

A New Development of Multi-application of Micro-controller through educational Training Systems

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Abstract—According to the latest survey, more than half of the total student in Faculty of Electrical & Electronics Engineering are having problem in understanding program structure and developing hardware, basically based on Intel 8051 microcontroller. The project objective is to build a development board, which could also be a learning tool for those who intend to learn microcontroller. As a development board, it could let the user to get start with their microcontroller application efficiently. Without wasting too much time in preparing prototype circuit is one of the advantages by using a development board. The Intel 8051 Microcontroller Educational Development System is also including the general application. Therefore, the users could just get start with their software construction if their applications are found in The Intel 8051 Microcontroller Educational Development System. As a learning tool, it could let the student to test their software on Intel 8051 Educational Development System.

Keywords: Microcontroller, Educational, Intel 8051

I. INTRODUCTION

Educational Tools are always the result of experience transformations in terms of which they are to be applied. In order for student to feel at any particular moment in time the need to change its educational tool's, it is necessary that new ideas and needs have emerged in which the former tools are no longer adequate.

In general, this project consists of two major parts that need to be developed; hardware and software. For the hardware part, it consists of a system board and an application board. System board includes microcontroller, RAM, ROM, and a RS232

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interfacing circuit. For this project, microcontroller plays an important role.

Application board, on the other hand, consists of two input devices and eight output devices. The output devices include LED, Bar Graph, 7-Segment Displays, Traffic Light, 8x8 Tri-Color Dot Matrix, Liquid Crystal Display (LCD), Stepper Motor, and direct current (DC) Motor. In contrast, the input devices consist of 8-ways Dual-In-Line Package (DIP) switches, and a 4x4 Keypad.

This Intel 8051 Microcontroller Educational Development System board is aim to getting user familiarize with the Intel 8-Bit 8051 microcontroller devices families. The Intel 8051 Microcontroller is very user friendly, reliable & robust system, which could enable any eager users quickly get themselves equipped with the fundamental of microcontroller technology. The Intel 8051 Microcontroller comes with a comprehensive operational manual that guides the user step by step to understand the entire training system approach. The demand from the institution and the enforcement of educational standards and policies, make this product got a commercial value.

II. HARDWARE DESIGN

Hardware design can be divided into two function boards. They are system board and application board. Hardware design for system board is based on expanded mode. This mode enables the user to have external RAM, ROM, and I/O port. However, port 0 and port 2 are unavailable since they are used for address bus and data bus respectively.

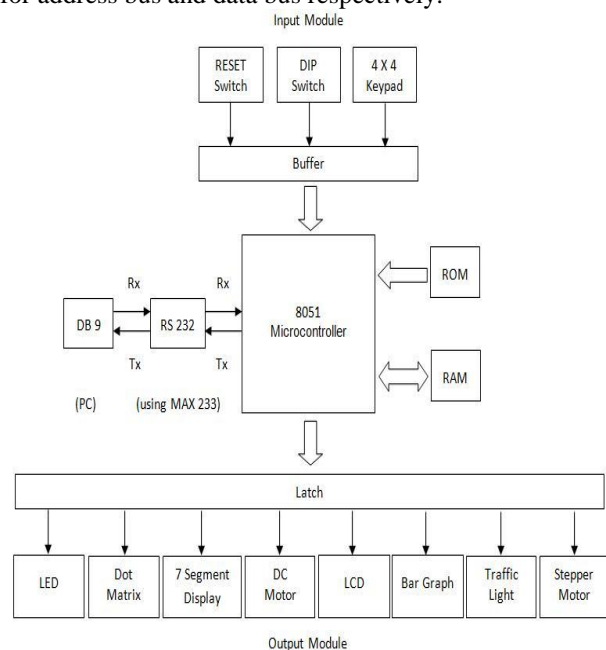


Fig.1 System Block Diagram

Since the limited I/O port available in the microcontroller, address decoder such as 74LS138, latch, and buffer are used for connected to various I/O devices. Some of the I/O devices are LED, Bar Graph, 7-Segment Displays, Traffic Light, 8x8 Tri-Color Dot Matrix and Dual-In-Line Package (DIP) switches. The remaining application which includes Keypad, Stepper Motor, Liquid Crystal Display (LCD) and DC motor are connected the available I/O port in microcontroller as shown in Fig.1.

