

HIGHER TECHNICAL INSTITUTE

ELECTRICAL ENGINEERING DEPARTMENT

DIPLOMA PROJECT

**DEVELOPMENT OF A COMPUTER/MICROCONTROLLER
INTERFACE**

by

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To my family.

SUMMARY

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The objectives of this project are to design, construct and test an 8031 microcontroller and a computer interface card. Also, to develop the appropriate computer and microcontroller software so that the computer and microcontroller interchange information.

The computer and microcontroller should have both serial and parallel connections and the language for the computer should be either Pascal or Assembly.

In order to fulfil the above requirements two printer circuit boards were constructed. These PCBs are:

- a multi purpose board based on the 8031 microcontroller
- a computer interface card based on the 8255 PPI.

The work was performed and completed successfully. All the software and hardware have been done and also some additional work completes the purpose of the project.

Some of the additional software features are:

- loading machine code programs in the PC
- examine/modify memory locations
- move memory
- fill memory
- change the communication baud rate between the PC and the μC
- downloading a program from the PC to the microcontroller
- executing the download program
- read the contents of the ROM or RAM of the μC

- run program at specified location
- monitoring the 8031 programs

Also in addition to the above, a stepper motor position and speed controller application was designed and constructed. For this application software and hardware were designed. The new PCBs which were constructed are:

- a stepper motor driver,
- a small keyboard, and
- two small power supplies (+5V and +12V).

All software and hardware are explained later in this project.

This project assumes that the reader has some background in digital logic and microprocessor circuits.

INTRODUCTION

The first objective of this project is to design construct and test a computer interface card. This card has three eight-bit ports which are terminated to an appropriate socket. These three ports can be used as parallel ports since the combination of them has the ability to give I/O ports and control signals(handshake).

The second objective is to design construct and test an 8031 microcontroller. To the design of this microcontroller the need of serial and parallel communication ports were taken in mind. Also during the design of the microcontroller some problems with the assembler of the 8031 were observed, which limits the maximum assembly program to be only 32K (this has affected the design of the hardware and software). Therefore, the maximum ROM on board was limited to 32K with 8K RAM for data storage. But, because the RAM is used to download programs from the computer to the 8031 microcontroller and then executed them (explain later), the design of the microcontroller is made such that the EPROM may be smaller than 32K (8K or 16K). By changing some jumpers the memory map of the RAM is shifted below 8000h (32K) in order to be able to download programs in it.

The third, and the most difficult, objective of this project was to succeed communication between the 8031 microcontroller with a Personal Computer (PC) IBM compatible. For this purpose both serial and parallel communication were tried in order to find which of them is the most practical and easy to apply.

Finally, although an application was not a mandatory one, an application with stepper motors was designed, constructed and tested, in order to demonstrate some applications and capabilities of the project. In addition to the above, in order to make the 8031 microcontroller and the stepper driver independent from the PC, a small keyboard was constructed to control the speed and the position of the stepper motors.

The main advantage of using PCs to control the speed of motors is that using the IBM PC gives more capabilities to the user to control the motor. The combination of the PC and the μ C gives the ability to the user to control the speed of the motor from a long distance, since serial communication is used and bulky cables are avoided.

The control program is written in PASCAL language which although is a structured programming language, is easy to be modified since all the program is written using procedures, functions and units.

The final conclusion using this system is that it speeds up the work of an 8031 user since he can download the prototype program to the 8031 and see if the program is working properly. The time of erasing and programming the EPROMS is affected.