



## AUTOMATIC CARVING TOOLS USING ARDUINO MICROCONTROLLER

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### Abstract

In carving crafts, there are a lot of motifs or regional characteristics from which the carvings originated, making a carving work requires special skills, patience, thoroughness, and full concentration so that there are no mistakes in carving. In today's technological developments, the manufacture of wood carving crafts using a CNC (Computer Numeric Control) carving machine has begun to shift the role of traditional carving craftsmen who are currently out of business, because the results of the CNC carving machines are much better and more detailed in carving, because of that work is a machine so an operator only enters certain codes into the machine computer, in operation a CNC carving machine operator must have special skills.

**Keywords:** Carving Crafts, Arduino, CNC, Micro Controller.

### INTRODUCTION

The manual craftsmanship process takes a long time and the variety of designs is also limited. In manual work using conventional chisels so that engraving products are always different from one craftsman with another craftsman with a different duration of work, so that the results also differ in terms of the quality of the chisel, precision and character of the engraving. Results of a survey on product work manual method as above is possible, when only producing products that are few in number. Carvers are very difficult if they get orders in large quantities[1]. Result the results will not be the same and the production speed is limited by the fatigue of the engraver. That reason strengthening the need for CNC, because with CNC product results and production speeds can be consistent[2]. Ornaments are commonly used in works of art, both traditional and modern[3]. The decoration usually in the form of a repeating pattern. Decoration is

also a subject that will accompany the image field (painting or other types of work) in visual form, the decorations consist of patterns and motifs[4]. Pattern is the spread of shapes and colors in a certain iteration, while the motif is a basic theme decoration. In traditional Minangkabau decorations, there are various forms of patterns and motifs[5]. The Minangkabau Ornamental variety, in particular, displays more animal and plant motifs. examples of animal motifs Of the Minangkabau decorations the most widely known are Itiak Pulang Patang, motifs kaluak Paku and aka cino[6]. Kaluak Paku motif is taken from the fern plant, the 'fern', the itiak Pulang Patang motif is taken from ducks who marched home in the afternoon[7]. There are many Minangkabau decorations its visual form as well as the source of its acquisition. From the carving of the rumah gadang istano pagaruyung there In addition to more than 70 motifs, there are different motifs resulting from several variations and combinations The basic Minangkabau





motifs are found in the illumination of the manuscripts found in several West Sumatra region, written in Herry Nur Hidayat's journal about the development of carving motives rumah gadang for fabric motifs: revitalization and development of creative industries [8]. On the other hand, Minangkabau traditional carvings are increasingly rare. This is caused by several factor. First, the high cost required to make these carvings. Second knowledge about the motif of the carving[9]. Knowledge of meaning and appropriateness of use is an important factor in making carvings at the rumah gadang. This is what makes people seem reluctant use it today. Therefore, there needs to be an effort to reintroduce the richness of tradition Minangkabau to the people who own these traditions[10].

## METHOD

Carving is the art of sculpting material with decorative patterns and structures that are made concave or convex to follow the flow of the image. Judging from the concept of carving, revealed by Gustami in his book Jepara carving furniture art that many carvings are carved on wood or steel with chisels made of iron or steel. In essence, carving is a technique not in the decorative design of the carving, this is always something that is misunderstood regarding the finished product which is often called by the cloud as carving because of its motive. The rapid industrial climate change demands market segmentation related to carving techniques that are compatible with economical calculations so that carving is an engineering commodity that cannot be

separated from its output. The carvings used are a description of the surrounding natural conditions, such as plants, animals, objects, and humans. The carvings are in accordance with the philosophy of life of the Minangkabau tribe, the nature of takambang becomes a teacher, which means that nature develops to become a teacher. If interpreted loosely, this philosophy of life shows that nature is an important teaching medium for the Minangkabau. Computer Numerical Controller or better known as the term CNC is a series of machines with program intelligence work patterns for the purpose of executing Drilling system work. Seeing the specificity of the performance of the CNC machine does not rule out the possibility that CNC machines can still function with a variety of materials including wood. CNC machine components consist of two basic components, namely the hard components in the form of physical machines and the soft components in the form of programmable devices or software drivers / executors. The working principle of a CNC machine is vertical and horizontal movement with the coordinates of the X Y and Z axes with a drive using a stepper motor and FanBelt, the NC (Numerical Computer) programming format known today is G-Code. The G-Code format was the first format introduced and specialized for NC programming. G-Code is the common name of ISO 6983 or Numerical Control Of Mechine of Address Words[11].

The machine used is a CNC router machine with a working dimension of 1500mm x 1250 mm with a cooling





system (collant) clamping system, cutting tools for carbide, engraving bits, with 60 angles and straight bits with a diameter of 6 mm each.

3. The raw materials used to make carvings are multiplex, Dutch teak wood and MDF. Ensure that the CNC machine can work optimally by using the various engraving tools available.

