The Computer Numerical Control for Automatic Seed Sowing Machine

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ABSTRACT

This research proposes the computer numerical automatic sowing machine to grow the seeds for this planting tray .To reduce the workload of farmers to have a working efficiency .This will be a new alternative for entrepreneurs or farmers who still use the method of planting by tube seeds into planting trays .This will reduce production costs and lead to increased productivity .From the study of automatic sowing machines and related equipment, the researcher has gathered the concepts, theories, related work, materials, equipment, and studied various data to be a guideline for finding design. We use stepper motor NEMA17 2 phase, 1.8 degrees, permanent magnet :for 2 stepper motor for x axis and 1 stepper motor for z axis. The rotation of the stepping motor that will rotate in a circle, so 1 circle has 360 degrees when the motor rotates 1 step, equal to 1.8 degrees per 1 step .Then input the values into the controller to get the correct rotation distance call that value .step/mm can be calculated from the following information :Number of pulses in 1 motor rotation equal to 360 degree was divided by 1.8 degree so that steps per revolution is 200 step/mm, The results of the movement of the seed head .From 40 tests, the movement of the moving stepping motor stops at the 5 cm hole as specified, so it can be concluded that the stepping motor is 100 %working .40 times After experimenting and calculating the accuracy, it was concluded that the accuracy of the automatic sowing machine was 89.95%, the error was 10.05 .%

Keywords: CNC, TB6560 stepper motor driver, Arduino Uno, Sowing machine

INTRODUCTION

Now a days computer numerical control automatic sowing machine to grow the seeds for this planting tray .To reduce the workload of farmers for fast performance .This will be a new alternative for entrepreneurs or farmers who still use the method of planting seed bulbs into trays .This will lower production costs and lead to increased productivity

Article history:
Received 7 June 2022; Revisions Required 26 June 2022;
Accepted 29 June 2023; Available online 30 June 2023.

Objective of research proposes computer numerical control)CNC (machine for automatic sowing machine to grow the seeds for this planting tray, It will reduce the working time, cost reduction, precision and reduce the loss.

Scope of research include, 1 Use an Arduino uno board to control the machine. 2 seeding trays, each hole is 5 cm apart from each other 3 Sow 1-5 seeds per head. 4. The size of the seeding machine 50 * 90 * 60 cm. 5 number of sowing heads 5 heads 6 Use seeds that are 1 mm in size. 7 Use circular seeds.

LITERATURE REVIEW

The following article related to an automatic sowing machine**.**

Muangmol et al., in 2020 **.**proposed the engraving laser machine in part of calibration. by Arduino Uno and TB6560 stepper motor driver board for engraving laser machine. The calibration result, the machine is accurate and the image obtained from laser firing with asymmetry and image scale is not distorted.

Muangmol et al., in 2019**.** proposed the design and implementation of a case study of computer numerical control (CNC) machine by Arduino Uno and TB6560 stepper motor driver board for low-cost engraving laser machine which is able to engrave any image or text file on wood surface by Laser GRBL (v.3.0.4) software. The result of this research, it can be easily to use and lower cost for Laser CNC machine.

Kumar et al., in 2018. proposed portable laser cutting and engraving machine. This paper describes design and fabrication the laser cutting and engraving machine which is convenient to controlled by the Arduino CNC. It is small, simple to work, cost of manufacturing and to effortlessly-transport from one work station to other work station.

Dhairya et al., in 2018. proposed Fabrication of low-cost CNC Engraving Machine. This paper describes advantage of this kind of desktop CNC that very small work pieces by Arduino and GRBL.

Sriranga et al., in 2018. proposed 3-axis CNC Milling machine. This paper describes design and fabrication of CNC with stepper motors that contacted with the lead screw moment along 3-axis.

Neha Chourasia et al., in 2018. proposed low-cost CNC Plotter Using Arduino. The approach involves Arduino uno with an Atmega328P micro-

controller converts G-code into a set of machine language instruction to be sent to the motor driver of the CNC plotter.

Mubarak Hossain et al., in 2018. proposed low-cost Micro Milling Machine and demonstrate that the developed machine can be used in fabricating the plastic based microfluidic device.

PROPOSED SYSTEM

This research, we propose the implementation and design of Automatic sowing machine to grow the seeds for this planting tray by stepper motor driver board and Arduino Uno for low**-**cost machine**.**

The idea of Automatic sowing machine to grow the seeds for this planting tray is TB6560 stepper motor driver board and arduino uno controller board.