III. SOFTWARE DESIGN

The software design is basically written by using assembly language. The program is stored in ROM as monitor program. This monitor program is used to perform specific function, such as object file (.hex file) loading, memory viewing, and executing user's program.

The monitor program plays an important role in the project because it allows user to load a program without the use of Erasable Programmable Read Only Memory (EPROM) programmer. The program also offers the features such as displaying memory and memory modification. There are two types of user interface proposed in this project; text-oriented and graphical-oriented.

In addition, ten sample applications and testing programs are preloaded into the ROM. They are LED testing, Bar Graph testing, 7-Segment Display testing, Traffic Light testing, Dot Matrix testing, LCD testing, 8-ways DIP Switches testing, Keypad testing, DC Motor testing and Stepper Motor testing. The purpose of those testing program is to test the functionality of each application in the application board.

A) Software Approach

The concept for the monitor program is shown in the Fig.3. This concept diagram is the main structure of the monitor program. It consists of various subroutines which each performs different functions. The basic function of the monitor software is to read the input based on user's selection. Based on the selection, it will determine which procedure will be executed.

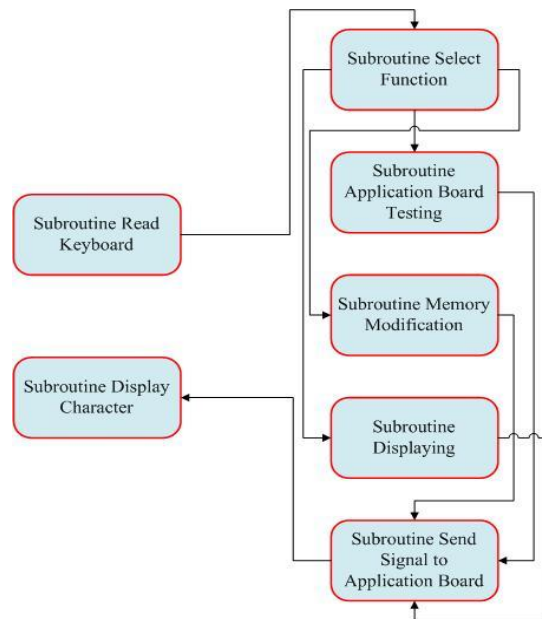


Fig.3 Concept Diagram of the Monitor Software

B) Menu Design

Designing a menu in the monitor program is very important since the function of the menu is to be used to link the main program to the subroutine. The flowchart in the Figure 18 shows the example on how the menu is designed. Based on the Figure 18, it clearly shows that the user is given a set of selection of the menu using keyboard. Then the appropriate subroutine will be executed according to user's choice.

