Buletinul Ştiinţific al Universităţii "Politehnica" din Timişoara

Seria ELECTRONICĂ şi TELECOMUNICAŢII
TRANSACTIONS on ELECTRONICS and COMMUNICATIONS

Tom 49(63), Fascicola 2, 2004

General Purpose PIC16F84A Based Development Board

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Abstract – The goal of this paper is to present the main features of a PIC16F84A microcontroller based development board, intended for teaching students microcontrollers and embedded systems.
Keywords: microcontroller, development board

I. INTRODUCTION

PIC16F84A is a high performance RISC controller operating up to 20 MHz, offering 1024 words of program memory, 68 bytes of RAM and 64 bytes of EPROM. The package provides only 18 pins, and only 13 may be used for input/output, making any extension suitable. The proposed board enhances the EPIC-1 board capabilities [3] and expands the main features of the microcontroller, providing:

- 8 analog inputs;
- 8 digital inputs and 8 digital outputs;
- 1 isolated digital input and 1 isolated digital output;
- 1 general purpose output with relay;
- display interfaces for a LCD 16x2 display, 2 digits and 8 LEDs;
- 4 buttons input, a buzzer;
- a standard RS232 interface;
- an ICSP programming port for In Circuit Programming.

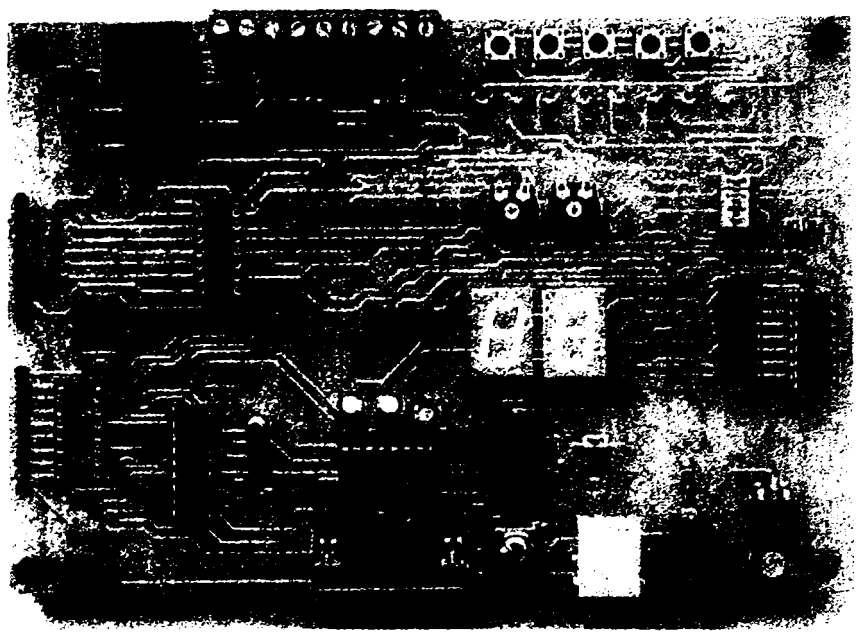

Fig. 1. PIC16F84A development board

The board is compatible with both Microchip's MPLAB IDE and JDM programmer, thus enabling the student with means for editing, simulating, programming and testing his own routines. Being FLASH based, the PIC16F84A microcontroller may be erased and program without removal from the socket via the JDM programmer and ICSP port. The board comes with specific demos highlighting the hardware characteristics of the system (usage of shift registers for input and output, multiplexing digits, building and external bus line) and also advanced software topics (interrupt driven RS232 routines, LCD interfacing, SPI communication with ADC).
All the hardware and software involved with this board was developed in Timisoara, at the Electronics and Telecommunication Faculty

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II BOARD DESCRIPTION

Due to the small number of I/O pins, shift registers [illegible] inputs and outputs. There are two such registers, one is input which increases the number of inputs to 8 more, and one output which increases the number of outputs also to 8 more. They are connected with a microcontroller via four lines found on the port A.

Several displays are used for program monitoring: eight LED diodes which can be moved to output of shift register on port B pins, but that can also be [illegible] ely by t king all eight jum ers off; two seven segment digits in multiplex mode that can successfully satisfy some numeric applications. Multiplexing is achieved with two transistors found on RA0 and RA1 lines; LCD display is very useful because it provides a lot of information to a programmer, and its lowered cost promises it will become an integral part off development systems of the future. Using a potentiometer the contrast can be adjusted.

Beeper on pin RA3 for sound signals can also serve as a means of indication. RA3 pin is shared by several components so it is necessary to choose which one of them is to be used.

One of the most important elements pf the board is the Microchip's 8-Channel 12-Bit A/D Converters with [illegible] nter ace [illegible] wi an external re erence o 5V. The ADC interface is serial type so it takes three pins for communication with the microcontroller.

