

Low Cost Thermocol Cutter

K.Fatema Shaikh, Pranami Sharma and Shailaja Kanawade
SITRC, SPPU, Pune, India.

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ABSTRACT

As we know radium cutting through PC is readily available from that, we got the idea of our project i.e. "Low cost, thermocol cutter". In this project the microcontroller is the backbone of the hardware circuitry. All the controlling actions are done by the micro controller. A hot rod basically the soldering gun is used for cutting purpose. Here, the thermocol is not actually cut, but it is melted at a specified temperature with the help of soldering gun. So this project is used for cutting different figures and shapes as per the program of the micro controller. Optocouplers are used to provide isolation between the micro controller and the hardware circuitry. Stepper motors are used for controlling the different directions of different axis. Thickness of the thermocol will depend upon the length of the cutter and its heating capacity. Alphabets and numerical are generally cut using this project but figures of all shapes and sizes can be cut up to the limit of the work platform.

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Introduction

This is a micro controller based device that uses a hot rod to cut the three axis. The program is fed in the micro controller and is delivered to the cutter. This device can be used for cutting various figures and shapes as per the program. The program is written in micro controller and is delivered to the hardware. The program can be written for cutting shape in two dimensions. The hardware consists of an isolation circuit made of opto couplers and associated components. This is an electrical isolation to protect the circuitry from any ill effects. Data from the isolation circuit is given to the stepper motor drivers that control the movements of the three axis. Each axis is controlled by a separate motor, for the up and down movement and linear moments of that axis. A relay driver drives a relay for the heater for cutting the thermocol. Sensors are provided to indicate end limits of the work platform. These signals are fed directly to the micro controller through the signal conditioner and the isolation circuit. The thickness of the thermocol to be cut will depend on the length of the cutter and its heating capacity. Alphabets and numerals are generally cut, using this device but figures of all shapes and sizes can be cut up to limits of the work platform.

Literature Review

Circuitry, so this project is smaller in size and user friendly as compared to that of the radium cutting through PC. In radium cutting through PC a skilled labour is required as it is complete. Our project is micro controller based thermocol cutter. Radium cutting through PC is available in market. In radium cutting the controlling actions are done by the PC and in our project the controlling actions are done by the micro controller so the cost is reduced efficiently. If the metal used for cutting is changed and the speed of the stepper motor is increased by changing the step angle of the stepper motor, this project can be used for PCB drilling, diamond cutting and many other applications. This project consists of mostly digital IC's and a compact hardware software oriented whereas in our project consists of simple keypad and a LCD display so there's no need of skilled labour.

Proposed System

In this microcontroller based thermocol cutter, here we have divided it into two sections, one is a hardware part and another is a software part.

Hardware Specification Details

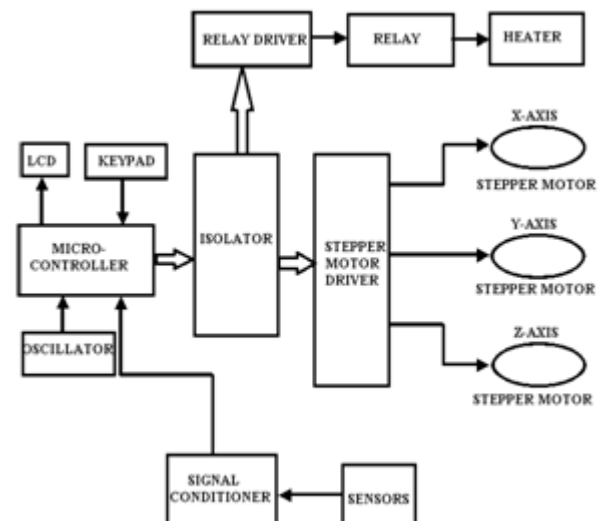


Figure 1. Block Diagram of Thermocol Cutter

The pattern to be cut is given to microcontroller through keypad and it is also displayed on LCD. Microcontroller will process the given command and operate the stepper motor as per preprogram of the given pattern. The stepper motor is driven by stepper motor driver which is isolated with the microcontroller through Isolator. The sensors are used to sense the position of stepper motor as X-axis, Y-axis and to sense the temperature of the cutting tool. The sensors output is in the range of few milli volts hence the signal conditioner is used. Relay driver is used to control the relay for the on-off of the heater.

Components Used

AT89c51uc-8051 based Fully Static 24MHz CMOS controller with 32 I/O Lines, 2Timers/Counters, 6 Interrupts/2 Priority Levels, UART, Three-Level Program Memory Lock

4K Bytes Flash Memory, 128 Bytes On-chip RAM. Microcontroller is used for controlling the stepper motor in the required direction. Direction means, it will decide the steps to be taken for the particular alphabets or numbers.

Dual Phototransistor optocoupler IC MCT6- Features

Two isolated channels per package Two packages fit into a 16 lead DIP socket Choice of three current transfer ratios.

L298 H-bridge Dual Bidirectional Motor Driver- This Dual Bidirectional Motor Driver is based on Very popular L298 H-bridge Dual Motor Driver Integrated circuit the circuit will allow you to easily and independently control two motors upto 2A each in both directions.

CD40106BC Hex Schmitt Trigger – Features Wide supply voltage range: 3V to 15V, High noise immunity: 0.7 VDD (typ.).