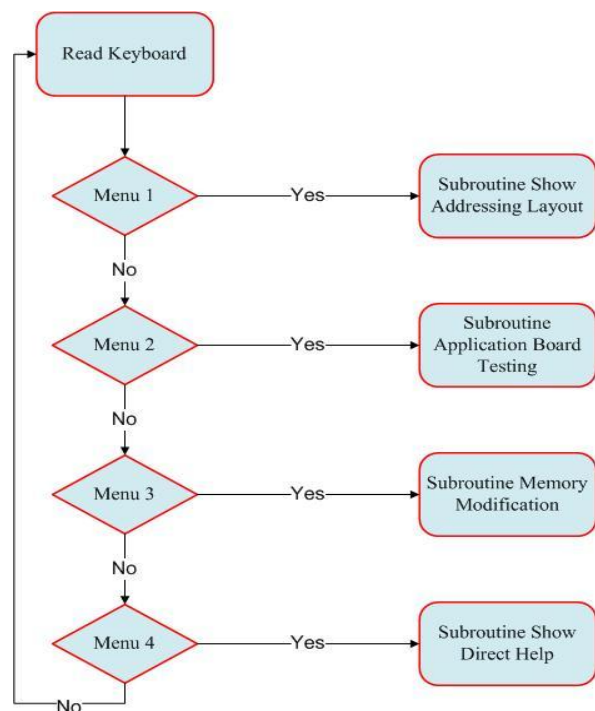


Fig.4 Flowchart of the Menu Selection

IV. RESULT & TESTING

Various tests are conducted in this project. The results of the testing reveal the system have achieved of substantial goal. Since the system consists of development board and application module, each part is tested independently. Finally, the modules are integrated and tested for its functionality. Fig.5 shows the flowchart of System Board Serial Interfacing with Computer

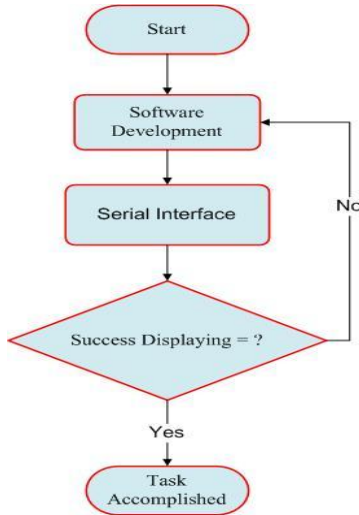


Fig.5 System Board Serial Interfacing with Computer

A) Monitor Program Testing

The last module for system board testing is to test the load and execute user's application program. These two menus provide the core function of the monitor program. Fig.6 shows the testing flowchart for load and execute user's application program. Fig.7 shows an output display for text-oriented design

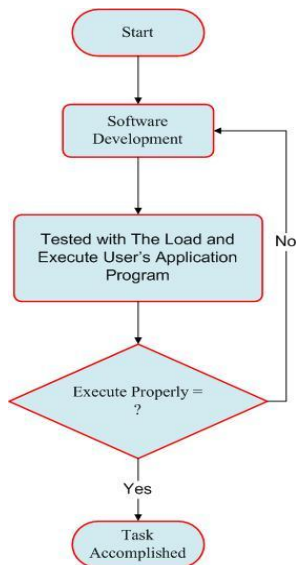


Fig.6 Monitor Program Testing

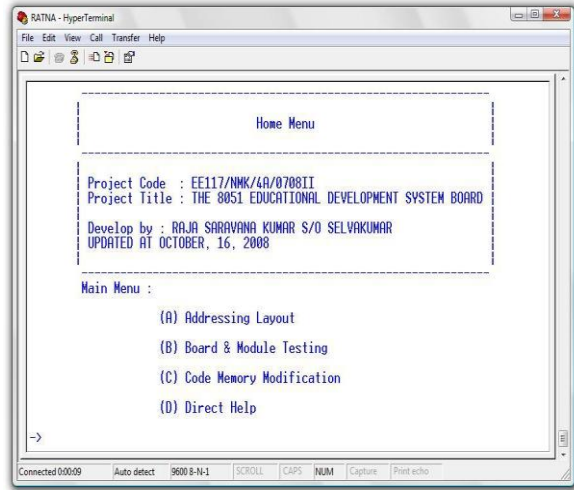


Fig.7 Text Oriented Display Mechanisms

B) Application Board Utility Testing

Since the application board consists of extensive devices, each of them must be tested individually to ensure its functionality. Flowchart of Fig.8 in the next page is used as a guide line for the testing module. The result of the testing reveals that application board is ready for interface purpose.

