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Discussion on Teaching Reform Based on Embedded Systems Courses

Bin Cheng[1], Baiyun Zhang[2,*]

[1]Nanfang College Guangzhou, Guangzhou 510900, Guangdong, China
[2]Ningbo Institute of Dalian University of Technology, Ningbo 315000, Zhejiang, China
**Correspondence Author, 27055675@qq.com*

Abstract: ***With the rapid development of electronic information technology, embedded systems have demonstrated extensive application value across numerous fields. However, the traditional teaching model of embedded systems has struggled to meet the current demand for embedded engineers in society. This paper aims to explore measures for reforming the teaching of embedded systems to enhance teaching quality and cultivate high-quality embedded engineers who meet market demands.***

Keywords: Technology Embedded, Systems Teaching Reform, Teaching Quality**.**

1. Introduction

An embedded system is a dedicated computer system whose hardware and software can be tailored according to application requirements, suitable for systems with strict requirements on functionality, reliability, cost, size, and power consumption. Due to its widespread application in industrial control, aerospace and military, information appliances, and other fields, the teaching of embedded systems is particularly important in higher education. However, the traditional teaching model has numerous shortcomings that require urgent reform.

2. Characteristics and Shortcomings of Embedded Systems Teaching

2.1 Teaching Characteristics

It involves a broad range of knowledge, including hardware, operating systems, programming, and digital circuits. Students need to possess a certain foundation in computer knowledge.

2.2 Teaching Shortcomings

Student interest and initiative are low due to the course's difficulty, which can lead to students feeling intimidated. Knowledge updates and iterates rapidly, making it difficult for traditional teaching content to keep pace with technological advancements. There are few practical cases, making it challenging for students to apply theoretical knowledge to actual development. The evaluation form is monotonous, focusing too much on outcome evaluation and neglecting the evaluation of students' learning processes.

3. Measures for Teaching Reform

3.1 Introduction of Generative AI Technology

Utilize generative AI technologies such as ChatGPT to update teaching resources and content, constructing a knowledge graph for embedded systems courses. Implement personalized teaching and intelligent recommendations to enhance teaching effectiveness and learning efficiency.

3.2 Establishment of an ARM-Based Teaching System

Cover theoretical teaching, experimental teaching, and course internships. Theoretical teaching includes an overview of embedded systems, hardware environments, operating systems, software development environments, and drivers. Experimental teaching selects microprocessor chips and software platforms based on the ARM core to conduct basic and comprehensive experiments. Course internships simulate the embedded system development process in enterprises, arranging students to collaboratively complete the development of an application program.

3.3 Construction of a "Dual-Teacher Classroom" Project-Based Teaching Model

Introduce human teachers and virtual digital teacher collaboration for instruction. Construct a teaching model that includes embedded project design, student-centered knowledge construction, and interdisciplinary ability cultivation.

3.4 Focus on "Competition-Driven Teaching and Integration of Courses and Competitions"

Encourage students to participate in various academic competitions to enhance their innovation levels. Utilize smart platforms for digital evaluation, establishing personalized evaluation models for each student.

3.5 Strengthening Interdisciplinary Integration and Industry-University Cooperation

Offer interdisciplinary elective courses such as "Embedded Systems and IoT Technology," "Embedded Systems and AI Applications. "Strengthen cooperation with enterprises to provide students with authentic project practice opportunities.

3.6 Promotion of Online Teaching Resources and Platforms

Leverage online teaching resources such as MOOCs and SPOCs to provide students with more diverse learning options. Utilize online platforms for remote experiments and virtual simulation experiments.

3.7 Establishment of a Comprehensive Evaluation System and Feedback Mechanism

Develop a diversified evaluation system, including process evaluation, performance evaluation, and peer evaluation. Establish a comprehensive feedback mechanism to promptly collect and analyze student learning feedback.

4. Teaching Reform Achievements

By implementing the aforementioned teaching reform measures, the following achievements have been made:

1) Enhanced student interest and initiative.

2) Strengthened students' practical and innovative abilities.

3) Optimized the teaching evaluation method, providing a more comprehensive evaluation of students' learning outcomes.

5. Teaching Reform Outlook

In the future, the teaching reform of embedded systems will continue to focus on cultivating students' innovative and practical abilities. Meanwhile, more advanced technologies such as AI and big data will be utilized to optimize teaching content and methods. Additionally, there will be enhanced exchanges and cooperation with international advanced educational ideas and teaching methods, promoting the continuous development of teaching reform in embedded systems in China.

6. Conclusion

The teaching reform of embedded systems is a long-term and arduous task. By continuously exploring and practicing new teaching methods and means, we can gradually address the existing problems and shortcomings in current teaching, enhance teaching quality and effectiveness, and make greater contributions to cultivating more excellent embedded engineers and promoting the continuous development of embedded technology.

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