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32 bit PIC EVALUATION BOARD

B.Gowri devi[1], V.Sowmyaa[2], P.Yuvarani[3], S.Sri Raja Markandayan[4], V.Yaswant Kumar[5]

[1] *Assistant Professor, Department of Electonics and Communication, Kathir College of Engineering,Coimbatore*
[2,3,4,5]*Student, Department of Electonics and Communication, Kathir College of Engineering,Coimbatore*

Abstract: The project aims to bring the industrial PIC32 Development working of 32-bit microcontrollers into the hands of the students. With 32-bit processing (the next version to the 16-bit microcontrollers used in courses today), learning incredible and advanced peripherals such as USB-OTG, CAN and high definition graphics (among others) becomes realizable. The goal of the project is to learn how these peripherals work and how to implement them on such an advanced platform. Throughout this project, these resources will be combined to make simple API's for students to use, vastly decreasing complexity and development time for laboratory exercises and projects. Once the firmware is stable, custom circuitry will be designed and manufactured with every single peripherals so that students can focus on the industrial development rather than mini circuits. Upon completion of the product, future students will have: A custom circuit board built specifically for laboratory assignments relating to industrial products, a clean and simple API for using advanced peripherals and firmware. These boards will expose our students to some of the most advanced microcontrollers on the market today, replacing the decades old technology that is currently used in the classroom**.**

I. INTRODUCTION

A PIC development board is a printed circuit board containing a microcontroller and the minimal support logic needed for an engineer to become acquainted with the microcontroller on the board and to learn to program it. The main ideology of the microcontroller board is to prototype applications in products. It serves as a testing platform. It also allows the users to handle peripherals such as OTG, CAN and other industrial devices.

A single-board PIC microcontroller is a microcontroller built onto a single evaluation board. This board provides all of the circuitry and peripherals necessary for a useful task: microprocessor, I/O circuits, RAM, stored program memory and any support ICs necessary. The intention is that the board is immediately useful to an application developer, without them needing to spend time and effort in developing the controller hardware. Among all the PIC MCU families, the popular PIC 32MX575F512L was chosen because of its need in Industrial Applications. It was also chosen for the same reason that students could get a practice of the Industrial exposure.

The 8-bit microcontroller has enjoyed a tremendous growth in embedded systems applications. So after the good knowledge of 8-bits, the knowledge can be extended in practicing of 32-bit embedded applications. The development board is a self-contained computer-on-a-chip that integrates a microcontroller, ROM and RAM memories, I/O ports and special hardware peripherals. The initial step starts with choosing the PIC MCU's then designing Schematics continues with the PCB Design using Software and finally getting printed in a PCB board which is called as "Development/Evaluation board".

II. THEME OF THE BOARD

PIC microcontroller Evaluation Board is a powerful development platform which is based on PIC32MX575F512L microcontroller. This board is ideal for developing embedded and real time applications involving high speed wireless communication, USB based data logging, real time data

monitoring and control, graphical display, peripheral to peripheral communication, protocol for automobiles, USB OTG,etc. The on-chip USB controller provides direct high speed interface to a computer with speeds up to 11.592Mbps. Based on the experiences with the IPS Board I present here a design for a multipurpose prototyping board for PIC 32Fbit controllers. As of today Microchip offers a wide range of PIC microcontrollers for various applications. If you use those microcontrollers to develop and prototype solutions it can become cumbersome to design different prototyping boards over and over again depending on the controller that are used. This evaluation Board is designed to allow students or engineers in order to easily exercise and explore the capabilities of the various microcontrollers with peripheral devices and hence this system made the effort to design a 32 bit high speed PIC evaluation board where a broad range of different controllers can be used for various applications. This evaluation board offers RS232 (RX,TX including RTS,CTS), USB interface, seven segment LED, LCD display, a reset and power monitoring, I2C, external/USB power, and power stabilization. The Input/Output pins on the PIC microcontroller can be accessed. Our board is made from double layered PCB board to provide increased reliability and flexibility. It requires the operating supply voltage in the range of 5V dc or 12 Vac and it has built-in reverse polarity protection facility.

