ABSTRACT

According to the characteristics of strong practice and good application of DSP techniques and application course in application-oriented universities and based on the analysis of teaching current situation, the theory and practice and also the software and hardware should be combined organically in the teaching process in order to improve the teaching effect and students’ practical ability. And through the project based teaching method, students can have a more profound understanding of the course in the process of participating in the design of DSP application systems.

KEYWORDS
DSP techniques and application; Teaching reform; Project actuation; Application-oriented universities

INTRODUCTION

Digital signal processor (DSP) is one of the hotspots of the embedded system development. With the increase of DSP chip computing capability and peripheral function, its application field is more and more extensive. The TMS320F281X series DSP chip of Texas Instruments integrates high-speed DSP kernel and a large number of flash memory, high-speed RAM memory, event manager for motor control, multichannel high-speed A/D conversion module and provides a high-performance single chip solution for the digital control system whose design function is complex. It is widely used in precision motion control, digital power supply, renewable energy, power line communication, household appliances, medical equipment and other fields.

Project based teaching method originated in Germany in the 1980s. The so-called project based teaching model is a teaching method based on constructivism theory basis, and also the teaching mode proposed by CDIO (conceive, design, implement and operate) idea. The improvement of students’ comprehensive quality and abilities needs to be realized through project based teaching mode. Different from the traditional teaching methods, the project based teaching mode takes students as the center, and gives full play to the initiative, enthusiasm and creativity of the students, so that the students can be in the context of exploring knowledge. Teachers just play the organization and guidance role in the whole teaching process.
In recent years, the project based teaching method has broken through the past limitations that this method only applies to higher vocational education. Some scholars have tried to apply it to the teaching activities in the higher education undergraduate stage, which has achieved good teaching results.

COURSE CONTENT AND TEACHING CURRENT SITUATION

We select C2000 series TMS320F2812 of TI Company as the leaning object. The course requires us to master basic knowledge about DSP hardware and software and the chip internal and external settings. At present, the teaching sequence of most DSP courses is basically the DSP chip’s internal hardware structure, interrupt system, and chip internal and external settings, programming language, man-machine interface and application system design. The knowledge learning is relatively independent, and the theory of DSP course is very strong, so even if the teacher explains it very well, there is no actual hands-on design process. Therefore, students still can’t understand the theoretical knowledge—not to mention the application. How to understand the theory through practice, apply the theory through practice, achieve the perfect combination of theory and practice, and promote each other have become an urgent problem for teachers to solve.

DSP TEACHING REFORM BASED ON PROJECT DRIVING

General Idea of Reform.

There are not many DSP courses in most application-oriented universities now, and the curriculum is very theoretical. After explaining the theory in the limited time, there is no practical system design time, and the DSP course is precisely a subject with strong application, so if the students do not design the application system themselves, they will never understand the book knowledge.

Teachers can make students learn while doing in the teaching process, arrange the course content according to the project module, explain the course through specific project organization, reorganize the teaching content and carry out the reform of the teaching content system scientifically in order to let students rebuild relevant theoretical knowledge and develop their professional ability in the process of completing the project themselves.

Project Driven Teaching Process.

The students are the main body and the teachers are the leading in project based teaching method, and it is the first principle that should be followed in the application of project based teaching method. Students should consciously choose the appropriate roles and work in the project according to their own characteristics, and through voluntary learning and team discussion, they will complete the assigned tasks automatically. Teachers need to act as facilitators and organizers, lead project design and task decomposition, and help students drive the project process. The flow of project based teaching mode of “DSP technology and application” course is shown in figure 1.
Theory and Practice Teaching Projectization.

In the theoretical teaching, we should not only simply introduce the composition structure and working principle of the chip, but also combine the relevant theoretical knowledge with the project. In the learning phase, students can do some simple
projects, but regardless of the size of the project, the design basically includes the following aspects of the work: the name of the project, the expected function of the project, the explanation of relevant theoretical knowledge, hardware circuit design, software programming and debugging, problems that should be paid attention to, circuit board welding and the integrated debugging of hardware and software. In the process of project design and debugging, students have accomplished the integration of theory and practical application, enhanced their practical ability and laid a solid foundation for future employment.

**Curriculum Project Design and Teaching Case.**

In the teaching of “DSP technology and application”, the project based teaching method is introduced, and a DC motor speed regulating system project is designed according to the knowledge system of the course. Figure 2 is the hardware composition of the DC speed regulation system. The project includes DSP minimum system, man-machine interface, event manager, ADC module, driver module and other theoretical knowledge and practical skills. The components used in the project include 32 bit F2812DSP chip, micro DC motor, drive module L298, Hall sensor, photoelectric encoder and so on. The teachers explain the use of each device in depth. After the necessary components of the project are determined, the proteus software can be used to draw the hardware design circuit diagram. The software flow chart can be drawn according to the needs of the actual work, and the CCS2000 software can be used to write and debug the program according to the software flow chart. Eventually it is downloaded to the circuit board for hardware and software integration testing.

Larger tasks can be decomposed by modules, and then the students can be divided into groups, and the members of each group are divided into each module for debugging. After the test of a single module is passed, they are integrated into a speed control system, and all members work together for integration debugging. This will not only enhance the students’ practical ability, but also cultivate the team spirit of students.

**Reform of Assessment Methods.**

DSP is a course which takes application as its main target. Therefore, the comprehensive application ability and system design ability of students should be investigated emphatically in the course assessment. The specific assessment methods are as follows:

In the assessment, first of all students should choose a suitable topic or the DSP application system topic recommended by teachers. If the project is large, several students can complete the system design together. After the topic is determined, students should find some information and determine the design plan within the prescribed time. Once the scheme is finalized, it is necessary to start the specific design work. When the students encounter a problem in the design, they should record the solutions and methods and set forth in the final defense assessment. After the work is finished, each member of the group should sort out the information and make the PPT of the whole development process to carry out the defense. The teacher will give the students’ grades according to the tasks they undertake in the project, the performance in the design and the situation of the defense.
CONCLUSION

The project based teaching method should be introduced into “DSP technology and its application”. In the course of teaching, the brief introduction of the chip principle should be emphasized, and the cultivation of students’ comprehensive application ability of knowledge should be enhanced to make students master the basic principles of DSP in a limited amount of time and fully develop students’ programming ability and practical ability taking a definite application target as the traction.

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REFERENCES