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Teaching Reform of Embedded Courses for New Energy Majors

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Abstract

Embedded is a professional core course in the direction of computer electronics. It plays a very important role in the whole teaching system. It is a very practical course. The traditional embedded teaching mainly includes the basic knowledge of single chip microcomputer and basic experiments, which is universal, but lacks professional orientation. Therefore, this paper proposes the embedded curriculum teaching reform based on the direction of new energy, which is project-oriented and guides students to learn single chip microcomputer.

Keywords

Embedded, Teaching Reform, New Energy.

1. Introduction

Embedded MCU internal structure and software and hardware development related knowledge is a practical course. This course is a professional course. The teaching objects are related to electrical engineering and automation, which provides necessary basis for students to learn other courses related to electrical automation. Through this course, students can master relevant knowledge of electronic product development from the perspective of application. The existing embedded teaching is generally developed based on STM32. The teaching contents mainly include: the characteristics of ARM processor and the principle of arm cortex processor; Principle, characteristics and selection of STM32 processor; Important internal resources of STM32 processor: timer; Usart; AD/DA; SPI; Circuit principle of can; Power circuit design of ARM processor; Clock circuit design; Reset circuit design, etc.

However, the existing teaching is too theoretical, not well combined with majors and projects, and students' mastery is not particularly ideal. In view of this problem, this paper intends to explore the project-based way, hoping to improve students' understanding of embedded courses through this teaching reform.

2. Curriculum Status and Deficiencies

2.1 Curriculum Status

At present, there are a variety of embedded courses in China. Each school has its own teaching system and supporting teaching resources, and the teaching contents are also very different, resulting in no unified standard for the embedded course. The content for embedded mainly includes two parts: one is whether to include the operating system. For example, the software school of Beijing University of Posts and telecommunications has always emphasized the real-time multitasking system (RTOS) as a key point in its embedded teaching, and insisted on using the RTOS type embedded operating system such as VxWorks and C / OS in teaching. Some schools adhere to the Linux operating system, based on the embedded development above the Linux operating system; The other is the teaching of embedded hardware chip. Now the mainstream is to take arm or STM32 as the embedded learning chip. With the development of communication technology, more and more schools have introduced

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some new communication technologies into embedded hardware, such as ZigBee, WiFi and Bluetooth. [1-3].

2.2 Deficiencies in Curriculum

2.2.1 Deficiency of Teaching Mode

The existing teaching mode mainly combines theoretical teaching, experimental teaching and practical teaching. Generally, the theoretical knowledge is verified through experimental teaching after theoretical teaching, and the qualified schools consolidate the course content through practical teaching during the holidays after the course. However, this model has many shortcomings, such as: it is too theoretical in theory teaching, and the course content is lengthy and not close to the follow-up experiment and practice teaching, and the learning effect of students in class is poor, which affects the subsequent experimental teaching and practice teaching. Therefore, a project-based model is needed to realize the tightness of each module [4-5].

2.2.2 Experimental Teaching Can Not Meet the Needs of Students

Existing colleges and universities are equipped with experimental boxes for the experiments of general embedded courses. This kind of experimental box is generally expensive and the equipment cycle is long. Some equipment has gone through more than ten years from production to procurement. Embedded products belong to high-tech industry. The chip iteration speed is very fast, and new technologies and systems continue to emerge, resulting in a serious disconnection between the existing embedded experimental equipment and the actual engineering application. Students can't apply to practical projects immediately after learning, which requires long-term practical adaptation, which also leads to the reduction of students' learning enthusiasm.

At the same time, there are few experimental hours in the school, which can not meet the needs of students. Although the school is equipped with a certain number of experimental teaching for embedded courses according to the needs of the courses, due to the limited class hours, it is unable to give students a lot of time for practical practice in the limited classes. At the same time, the existing experiments tend to be confirmatory experiments. Students operate the experimental steps according to the instructions and lack in-depth thinking, which is obviously not enough for embedded courses. This course needs a lot of extra-curricular time for in-depth study and practice in order to meet the teaching requirements [6].

