

Development of a Microprocessor Controlled Embroidery Machine

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A drive system for a microprocessor based embroidery machine has been developed for domestic application. The system controls two stepper motors to produce the embroidery patterns. The system is designed for ease of handling by the user as well as flexibility in choosing the pattern. Therefore, it is interfaced to a keypad and an LCD. A software has been developed to create the pattern for the alphabet "L" and "V". An experiment was also carried out to determine the resolution of the pattern.

1. INTRODUCTION

Creating a well designed, uniform and beautifully finished embroidery pattern has traditionally been the exclusive job of a skillful person. The normal sewing machine, even one specially designed for embroidery, simulates the movement in one direction only. The user has to move the frame on which the cloth is fastened, or a special knob on the latter models, to get the required pattern. Apart from the skill required, the process also requires a lot of time especially in producing complicated patterns. To overcome these setbacks, automated embroidery machines have been in use for some time for commercial purposes, but targetted mainly for mass production of embroidered products. These machines are mostly too expensive for the domestic users. Therefore, a low-cost machine having similar features should be a handy and useful tool for the non-commercial users.

The objective of the study is to accomplish the required embroidery pattern using a low-cost microprocessor based control unit. The embroidery machine is interfaced to a CPU, an Intel 8088 microprocessor, its supporting devices and input/output devices all built on a programmable motherboard. It incorporates 8 pa-

irs of driver for the two stepper motors attached to the x-y table. The design of a rigid, precise and vibrationless x-y table without the high price tag as in the market, is also included in this study which involves personnels from both the electrical and mechanical engineering departments of the University of Malaya.

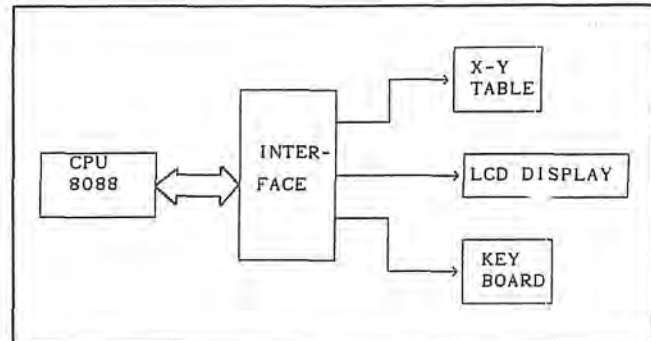


Figure 1. Overall Layout of the System

Sekil 1. Sistemin genel dizilişi

2. HARDWARE SETUP

Figure 1 shows the overall layout of the system. The Intel 8088, chosen for its versatility, controls all the read or write operation and can operate either in minimum or maximum mode. Therefore the system can always be expanded to include more than one processor when put in maximum mode. The system software as well as the pattern programs are held in the 32K EPROM. Two programmable peripheral interface (PPI) ICs, 8255, are used in the project. PPI#1 is used to send and receive data from the LCD whilst PPI#2 is used to control the movement of the motors. A 8279 IC is used to interface a 4x4 matrix keyboard as it can perform the three tasks needed for controlling a keyboard. In order to view instructions to be followed as well as the pattern to be embroidered on the cloth, a high contrast, large viewing angle LCD module with built-in MOS driver and controller is used. The controller is equipped with an internal character generator ROM and a RAM for data display. All display functions can be controlled by the CPU.

The stepper motors used are the Sanyo-Denki Step-Syn 103-775-6 model with step angle of 1.8° per step and it is a unique type of motor useful for moving things in small increments. The two motors, with four phases per motor, require eight pairs of driver. Each driver, shown in Figure 2, consists of the C945 transistor which acts as the switching transistor. It supplies base current to the TIP120 transistor which is a darlington pair responsible for increasing the current level fed to the motor. Figure 3 shows the circuit diagram of the completed hardware setup.

3. SOFTWARE DEVELOPMENT AND PATTERN GENERATION

The software of the system was developed using the Intel 8086/8088 assembly language. Initially the