A. controller board

The Arduino controller board is a microcontroller. It can read input from analog and digital signal and turn it into an output that activates a motor, turn on an LED which has additional commands to be written in C++, and uses the Arduino IDE software as the basis for processing. as shown in Fig .1,

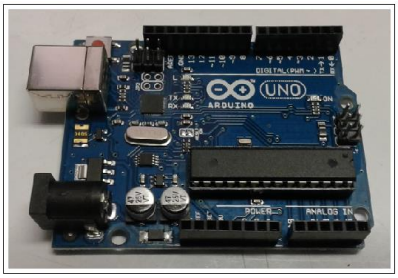

Figure 1 controller board

B. stepper motor driver

A stepping motor drive is a type of electric motor designed for controlling the rotation of various machines in a factory. printer or conveyor belt, etc. Stepping Motor Drive uses a square wave electrical signal (Pulse) to drive the motor. to cause the axis to rotate step by step It can rotate about 360 degrees around its axis, resulting in a low-speed spindle motion mechanism. It also helps to maintain torque instantly. causing damage to the motor when in use, but it depends on the structure of each motor as well. There are various types of Stepping Motor Drives. Each type depends on different applications, so we should choose a stepping motor drive that is suitable for our applications., as shown in Fig .2 and 3,

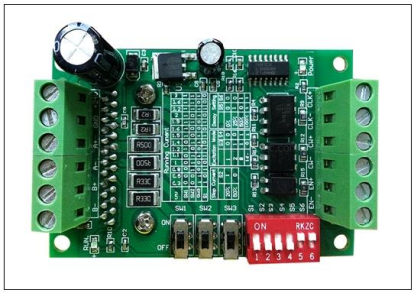

Figure 2 TB6560 stepper motor driver board
/https//:www.thaieasyelec.com/products/robotics/motor/tb6560-3a-stepper-motor-driver-board-detail.html/

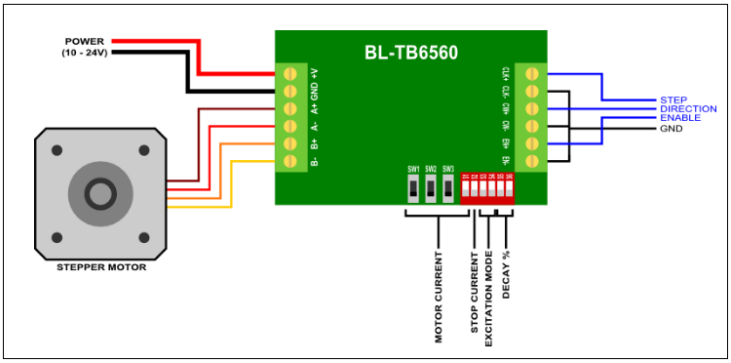

Figure 3 TB6560 stepper motor driver board diagram
/https//:www.zonemaker.com/product/44/tb6560-3a-stepper-motor-driver-board/

C. Seed sowing head

Sowing seeds means dropping the seed of the plant you want to plant into a well-prepared planting hole .This method of planting is often used for plants with large seeds, deep root systems, or bushy trees, such as perennial fruit trees and melons .Planting plants by sowing seeds into holes .This can be done by preparing the soil in the planting hole to make it loose and provide enough plant nutrients to meet the needs of plants .Make a hole about 1–2 cm deep and place 2–3 seeds in the middle of the hole and cover the soil with water .Every day and should be careful not to flood the planting holes . because it can cause the seeds to rot .After about 3–5 days)depending on the type of plant(, the seeds will sprout into a sprout that will grow above the soil .And when it's strong, there are 2-4 true leaves, then withdraw, leaving 1-2 per hole and taking care of it until the seeds are planted in the finished seeding container.

In general, there are three methods of growing plants using seeds . sowing and sowing seeds into holes Each method is suitable for different types of plants .Therefore, to grow plants using seeds in any way .Therefore, it should be considered to suit the type of plant, size, shape or nature of the seed .as well as places or containers that will be used for planting This is to allow plants to grow well .have complete strength and produce good results . The sowing head is a quick and easy to use sowing head, just press the button to dispense seeds and can be used with fertilizer seeds and plant seeds as shown in Fig. 4,

Figure 4 Seed sowing head
/https//:www.lazada.co.th/products/wow-wow-i3902815066-s14993308545.html?clickTrackInfo=undefined&search=1&source=search&spm=a2o4m.searchlist.list.i7.be153a5f0MIwa5/

D. Design and Assembly

We use stepper motor 2 phase for X and Y axis, 1.8 degrees, 1.7A rated current, 1.5ohm resistanceas shown in Fig. 5,