3. Curriculum Reform Plan

3.1 Project Setting of Project-based Teaching

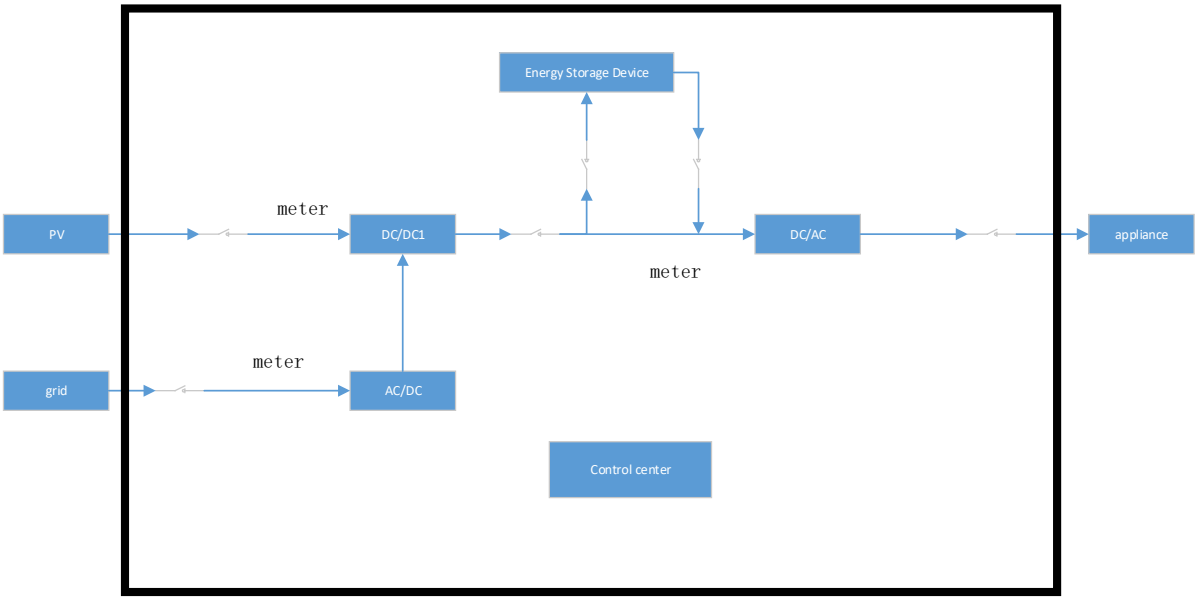

Figure 1. Structure diagram of the project

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In order to introduce new energy into the project of integrating expertise and expertise, this paper introduces the project of integrated photovoltaic energy storage control. The project is designed with embedded chip STM32, which includes most of the embedded functions.

In the above schematic diagram, the project is mainly composed of the following parts: photovoltaic, mains power, energy storage and load, and the devices mainly include DC / DC1, DC / AC, AC / DC, electricity meter and relay. The internal functions of STM32 related to these are: serial communication, can, ADC, SPI, timer, etc., which can well meet the requirements of embedded teaching.

3.2 Setting of Teaching Plan

For embedded content, this paper establishes the structural relationship between the project and embedded related knowledge points. The relationship structure is as follows:

Table 1. Content of courses

Numble	Embedded content	Project function
1	Basic concepts of embedded system; The development, classification and characteristics of embedded processors; The basic principle of embedded operating system; Application field and development trend of embedded system;	Project background knowledge and project original selection
2	Master the power circuit design, clock circuit design, reset circuit design, drive circuit design, etc. of ARM processor	Design and implementation of project hardware
3	The internal important resources of STM32 processor: the circuit principle of timer, USART, ADC and can, and the basic principle and method of embedded circuit design.	Communication with AD / DC, DC / DC and meter
4	Master the development of Keil based on embedded software development platform and the peripheral programming method based on stm32lib library.	Project compilation and debugging

Through the teaching of the project, the following embedded knowledge points are achieved:

1) Master the core technologies of ARM processor, such as core architecture, storage space allocation mechanism, interrupt nesting control mechanism. Understand the use of core registers of ARM processor.

2) Master the following embedded knowledge points: teaching content: basic principle of stm32f10x series arm processor, important peripheral functions of STM32 processor, learning requirements: understand the relationship between STM32 processor and arm core. Master the use and programming methods of the main peripherals of STM32 processor. For example, master the configuration and usage of general IO port of STM32 processor; Master the use and programming of timer component of STM32 processor; Master the use and programming method of STM32 USART serial communication component; Master the use and programming methods of STM32 SPI communication components; Master the use and programming methods of STM32 I2C components.

3) Embedded hardware design based on ARM Processor: master the basic principles and methods of embedded circuit design, such as power circuit design, clock circuit design, reset circuit design, drive circuit design and so on.

4) Embedded software design based on ARM Processor: understand the instruction system of ARM processor and assembly programming method. Master the C language programming of ARM processor and the C language programming based on stm32lib library. Be able to design timer

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application program, communication program, interrupt program, AD / DA data acquisition program, etc.

3.3 Reform of Teaching Methods

The disadvantages of the traditional teaching mode of embedded curriculum: theoretical teaching, experimental verification and practical operation are becoming more and more obvious. At the same time, the existing colleges and universities have greatly reduced the class hours, which has brought greater adjustment to embedded teaching. Therefore, we need to innovate in the teaching mode. This paper is project-oriented, takes the functional module as the specific ethics, focuses on students' practical ability, and improves students' knowledge mastery by doing seed learning and doing in learning.

The specific teaching process is as follows: Teaching Demonstration - small case practice - project analysis - group discussion - comprehensive case practice. In the theory class stage, through the seamless connection of small case explanation + practice, help students master knowledge points. In the stage of comprehensive practice, on the basis of mastering the basic knowledge points, specific experimental projects are designed for specific applications. Students can form teams freely and master the application of theoretical knowledge and team cooperation in the process of completion.

3.4 Reform of Assessment Methods

At present, the teaching reform is mainly evaluated by the way of final grade. This paper also explores the assessment methods. Student achievement is an effective way to evaluate the effect of teaching links. It plays a very important channel role in students and teachers. However, the embedded course is different from other professional courses. It is a course focusing on practical ability. A single examination on the end of the expiration date can not reflect students' achievements. Therefore, it is necessary to establish a diversified evaluation system, which should not only pay attention to students' understanding ability in practical practice, but also consider the importance of theoretical knowledge. Therefore, the assessment method of this course has strengthened the usual assessment, focusing on the process assessment. The assessment form is as follows:

Table 2. Assessment method

Numble	Module	Score
1	ADC module	10%
2	CAN module	10%
3	UASRT module	10%
4	Timer module	10%
5	Hardware circuit	20%
6	Usual homework performance	10%
7	Final examination	30%

Through this project-based teaching mode, focusing on the assessment of usual curriculum modules and establishing the corresponding multiple evaluation system can not only improve students' enthusiasm, but also ensure the effect of students' learning.

4. Conclusion

Aiming at the shortcomings of the existing embedded curriculum, this paper puts forward a project driven teaching reform model. The exploration of this model can improve students' learning efficiency. It has a certain reference value for the opening of this course in other schools.

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