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Embedded System Design Course simulation platform Based on Proteus and Keil

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Abstract. This study aims at the status quo that theory is divorced from practice in embedded systems teaching process. A new theory teaching method is proposed that using Proteus as hardware simulation environment and Keil as software design environment. With this new method, in the teaching process, the hardware circuit can be simulated by the software environment. By this method, it can stimulated students' interest in learning, and enhance the students' understanding of the principles and application of Embedded System Design. Thereby using this method can also improve the embedded system experiment teaching effect.

Keywords: ARM; Practice teaching; Proteus; Keil

1 Introduction

Embedded Systems Design is the main course of computer, electronic information, automation and other majors. Through learning this course, students can grasp the concept, architecture, system components and design methods of the embedded system. Besides, students can understand the architecture and instruction system of embedded processors. Furthermore, they can know some other knowledge as well, such as the overall structure of embedded processors, memory organization, system control module, the I/O peripheral control module, microprocessor architecture and instruction set, and the analytic and designed methods of the embedded system. The traditional teaching process of the embedded system use the teaching model which is "the theory explanation firstly, and then hands-on experiments." This teaching model uses a large number of principles to guide the students to get started. By this way, students feel boring and have trouble in understanding. Meanwhile, the overemphasis of the processor core principles and the disjuncture of the application and theory result in the scarcity of students' practical ability. Besides, the course is introduced by separating the introduction of hardware and software, and the system design methods which combine software with hardware are not stressed enough. So students are lack of the systematic way of thinking when building real applications. In practical aspects of traditional education process, students mainly use the embedded chamber or the

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embedded development board. And in the practical process, students do mechanical connection merely, so that they cannot master the detailed circuit design and schematic design. Moreover, because there is a separation between practice and theory, the course cannot obtain the good teaching effect.

EDA stands for Electronic Design Automation. The emergence of EDA technology greatly improves the efficiency of the circuit design and reduces the labor intensity of designers. This study proposes assembling electronic components and conducting circuit simulation based on EDA technology in the teaching process. For that matter, it can strengthen students' understanding of the principles of embedded system design [1, 2].

2 The Teaching and Practice Innovation

Throughout the design process of teaching and practice, top-down design method is adopted. According to the different application, the design process is divided into five steps, such as requirements analysis, specifications, hardware and software building design, system integration, and system testing. This process starts with the most abstract description of the system, and then refines the details.

(1)Requirements analysis: Distinguishing and refining hardware and software according to the experience of engineers. Determining the work which puts forward complete, accurate, clear and specific demands to the target system;

(2)Specifications: Refining the needs. Getting the system specifications as formal design guidance and standard of acceptance;

(3) Hardware and software building design: First divided hardware and software according to the function, and then implemented software function by Keil IDE. Selecting electronic components involved in use by Proteus. Drawing hardware circuit diagram as the virtual hardware circuit simulated by embedded system.

(4) System Integration: Loading the software design process into simulation circuit for system simulation.

(5)System test: Carrying out the system functional test and the procedure stability test by the register, simulation oscilloscopes and other components in analog circuit.

In the specific implementation process, the whole design process can be divided into the software platform design and the hardware platform simulation. The software design is built by Keil integration framework platform. Keil for ARM integrated development environment is μVision IDE. It is a window-based software development platform, and it integrates a powerful editor, a project manager, and make tools. μVision IDE integrated tools includes the C compiler, the macro assembler, the linker / locator and the hex file generator. μVision has two kinds of work mode ,compiling and debugging. In the two modes, designers can view and modify the source file. They can also use single-step execution tools and software simulation tools to observe the operation of the program and the content change of registers, the on-chip RAM and chip RAM, ROM with the program running. This approach is very suitable for the software simulation experiments. Software design in the Keil as shown in Figure 1:

