ARDUINO BASED AUTOMATIC SKETCHING MACHINE

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Abstract - *This research work describes the design and fabrication of a mini Computer Numerical Control (CNC) two dimensional (2D) sketcher for accurate building drawing. The main components of this low cost mini CNC 2D sketcher are Arduino controller, pen writer, Stepper motors, Servo motor, motor drivers and battery. This whole system is working based on source codes. Drawing perfect sketch by hand can now be done by machines too. Here we propose an automated image sketching machine that sketches drawings similar to a real human but with a lot more accuracy. The proposed system makes use of an Arduino based circuitry that is interfaced with motors and belt based setup that is used to provide the mechanism needed by a pen to draw the sketch. The Arduino based circuit is interfaced with 2 stepper motors and one servo motor in order to transmit the movement commands as per the image fed to it. It then controls the sketching process through a well-controlled mechanism in order to achieve this task. The pen only touches the paper where a dot is to be placed is raised above the paper by the motor where not needed. This motion coupled with the x and y axis movement of the motors allows for a 2D sketching mechanism on the paper using this mechanism.*

Keywords: aurdino board, G-code software

1. INTRODUCTION

A Plotter is a special type of printer that uses a pen to draw images on solid surfaces. CNC Machining is a process used in the manufacturing sector that involves the use of computers to control machine tools. A computer program is customized for an object and the machines are programmed with CNC machine language called G-code that essentially controls all features like feed rate, coordination, location and speeds. With CNC machining, the computer can control exact positioning and velocity. In automatic sketcher machine, microcontroller is used which is capable of processing logical instructions interfaced with it. The logical instructions are provided by using a microcontroller in the form of code or text or image which is then transformed into a machine language. This automatic sketcher machine is a 3D controlled 2D plotting machines which uses a pen to draw text or image on any given solid surface. It can be used for the purposes such as PCB Design, logo design, etc. This project is based on CNC plotter machine. With the increasing demand for the use of CNC plotters in universities and laboratories, a cheap and less complex design is an absolute need. The parts used for the plotter in our project are easily available at a very low price and spare parts are also used. The construction is very

simple and robust. A pen touches the surface & prints the pixel for logic 1 and lifts up in air for logic zero & actuator changes it position for next commands execution Presented plotter is two dimensional 2D sketcher machine.

2. METHODOLOGY

The block diagram and circuit diagram for that project is as follow
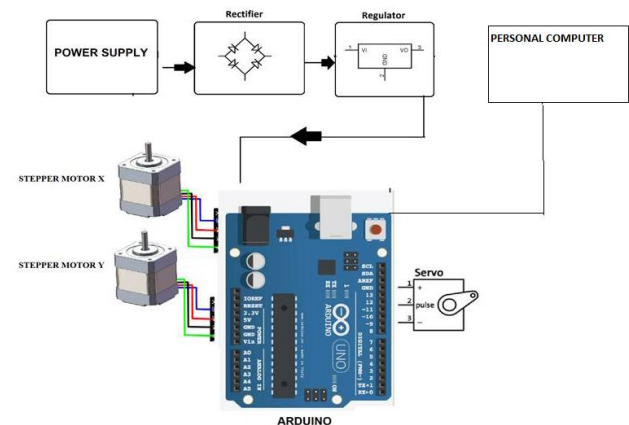
2.1 BLOCK-DIAGRAM

Fig.1: Block diagram of automatic skecthing machine

The above diagram shows the architecture of the proposed system. This system is designed around Arduino microcontroller as shown in the above diagram of the system. This system uses Arduino controller platform with Arduino UNO This board is the brain of our sketching machine and serves as the main interface to the Computer. The Arduino board is programmed with a modified G-Code interpreter and the 3 axes motion. Main block of this system consists of power supply. From power supply we get two voltages i.e. +5volt and +12 volt. 5volt which is required to Arduino UNO, Easy drivers whereas +12volt supply is required to stepper motors. The architecture of the sketching machine consists of two stepper motors interfaced with the microcontroller as shown in the above diagram. These stepper motors are used to make X and Y axis of the system design. A stepper motor is a brushless, synchronous electric motor that converts digital pulses into mechanical shaft rotation in a number of equal steps. Used to control the movement of work table in X, This sketching machine is

able to draw complex line drawings. The coordinates are uploaded to the machine controller by a separate program. The image file is transformed into a G-code via Software. Then the code is transferred to the microcontroller by which the motor mechanism is instructed to draw the image. Depending on the image to be drawn, the computer will generate the appropriate coordinates and send them to the microcontroller through the USB port. The sketching axes are controlled by G code. Then G code is uploaded on the Microcontroller of the sketching machine. Then the controller outputs commands to motors and accessories that can repetitively and extremely accurately design or draw. The automatic sketch pen movement for building drawing or sketch is obtained by processing G code through the microcontroller. The servo motor will be used along the Y& Z axes. The z-axis is used lift and lower the pen onto the plain paper. To move the sketching device i.e. a pen in this system a servo motor is used and interfaced with the Arduino microcontroller as shown in the above block diagram.