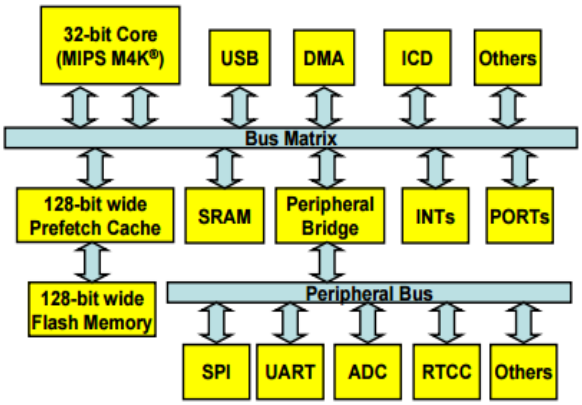

Figure 1: Block diagram

III. SELECTION OF PERIPHERALS

In an embedded system, peripheral devices are those which definehow a microcontroller communicates with the real time outside world. The peripherals provide a many functions, which includes sensors which provide data as input for functions, input or output devices such as buttons and displays which provides a user interface, and network interfaces that enable device to device communication to achieve this it follows that the peripherals included on the development board need to enable students to experiment with embedded systems on real time applications in their laboratories. Even though, there exists a wide variety of peripherals, these devices are evaluated depending on their contribution to the total overall system on three main criteria which are explained below:

Functionality: All the peripheral device affords the evaluation platform some function, either by providing data (like a button or sensor) or by utilising the data in a useful way (like a display or running a motor). The functionality afforded by the individual device in the board was evaluated against the requirements of the evaluation board.

nterface: As we know, peripheral devices must be connected to a host device. Microcontrollers provide many interfaces, each having different speed and different implementation challenges in it. All the peripherals are evaluated based on the feasibility of using its interface on the evaluation board in laboratory and their contribution to students‟ knowledge of peripheral interfaces.

Cost: As we know that all the peripheral devices have implementation costs, including the computational and hardware resources which is mandatory to utilize a particular device. These costs are evaluated depending on the feasibility of adding the device to the hardware design and also software implementation to the embedded microcontrollers available for this type of embedded system.

IV. DESIGN PROCESS

Generally, an evaluation board consists of three major components: a microcontroller for students in order to program in their labs, user input and output devices for students which can be used to control the system, and other peripheral devices like sensors which provide input data for computations. The interfaces that are used to interface the peripherals to the microcontroller are much important course topics , meaning that the interfaces for the peripherals are little critical to the design as well. The design requirements and the course goals are used to guide selection of these components and interfaces. In addition to the specific requirements of the existing development boards, a number of other general features are necessary for flexibility and for the exposure of the students to exercise them.