Keypad - In this project we use 6x6 matrix keypad. In this keypad that consists of all numerical and alphabets. The keypad is used for entering the characters and numerical to the microcontroller. Also it is use for changing the fontsize. Keyboards and LCDs are the most widely used input/output devices of the 8051, and a basic understanding of them is essential.

LCD Display - Liquid Crystal Display (LCD) which we have used is 2x16 LCD i.e. two lines each with 16 characters. We have used the LCD in 8 bit mode i.e. 8 data lines are required. Other than 8 data line one RS, one RW and one Enable line is also required. The RS line is used to select whether the data or instruction is being transferred between the controller and the LCD. The RW line is used to indicate if data is being read from the LCD or written into the LCD. The RW pin is pulled low when data is being sent to the LCD. The Enable pin is basically a latch pin which tells the LCD that the data is available on the data lines. The resistor used to set the intensity of the backlight.

Sensors -Infrared sensor (IR) to determine the platform limitations. The output of the sensors is given to the micro controller through the signal conditioner. As per the sensor indications the micro controller determines the platform limitations. Using the sensors we defines the zero position of all the axis. An IR sensor is a device which detects IR radiation falling on it. There are numerous types of IR sensors that are built and can be built depending on the application.

Isolation - The isolation consists of opto couplers. It is used for sharpening the signal and also used to protect any ill effect from the hardware circuit. The output of the isolation is given to the stepper motor drivers. In electronics, an opto-isolator, also called an optocoupler, photocoupler, or optical isolator, is a component that transfers electrical signals between two isolated circuits by using light. Opto-isolators prevent high voltages from affecting the system receiving the signal. Commercially available opto-isolators withstand input To – output voltages up to 10 kV. A common type of opto – isolator consists of an LED and a phototransistor in the same opaque package. Other types of source - sensor combinations include LED-photodiode , LED - LASER, and lamp-photoreistor pairs.

Stepper Motors - There are three axis namely X, Y and Z-axis. Separate stepper motor is used for the different axis. As per the programming the stepper motor moves. The X-axis and Y-axis stepper motor is used for the forward and backward movements and the Z-axis stepper motor is used for the up and down movement of the cutter. A stepper motor is an electromechanical device which converts electrical pulses into discrete mechanical movements. The shaft or spindle of a stepper motor rotates in discrete step increments when electrical

command pulses are applied to it in the proper sequence. The motors rotation has several direct relationships to these applied input pulses. The sequence of the applied pulses is directly related to the direction of motor shafts rotation. The speed of the motor shafts rotation is directly related to the frequency of the input pulses and the length of rotation is directly related to the number of input pulses applied.

Relay - The main purpose of relay is to ON-OFF the heater. The relay driver is used for controlling the relay.

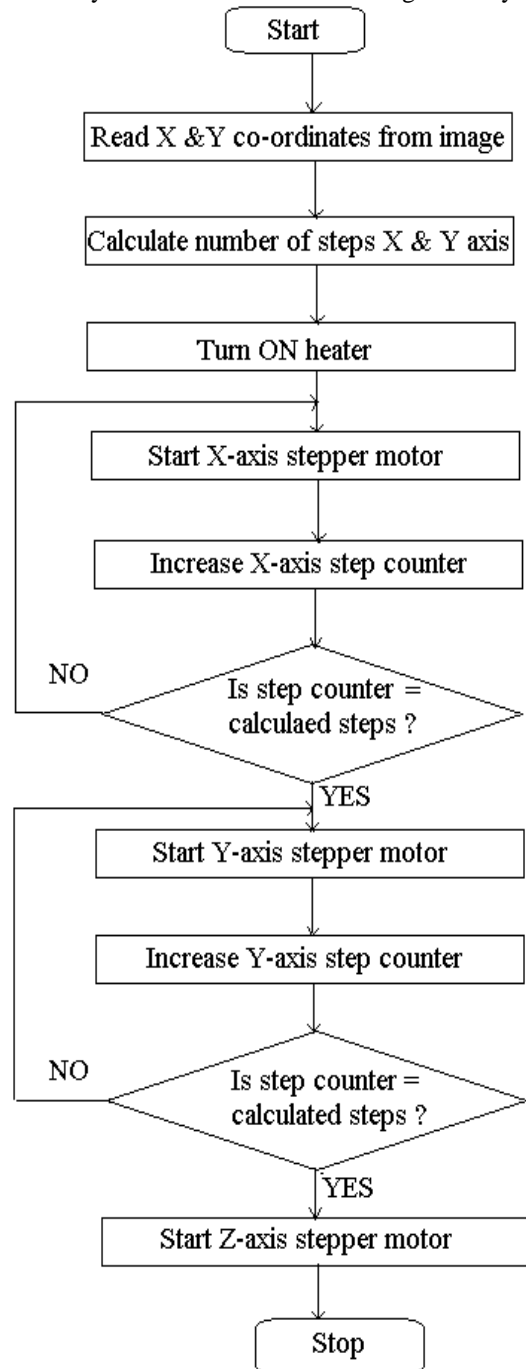


Figure 2. Flow Chart For Driving Motor in X, Y and Z direction

Conclusion

This project is designed for the cutting of the thermocol with the help of micro controller. This project can be used for preparation of banners, wordings, for decoration purpose, to create sign and symbols, and for making of road indicators. The project is micro controller based so all the controlling actions are done by the micro controller.

By the use of micro controller the cost of the project is reduced efficiently. And the project is user friendly.

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