mini CNC Machine For example, it can be used for laser engraving, etching, etc., but the material that can be used with the CNC Mini machine must be the material. Soft, acrylic, plastic, aluminum and brass. The work will come out in the form. Two Dimensions and Dimensions In the use of computers only control the design of the work. Including a programmable controller for the high-cost CNC machine don't be used in general, so it is difficult to learn the process of CNC machines. With many tools and equipment. Therefore, it is necessary to choose the appropriate job. [2]

Therefore, the creation of a CNC machine with a computer-controlled process focuses on a convenient application program and a small program size. Including the study of the work process of CNC Mini Machine by the work came out in two-dimensional form. From this problem, this

research has created a mini CNC machine. Used for two-dimensional drawing. To study the working process of the machine and to find the tolerances of mini CNC machine.

2. Methodology

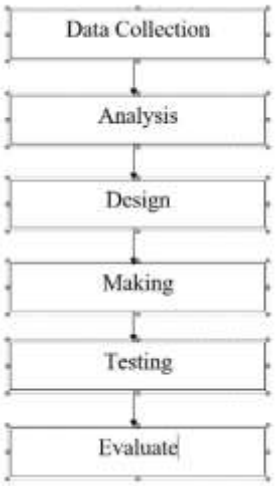

Figure 1 Methodology

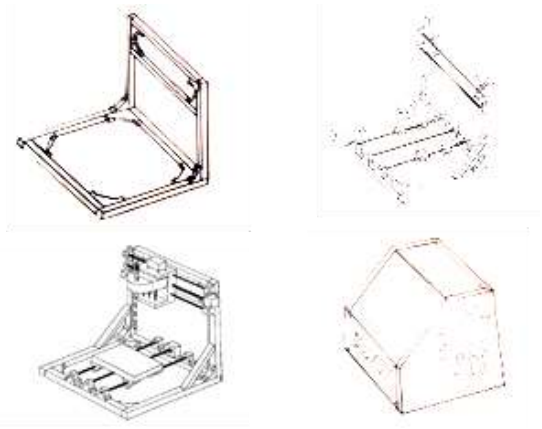

Figure 2. mini CNC Structure sketch.

The process can be carried out according to the procedure of the study. The following topics.

1) Basic Data Collection
2) Design and construction of mini CNC machine structure.
   2.1) Mini Body Design Mini CNC Hands on paper
   2.2) Mini-machine modeling with Solid Work
3) Make Mini CNC Machine
4) Equipment and tools used in assembly
   4.1) Miniature CNC Engraving Equipment
   4.2) Tools used in assembly
   4.3) Production tools
5) Test mini-CNC machine According to the job format.
   5.1) Design of workpiece
   5.2) Run GRBL Control
6) Test the performance of mini CNC machine
   6.1) Test procedure with Digital Microscope

2.1 Data Collection

The data collected showed that the researcher gained knowledge in various fields such as design, drawing, operation, research, education, and industrial production.

2.2 Design and construction of mini CNC machine structure.

The design of mini CNC consists of:

1) Mini Body Design Mini CNC Hands on paper Sketch on paper to plan process and components

3. Experimental Setup

3.1 mini CNC Assembly

Ball Screw with slide each axis (aluminum), moving mini CNC part sketch, mini CNC sketch, Cover.

2) Mini-machine modeling with Solid Work

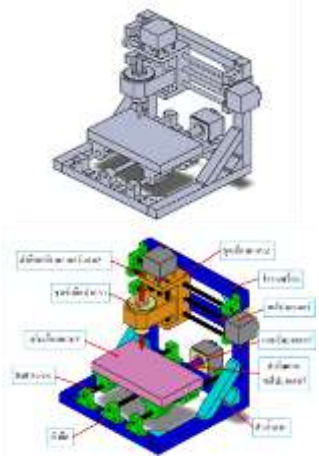

Figure 3. Components of mini CNC

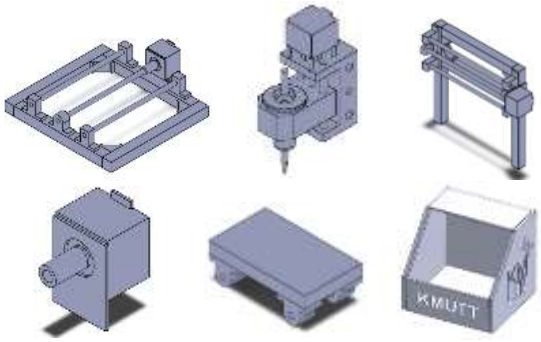

Figure 4. Y, X, Z axis Body table and Cover

Design for mini CNC Body, design Y axis with Ball Screw & Stepper motor 256 x 240 x 62 mm^3, 284 x 240 x 67 mm^3, 150 x 117 x 58 mm^3, and Table 170 x 100 x 20 mm^3 in Fig. 4 and 5. Cover aluminum thickness 1.5 mm. 380x370x407 mm^3.

Figure 6. Components to Assembly.

Figure 7. PRESS BRAKE MACHINE

3.2 Testing

1 with Mastercam X5

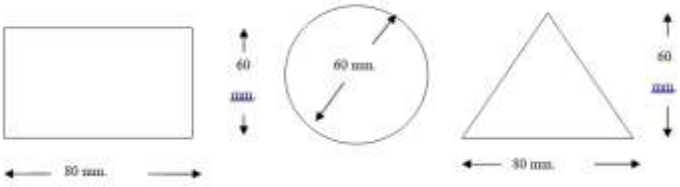

Figure 8. 3 Testing Drawing

3.3 Run GRBL Control

To draw rectangular 80 mm x 60 mm, Circle diameter 60 mm, and Triangle 60 mm x 60 mm. consequently and G-code.