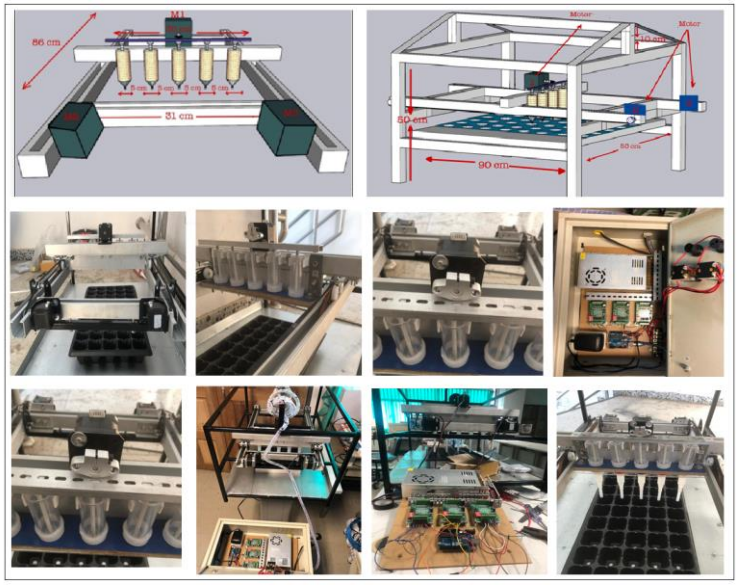

Figure 5 Design and Assembly

E. Calibration for accurate movement

We use the equation to calculate calibration for accurate movement of stepping motor.

$$X = A*B / C \quad (1)$$

When

X = final step /mm.

A = current step /mm.

B =expected length.

C =actual length.

1 .Test the movement for accuracy of the X-axis motor by executing the program via GRBL program .The plus sign moves from 0 mm to 20 mm. Which is very accurate as shown in the in Fig. 6,

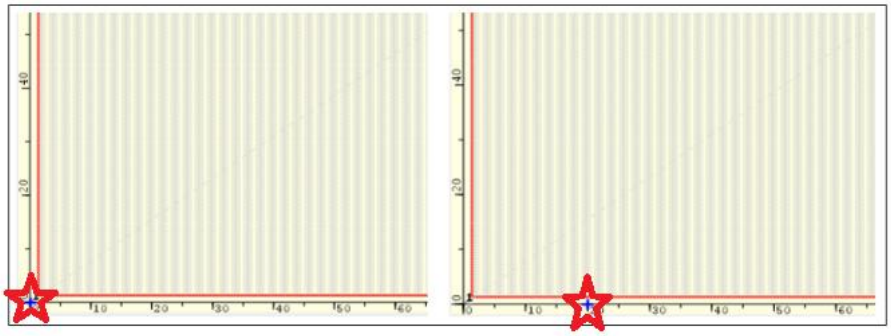

Figure 6 Testing the movement for accuracy of the X axis motor to the point of 20 mm.

2**.** Test the movement for accuracy of the X**-**axis motor by executing the program via GRBL program **.**The plus sign moves from 0 mm to 50 mm**.** Which is very accurate as shown in the in Fig. 7,

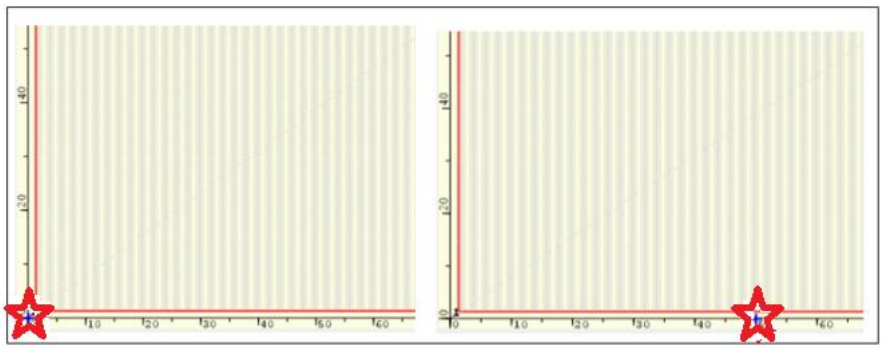

Figure 7 Testing the movement for accuracy of the X axis motor to the point of 50 mm.

