**Abstract**

Automation of manufacturing processes became an important objective after the industrial

revelation since the 19th century. Machining operations used to be done manually, where

they will take time to finish the work. Nowadays, these operation are done by computer,

that will increase the performance of the operation.

CNC machines are now taking place approximately in each operation, if that is important,

though. This project concerned with the milling operation for small pats. It contains three

main components, the mechanical one talks about the mechanical design of machine’s

parts. The electrical one, which focuses on the controllers and the safety circuits and the

driving motors. And the software, that talks about the programs that are going to be used in

programming and operating the machine.

Manufacturing processes modified from manual operation to be automated. This will

increase the efficiency of the operations, decrease the production time, reduce the labor cost

and reduce the losses in row materials.

Machining is the most versatile and accurate of all manufacturing processes in its capability

to produce a diversity of part geometries and geometric features. CNC milling machines

replaced the traditional milling operation, due to its high accuracy.

Most of CNC milling machines are computer controlled vertical mills with the ability to

move the spindle vertically along the Z-axis. This extra degree of freedom permits their use

in engraving applications, and also allows to create 3D surfaces such as relief sculptures.

When combined with the use of conical tools or a ball nose cutter, it also significantly

improves milling precision without impacting speed, providing a cost-efficient alternative

to most flat-surface hand-engraving work.

CNC is a field where Mechatronics engineering takes a place, 3D CNC milling machine

aims to produce small, simple and complex products that are not easy to be made manually.

This project aims To understand the Mechatronics systems and how to build such one.

Learn the team work, learns the responsibility. Also it is a good way to

1.1 Overview of The Project

The machining or cutting of metals portion of manufacturing became important around the

time of the industrial revolution. In 1775, John Wilkinson invented a cannon-boring

machine (lathe) in England .He adapted that machine for boring the cylinders for

Boulton & Watt's steam engines. His boring process was the only one of its kind to produce

the smooth, tightly tolerance bores required of the cylinder of a steam engine.

A bit later in the year 1818 Eli Whitney (inventor of the cotton gin) invented a milling

machine in New Haven Connecticut .Prior to the milling machine, a machinist's tools

were primarily files and required a highly skilled operator. The milling machine allowed a

less skilled operator to make the same quality of parts as the skilled operator with the file.

The spindle of Eli Whitney's milling machine was moved from being horizontal to being

vertical. This is commonly seen in the Bridgeport style knee-mill.

In year 1952 John Parsons invented NC (Numeric Control) milling machine. Parsons

worked to attach servomotors to the x and y axis controlling them with a computer that

reads punch cards to give it positioning instructions .The reason for devising such a

system was to machine complex shapes like arcs that can be made into airfoils for

airplanes.

Today, modern machinery are CNC (Computer Numeric Control) milling machines and

lathes. A microprocessor in each machine reads the G-Code program that the user creates

and performs the programmed operations. Personal Computers are used to design the parts

and are also used to write programs by either manual typing of G-Code or using CAM

(Computer Aided Manufacturing) software that outputs G-Code from the users input of

cutters and tool path . CNC can be classified according work as lathes, milling machines,

laser cutters and other industrial tools. The CNC term refers to a large group of these

machines that utilize computer logic to control movements and perform the

metalworking[2].

Lathes are designed for the precise machining of relative hard materials. These rigid

machine tools remove material from a rotating work piece via the (typically linear)

movements of various cutting tools, such as tool bits and drill bits.

Rotating is the way that lathe shapes the material and with a rapid speed, this is done by

pressing a fixed cutting or abrading tool. Now a days, lathes equipped with the CNC to help

fashion tool and products.

The machine is controlled electronically via a computer menu style interface, the program

may be modified and displayed at the machine, along with a simulated view of the process.

The operator needs a high level of skill to perform the process, however the knowledge

base is broader compared to the older production machines where intimate knowledge of

each machine was considered essential. These machines are often set and operated by the

same person, where the operator will supervise a small number of machines (cell)[3].

Milling is the process of cutting away material by feeding a workpiece past a rotating

multiple tooth cutter. The cutting action of the many teeth around the milling cutter

provides a fast method of machining. Milling machines are classified to, peripheral milling,

Another classification of milling according to the movement is the vertical and horizontal

milling. In the vertical mill, the spindle axis is vertically oriented. The horizontal mill has

the same sort of x–y table, but the cutters are mounted on a horizontal arbor across the

table[4].

All CNC machine types share this commonality: They all have two or more programmable

directions of motion called axes. An axis of motion can be linear (along a straight line) or

rotary (along a circular path). One of the first specifications that implies a CNC machine's

complexity is how many axes it has. Generally, the more axes, the more complex the

machine .