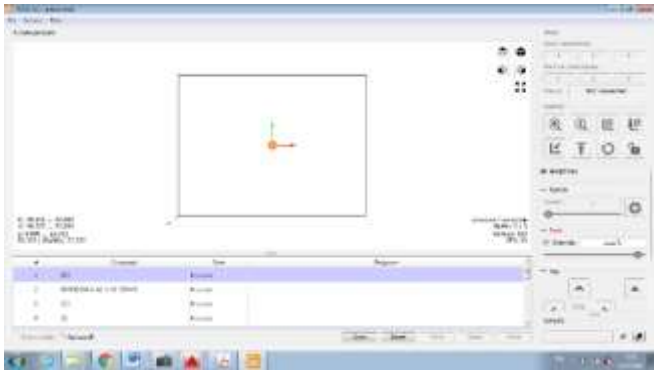

Figure 9. run GRBL Control

3.4 Efficiency of mini CNC

With Digital Microscope for dimension accuracy 3 time/point.

Figure 10. Digital Microscope

4. Result and Discussion

The result for drawing on X axis and Y axis example follow:

4.1 Rectangular result

1. X axis result, distance 80 mm. 9 times/pcs with 3 duplicate and then average, and % error.

Table 1 shows that the values measured in the eighth time were 80.009 millimeters. The values were close to the actual values of 80 millimeters and the mean values were 80.198 millimeters. The value is close to the actual value at 80 mm.

2. Y axis result, distance 60 mm. 9 times/pcs with 3 duplicate and then average, and % error.

Table 1. show X axis result

No.	Nominal	X axis			Ave. mm.	(Error %)
		1	2	3		
1	80	80.131	80.166	80.129	80.142	0.178
2	80	80.258	80.159	80.178	80.198	0.248
3	80	80.250	80.088	80.112	80.150	0.188
4	80	80.129	80.178	80.103	80.137	0.171
5	80	80.106	80.097	80.007	80.070	0.088
6	80	80.026	80.096	80.132	80.085	0.106
7	80	80.101	80.021	79.983	80.035	0.044
8	80	79.999	80.033	79.996	80.009	0.011
9	80	80.027	80.093	80.026	80.049	0.061

Table 2 show Y axis result

No.	nominal	X axis			Ave. mm.	(Error %)
		1	2	3		
1	60	60.068	60.060	60.106	60.078	0.130
2	60	60.018	60.032	60.082	60.044	0.073
3	60	60.172	60.062	60.155	60.130	0.217
4	60	60.152	60.018	60.211	60.127	0.212
5	60	60.239	60.133	60.174	60.182	0.303
6	60	60.209	60.011	60.227	60.149	0.248
7	60	60.135	60.098	60.114	60.116	0.193
8	60	60.017	60.027	60.069	60.238	0.397
9	60	60.156	60.043	60.166	60.122	0.203

Table 2 shows that the mean value of the second measurement was 60.044 millimeters, the closest to the actual value of 60 millimeters, and the mean value of the second measurement was 60.238 millimeters. The value is close to the actual value at 60 mm minimum.

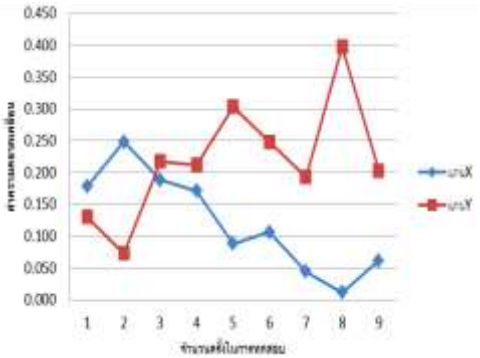

Figure 11. show error %

Figure 11 shows that the values measured in the X axis of the eighth time have the same magnitude. In the second, the maximum deviation is 0.248 percent. At the 8th, the maximum error is 0.397 percent. Therefore, since the error of the X axis is less than the Y axis, it can be concluded that in the drawing of this rectangle Accuracy of X axis movement over Y axis

5. Conclusion

Performance test of mini CNC machine. For 2D drawing, the speed of the stepper motors and drawing using the pen. Affects the accuracy of two-dimensional drawing as desired. Percentage error and the ability to move the pen handle has increased. Since the speed of the stepper motor is transmitted to each axis of movement. As a result, the drawings have come out with discrepancies. The result of the performance test is the tolerance for drawing in this project. This test has chosen to test a rectangular 80 x 60 mm, 80 x 60 mm triangle, and a circle of diameter. 60 mm. The error percentage in the X axis is 0.121 percent. See that the X axis is less than the Y axis, so it can be concluded that in this drawing, the rectangle is accurate. Before the X-axis and Y-axis than the acceptable threshold. Consistent with the assumptions set. This is consistent with the research of Chanchai Luekwit and Thaweesuppakdee. Research on the design and construction of small milling machines controlled by computer systems. The purpose mechanical structure and control unit of the CNC milling machine have been tested. The tolerances of the size are determined by the size of the workpiece of both X-axis, Y-axis and Z-axis. The test results show that the milling machine can mite the MDF. The tolerances are less than 0.3 millimeters. X-axis and Y-axis

6. Reference

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