3**.** Test the movement for accuracy of the Z**-**axis motor by executing the program via GRBL program **.**The plus sign moves from 0 mm to 20 mm**.** Which is very accurate as shown in the in Fig. 8,

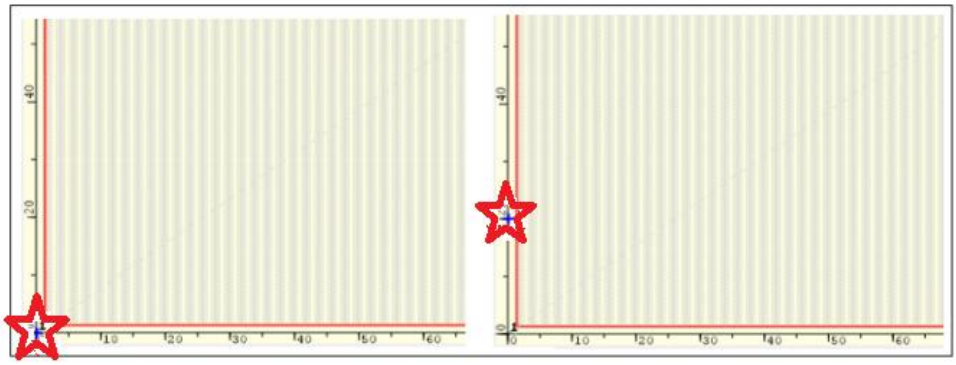

Figure 8 Testing the movement for accuracy of the Z axis motor to the point of 20 mm.

4**.** Test the movement for accuracy of the Z**-**axis motor by executing the program via GRBL program **.**The plus sign moves from 0 mm to 50 mm**.** Which is very accurate as shown in the in Fig. 9,

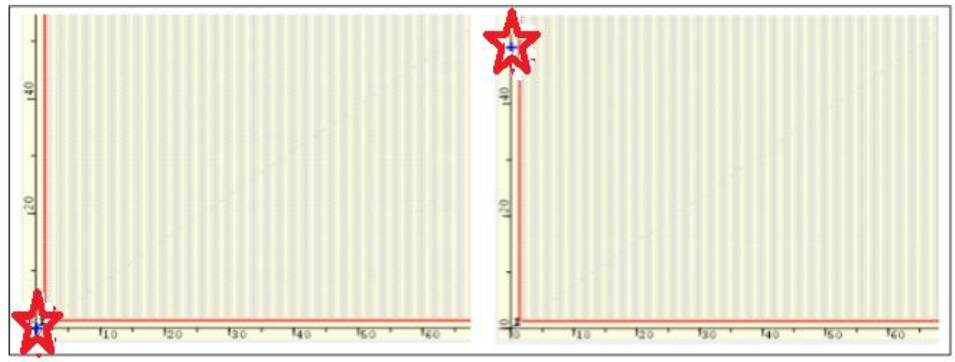

Figure 9 Testing the movement for accuracy of the Z axis motor to the point of 50 mm.

F. Implementation Example

1. example of movement of the sowing head

It can be concluded that the test results of the stepping motor motion move to match the holes of the seeding tray. from 40 tests, the motion of the moving stepping motor stops at the specified 5 cm hole. Therefore, it can be concluded that the movement of the stepping motor is highly accurate at 100%.

2. example of plant seed sowing

The results of plant seed sowing example were 1-5 seeds from plant seed sowing experiments. It was found that each seeding head had different seeding. The researcher therefore calculated the accuracy as a percentage. and the graph combines the accuracy values as follows: The experimental results of the operation of all machines were 1-40 times. When the experiment was performed and the accuracy was calculated, it was concluded that the accuracy of all automatic seeders was 89.95%. Fully automatic at 10.05%

EXPERIMENTAL RESULTS

We started from Stepping motor motion test: results for move to match the holes of the seeding tray, Test 40 times, the movement of the stepping motor stopped at the specified 5 cm hole .Therefore, it can be concluded the movement of the stepping motor is highly accurate at 100% and the accuracy, it was concluded the accuracy of the automatic sowing machine was 89.95%, the error was 10.05 %as shown in Fig. 10,