RS232 communication is accomplished using a standard MAX232 transceiver. RB0/INT line is used as an Rx pin due to the interrupt feature of the pin, while RA3 is used as the Tx pin (PIC16F84A has no USART, so all communication is done be software).

III. RESULTS

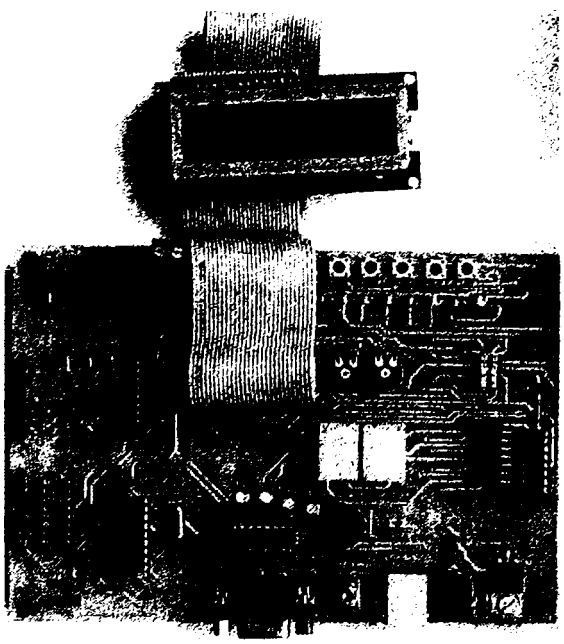

Fig. 2. Connecting an external LCD to the development board.

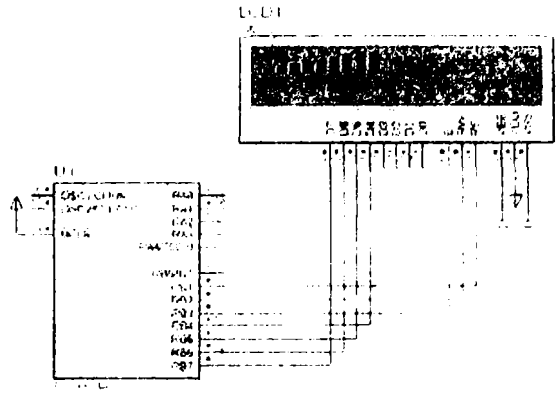

Fig. 3. LCD usage.

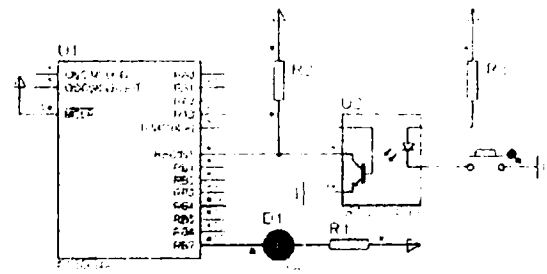

Fig. 4. Connecting an optocoupler.

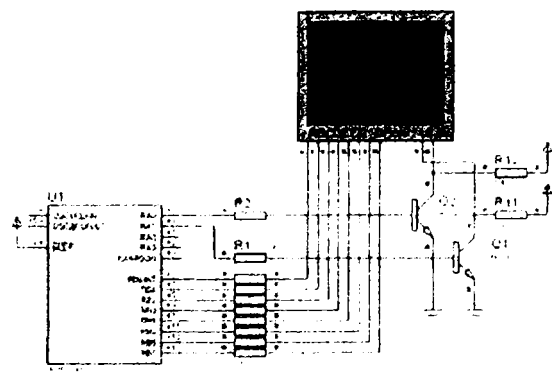

Fig. 5. Multiplexed digit display.

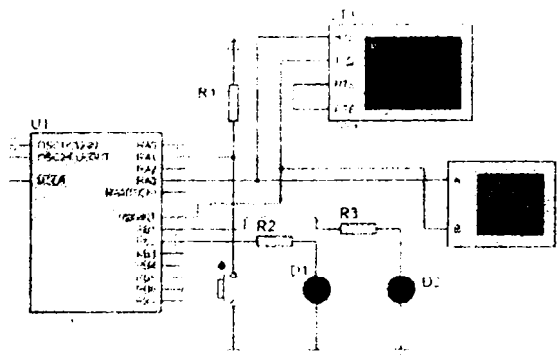

Fig. 6. Serial transmission communication.

Several applications have been developed and tested with the board. The include LCD dis lay routines (fig. 2 and 3), interfacing an optocoupler (fig. 4),

displaying with the multiplexed digits (fig. 5), SPI interfacing for the shift registers and ADC, complete RS232 communication software.

IV. CONCLUSIONS

The novel approach in this development board is the possibility of in circuit programming the microcontroller, using the ultra-low cost JDM programmer. Various displays possibilities and flexible architecture for the input switches make the debug process an easy task. Although the PIC16F84A has limited peripheral capabilities, with the extensions provided buy the board the student or the designer may experiment, debug and verify specific projects.

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