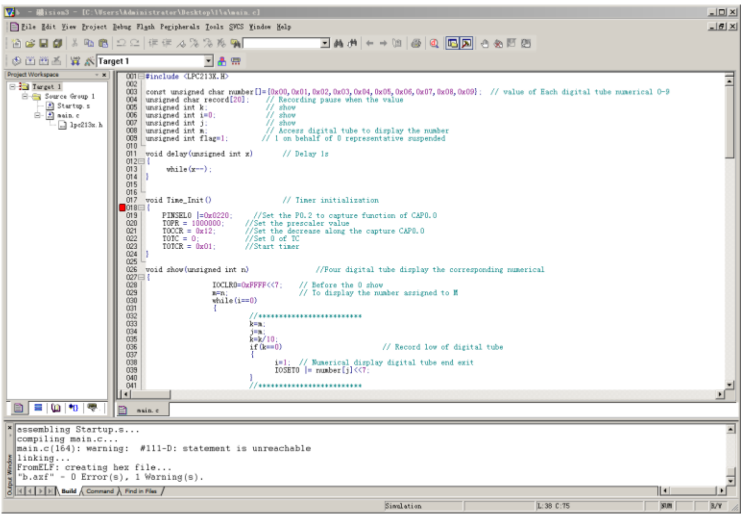

Fig. 1 Keil IDE

Hardware circuit simulation is carried out by Proteus, which is the world's leading EDA tools (simulation software). From the schematic layout, code debugging to the SCM and peripheral circuit co-simulation, a key switch to the PCB design, it truly achieves completely design from concept to product. Proteus is a design platform which combines circuit simulation software, PCB design software and virtual models simulation software. At present, it is unique in the world. Proteus has more than 6000 kinds of component models and peripheral devices commonly using in Embedded system design.Those peripheral devices ,including bus drivers, LED, LCD modules, programmable timer, parallel interface, matrix keyboard, real time clock, power modules, multiple D / A and A / D converter etc, can be called directly. It is particularly suitable for single-chip system simulation and use.

3 The Building of Simulation Platform

Main steps of Proteus simulation as follows[5]:

At first, starting Proteus, creating a project and setting the paper size, project description;

Secondly, drawing components node, placing simulation components in the schematic editor window and connect the circuit. Through the above steps to complete the system schematic(Fig2) drawing;

Then doing reasonable layout for components, configure POWER and GROUND module and connecting various components[6].

Finally, loading the compiled .hex object file into Proteus simulation circuit, in Proteus editing area, right-click the LPC2138 chip, selecting Edit Properties, find **. hex file generated by KEIL software compiling, clicking the play or pause to put the system into operation status, as shown in Figure 2.

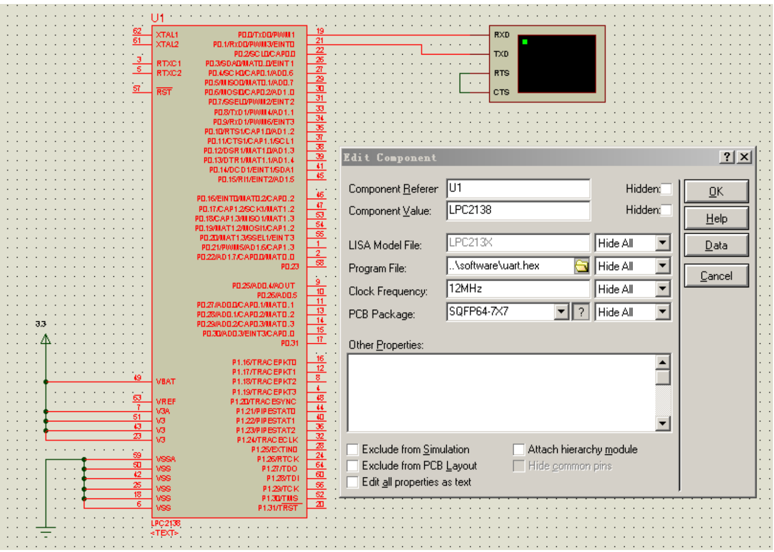

Fig. 2 Simulation Platform

4 Conclusions

This study has designed a kind of embedded system teaching platform based on Proteus and Keil. Through this platform, intelligent LED control simulation can be implemented. Besides, the simulation result is consistent with the experimental result produced by building realistic circuits. This method introduces EDA technology in teaching practice to implement the co-simulation test of embedded system program design. This method is not only a powerful complement to traditional physical circuit simulation, but also a new attempt. Practice has proved that this design method greatly reduces various work, such as circuit board production in process of the hardware circuit testing and the whole system debugging, the installation and welding of components and the adjustment and plug of components.

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