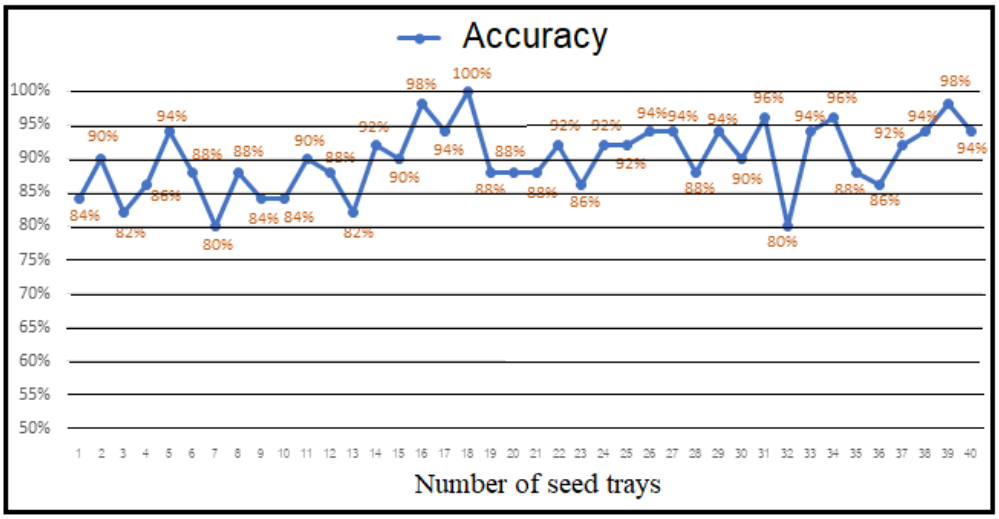

Figure10 Experiment result

CONCLUSION

This paper, proposed the computer numerical automatic sowing machine to grow the seeds for this planting tray .To reduce the workload of farmers to have a working efficiency .This will be a new alternative for entrepreneurs or farmers who still use the method of planting by tube seeds into planting trays .

This will reduce production costs of software and hardware and lead to increased productivity .From the study of automatic sowing machines and related equipment, the researcher has gathered the concepts, theories, related work, materials, equipment, and studied various data to be a guideline for finding design information and inventing a method for creating an automatic sowing machine .which has the following steps.

The process of automatic sowing machine by TB6560 stepper motor driver board and Arduino Uno and stepping motor for x and z axis. The rotation of the stepping motor that will rotate in a circle, so 1 circle has 360 degrees when the motor rotates 1 step, equal to 1.8 degrees per 1 step .Then input the values into the controller to get the correct rotation distance call that value .step/mm can be calculated from the following information :Number of pulses in 1 motor rotation equal to 360 degree was divided by 1.8 degree so that steps per revolution is 200 step/mm.

The results of the movement of the seed head .From 40 tests, the movement of the moving stepping motor stops at the 5 cm hole as specified, so it can be concluded that the stepping motor is 100 %working .40 times After experimenting and calculating the accuracy, it was concluded that the accuracy of the automatic sowing machine was 89.95 %, the error was 10.05 .%The accuracy is caused by the calibration process as in Equation 1.

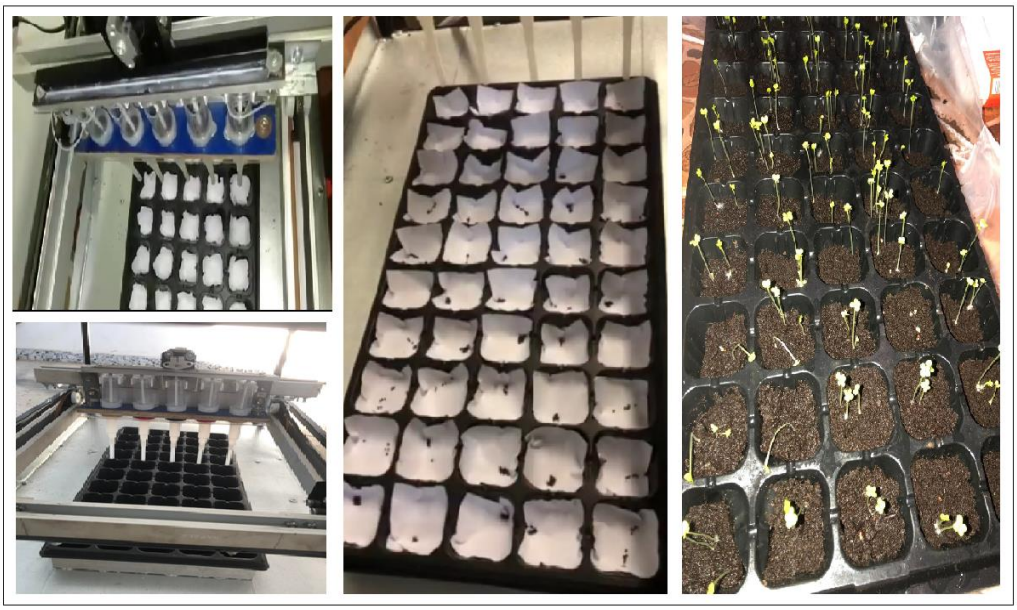

Figure 11 The results of computer numerical automatic sowing machine to grow the seeds

ACKNOWLEDGMENTS

This research was supported by 5th Fund of Research Support for the year 2020, Loei Rajabhat University. We thank our Research Office.

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