Depending on the image to be drawn, the computer will generate the appropriate coordinates and send them to the microcontroller through the USB port. The microcontroller interprets these coordinates and the ncontrols the positions of the motors to create the image.
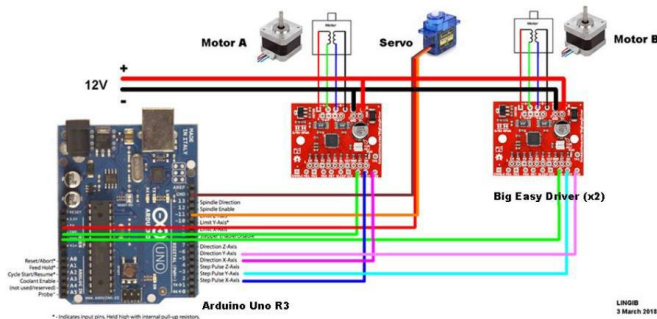
2.2 CIRCUIT DIAGRAM

Fig. 2: Circuit digram of automatic skeching machine

The above diagram shows the complete circuit implementation of the proposed system "Automatic Sketching Machine". In this system all the circuit components require regulated power for their working functionality. To fulfill this requirement of the circuit we have designed a power supply unit to provide regulated power supply to the circuit components. The supply is provided through mains i.e., 230v. The supply is stepped down to 12v from 230v through transformer. Hence at the secondary terminal of the transformer we get 12v AC. This ac output of the transformer is converted into DC with the help of the full bridge rectifier. The output of the rectifier is 12v DC. This 12v is provided to the regulator IC. This regulator IC used is LM7805. The input to the regulator is provided at pin no 1 of the regulator and the output is taken out at pin no 3 of the regulator IC. The

ground is provided at pin no 2 of the regulator. The 5v from one IC is provided to the controller. An LED is connected in between the regulator and the controllerto indicate whether the power is on or off. The capacitor at the input and the output of the regulator is used to remove the ripples in the signal i.e., this are filter capacitor.As shown in the above circuit diagram the servo motor used to move up and down as per the commands fed to the microcontroller through the PC. This servo motor is interfaced and controlled with the microcontroller. The VCC wire of the servo motor is connected to the 5V pin of the Arduino board and the ground pin is connected to the ground on the board and the remaining controlling wire is connected to the pin number 11 of the Arduino board as shown in the above circuit diagram of the system.To control the X and Y axis in the drawing operation two stepper motors are used andinterfaced with the Arduino. These stepper motors are controlled by means of a driver circuit A4988 driver. To control these stepper with the microcontroller each one is connected through a driver as shown in the above circuit diagram of the system. These driver circuits require 12V regulated supply for the operation.

WORKING

This sketching machine is able to draw complex line drawings. The coordinates are uploaded to the machine controller by a separate program. The image file is transformed into a G-code via Software. Then the code is transferred to the microcontroller by which the motor mechanism is instructed to draw the image. Depending on the image to be drawn, the computer will generate the appropriate coordinates and send them to the microcontroller through the USB port. The sketching axes are controlled by G code. Then G code is uploaded on the Microcontroller of the sketching machine. Then the controller outputs commands to motors and accessories that can repetitively and extremely accurately design or draw. The automatic sketch pen movement for building drawing or sketch is obtained by processing G code through the microcontroller. The servo motor will be used along the Z axis for positioning the pen which will go up for logic 0 and down for logic 1. Drawing will be done on the X-Y plane where the positioning will be controlled by stepper motors. The two axes pen movements can be precisely and automatically positioned along their lengths of travel by a servo motor and two stepper motors. The motor drivers are used to process the machinelanguage obtained from microcontroller and in turn run the motors in clockwise or anticlockwise directions so as to achieve the desired pen movement. An A4 sheet is pasted using cello tape at the edges of the proposed 2D sketcher table.

We feel great pleasure to present the Dissertation entitled"**aurduino based automatic sketching machine".** But it would be unfair on our part if we do not acknowledge efforts of some of the people without the support of whom, this dissertation work would not have been a success.

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