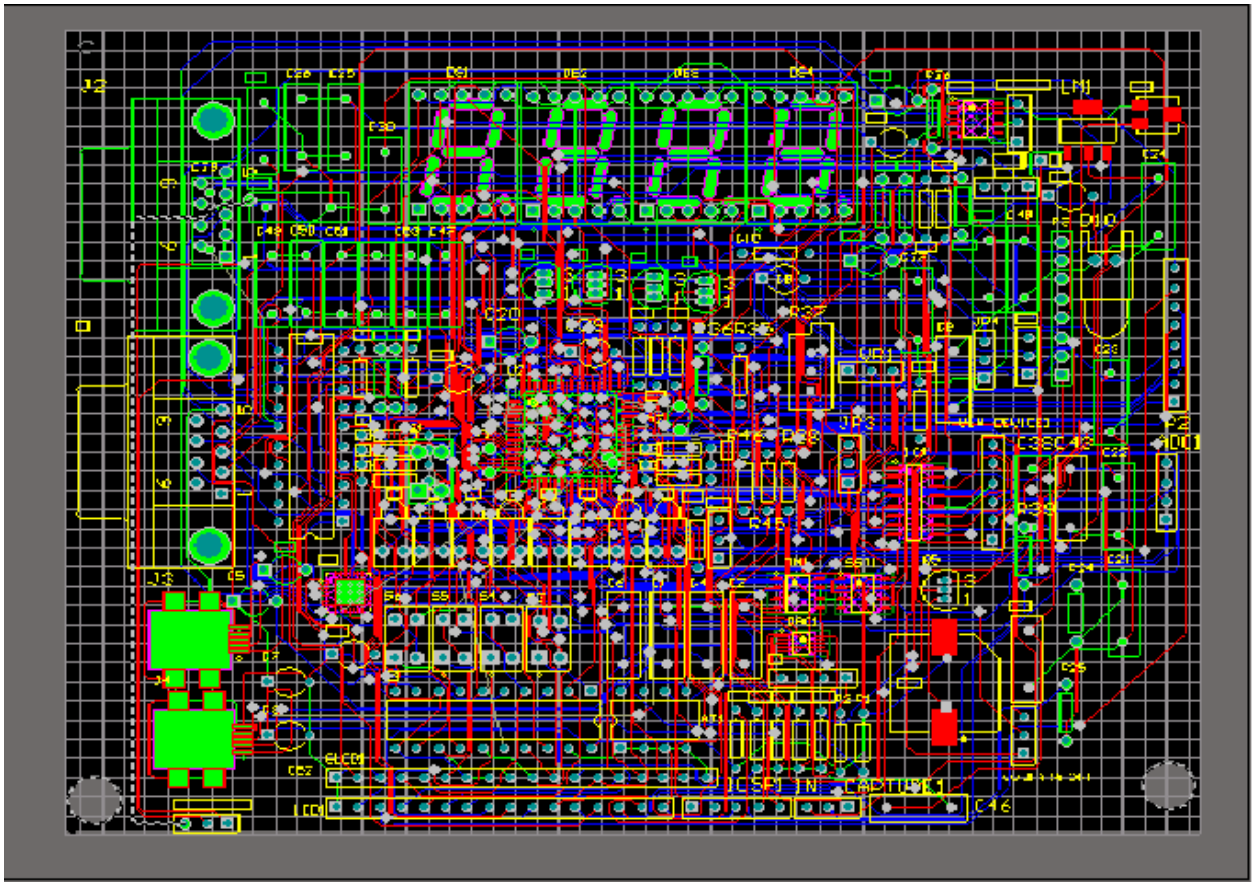

Figure 2: layout design of PCB

Additional features such as SPI, CAN interface, I2C, I/O peripherals etc are added for specific use. Initially the circuit design for the requirements was designed using the Altium designer summer tool. Then all the individual circuits are integrated in order to interface all the peripherals to the PIC microcontroller. As the next step the layout for the PCB was designed with the required dimensions and paths. After many corrections, the Gerber file was created. And then the created file was given

to the PCB manufacturer in order to generate the double layered PCB board. After few days the PCB was ready to place the components. The components are soldered on the manufactured PCB.

V. TESTING ANDANALYSIS

A device, which is in testing program phase, can simulate in any environment, is called a development system. The development system contains elements for input pin activation and output pin monitoring. A high quality version of LED displays, LCD displays and all other elements which the target device can be supplied with. These peripherals could be connected to the microcontroller. In this way, the whole program will execute.
This Evaluation boards result for various applications such as

- 7-segment display
- Character Generator LCD Display
- LED Glows as per the programming
- RTCC Hardware (Real-Time Clock and Calendar with Alarms) etc.,.

The above results is taken through this evaluation board for controlling several applications as per decoding the codes . This board has some expansion connector that brought out all the necessary CPU signals, so that an engineer could build and test their their own experimental interface or other electronic device.External interfaces on this board were often limited to a single RS-232 serial port, so a printer, or Teletype could be connected

VI. CONCLUSION

We developed a PlC-based microcontroller design laboratory. We believe that this low-cost and reliable laboratory constitutes, for undergraduate students, a smooth transition to the graduate-level co-design courses. Wide range of interfaces like I²C, SPI, USB, USART, A/D, and programmable comparators like PWM, CAN help the students to do their exercise easily .PIC32 architecture allows us to compute more complex program easily.

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