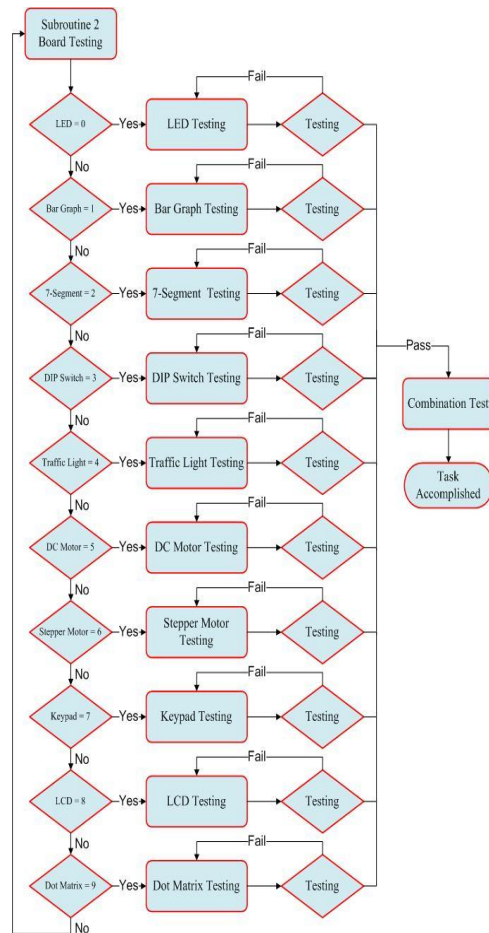


Fig.8 Application Board Testing

C) Visual Basic Testing

Fig.9 is a flowchart for the graphical-oriented testing.

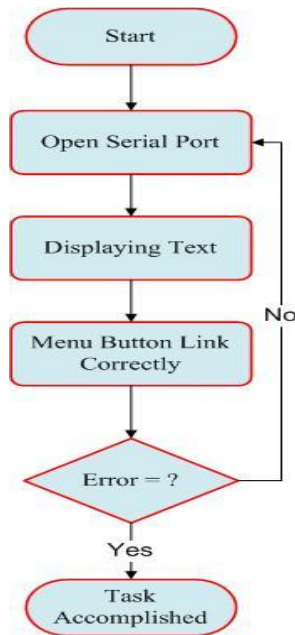


Fig.9 Graphical Oriented Testing

The graphical-oriented is developed by using VB 2008. The VB 2008 is the most powerful programming language that provided standard windows object and graphic user interface that will make the program become user friendly. It requires initialization process before it can fully communicate with the development board. Fig.10 is an output display for graphical-oriented.

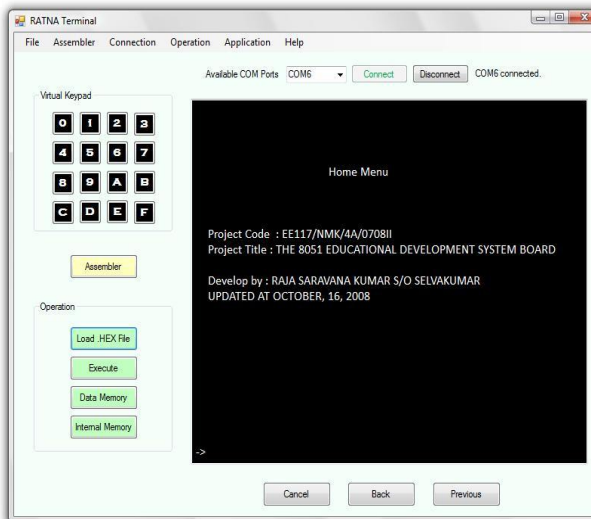


Fig.10 Graphical Oriented Display Mechanisms

V. CONCLUSION

This project is considered success as the project has achieved all of the requirements. The software and the hardware developed of Intel 8051 Educational Development System are ready to be explored for educational purposes with minor modification.

The system board which consists of external RAM and external ROM are designed to allow user to explore unlimited number of I/O devices and extra memory.

In similar manner, application board offers several I/O devices such as LED Bar Graph, 7-Segment Display, Traffic Light, Dot Matrix, LCD, 8-ways DIP switches, Keypad, DC motor, and Stepper Motor. These various form of I/O devices are suitable to be used for educational purpose. A prototype of the 8051 Educational Development System is successfully designed, built and tested

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