4. The 3 axis CNC router machine used is homemade with a budget of IDR 25,000,000 with a work area of 1500mm x 1250 mm using a router with a speed of 5000 Rpm, 4 stepper motors, 4 motor drivers, and a combination of tools using pentab and Bluetooth connection.

5. Machine testing was carried out with 3 different materials, namely MDF, Multiplex and Pine Wood. In this test, the main thing is to find the most appropriate parameter values to produce the best engraving. The process of iterating the CNC parameter values is carried out until there are engravings that can be used to carry out the actual Minangkabau carving machining.

6. Evaluation is an important step to obtain information about the best parameters (router rotation, infeed rate, cutting depth, type of cutting tools) to be correlated with the quality of engraving results and safety of CNC router equipment and machines.

7. The product result of a CNC machine is a correlation between a 3D design and a valid CNC machine or between the design and the results that already have a 100% similarity level.

8. Finishing is done by providing a creative product display that is attractive and has the highest quality selling value



Figure 1 : Scheme Research

Consists of the following stages :

1. Identify the need for a CNC machine with a working area of 1500mm x 1250mm.

2. The designs of the Minangkabau carving motifs used were Itiak Pulang Patang, Pucuk Paku and Aka Cino with aspire vectric software and Universal Gcode Sender to be sent to Arduino for execution





## RESULT

The first test is a picture of Minangkabau carving with the name Kaluak Paku. Usually these carvings are on the walls of the rumah gadang. The manual creation can take 2 to 3 months for a novice engraver. In the professional engraver category, it can take up to 3 weeks to 1 month at a fairly high cost.



Figure 2 . Kaluak Paku in 2D

Then, the image will be imported into aspire vector software to make a 3D design. The following are the results of the aspire vector software processing.

### Functions and Uses of a CNC Router Machine

This simple wood lathe has 3 functions or uses. The first function is cutting or cutting, which is cutting wood according to your wishes when running it using a computer. Then the error in cutting can be reduced.

The second function is engraving or engraving. So that by using this machine you can decorate wood in such a way as to make it look nicer and also seem more unique. So that the resulting product will be very satisfying and very beautiful.

After cutting and engraving, another function that this cnc-based wood

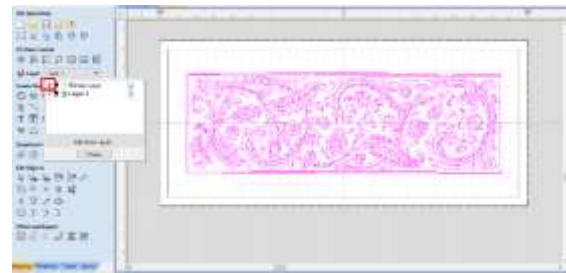


Figure 3 . Kaluak Paku in 2D ke Aspire Vectric



Figure 4 . Kaluak Paku in 3D Model

router machine has is marking or marking. What is meant here is to give marks on the wood that will be used. So that the finishing touch will be appropriate and neat.

### How CNC Machines Work

After knowing about the function or use of this machine, it is very important for you to know more about how this machine works so that it can be a reference for you later.

1. The first thing you have to understand is that this cnc wood router machine for cutting, engraving or marking uses drill bits with various shapes that are tailored to the needs which are





- mounted on the spindle head which will move automatically.
2. This machine also has another advantage, namely having a total of three axes. So that with this tool can move the drill bit right-left, back and forth and also up and down. With this, of course, this machine can engrave wood with three-dimensional results and a very fitting engraving.
  3. Because using a drill bit, you should check its sharpness periodically because over time the drill bit will wear out and it could break. This will certainly have an impact on the product. In addition, each function of the wood cnc router machine has a different drill bit.
  4. For the price of this wood cnc router machine also varies because there are so many types of this machine. Maybe if you have more functions, the price offered will also be more expensive. The point is to adjust the purchase to your production needs.
  5. For the cutting done, it cannot be sharp because it uses a drill bit. So that the results of the cut that has an indentation will be adjusted to the diameter of the drill bit used for cutting. This is the disadvantage of a wood router machine from the many existing advantages.



Figure 5 . CNC Machines



Figure 6 . CNC Result

## CONCLUSION

Based on the test results, the following conclusions can be drawn, In order for the shape of the carving to be more perfect, the 3D engraving results are affected by the amount of the image pixel value obtained when applied to a CNC machine. Minangkabau motif carvings are only in the form of images, so it needs a shape The 3D of each Minangkabau motif so that the richness of Minangkabau culture can be maintained. The determination of working media such as the use of wood, multiplex and MDF materials must also be considered because it relates to the engine working speed and results. It is recommended that the calibration of the CNC machine needs to be done every time you make a new engraving. Given the process of working on an engraving takes more than 100 minutes with medium different.





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