Cross-Curricular Intelligent Vehicle Learning Platform Based on Deep Learning Framework

Nixuan Lin[1], Xiaochun Xu*[1], Yuwei Wu[2], Chenchen Xu[2] and Xin Wang[1], Huibin Feng[1]

[1]School of Computer and Big Data, Minjiang University, Fuzhou, 350108, China
[2]International Digital Economy College, Minjiang University, Fuzhou, 350108, China

*xuxiaochun0303@126.com

Abstract. The artificial intelligence industry is advancing rapidly, yet there is a noticeable lag in China's higher education curriculum, causing classroom teaching to be out of sync with the demands of the job market. To address this issue, this paper proposes a cross-curricular intelligent vehicle learning platform based on a deep learning framework that bridges multiple curriculum systems and integrates theory with practical application. The platform holistically develops students' hardware design and software programming skills, spanning from foundational courses to specialized ones. It supports the implementation of emerging artificial intelligence technologies such as machine vision and deep learning, and aligns flexibly with employment market needs, making it an ideal educational system for the comprehensive training of undergraduates.

Keywords: Jason Nano, Cross-curricular Platform, Intelligent Vehicle.

1 Introduction

Currently, there is a noticeable lag in China's higher education system, with some professional talent training programs falling behind the evolving societal demands. Training programs in colleges and universities should align with national priorities and market needs to cultivate individuals with comprehensive competitiveness in the job market[1]. However, many institutions still rely on outdated learning tools, offer relatively narrow learning methods, and lack effective feedback mechanisms. As a result, students often lack sufficient autonomy in their learning process, and there is a disconnect between theoretical knowledge and practical application. This gap leads to weaker comprehensive abilities and lower employment competitiveness.

This paper proposes a cross-curricular intelligent vehicle learning platform based on a deep learning framework that bridges multiple course systems and integrates theory with practice. The platform's implementation transforms abstract theoretical knowledge into intuitive, three-dimensional physical representations, significantly reducing the complexity of understanding theoretical concepts while enhancing students' interest and depth of learning. Furthermore, the platform features a mature software development environment and comprehensive hardware sensing modules, supporting

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technologies like machine vision[2] and deep learning[3]. Its modular hardware design enhances system flexibility and scalability, making it an ideal educational and learning system for comprehensive undergraduate training.

2 Survey on the Demand for Cross-Curricular Intelligent Vehicle Learning Platform

To gain a deeper understanding of the current demand for a cross-curricular learning system among college students, a survey was conducted among all undergraduate students in the Computer Science Department of the University. The results of this survey are presented in Fig.1.

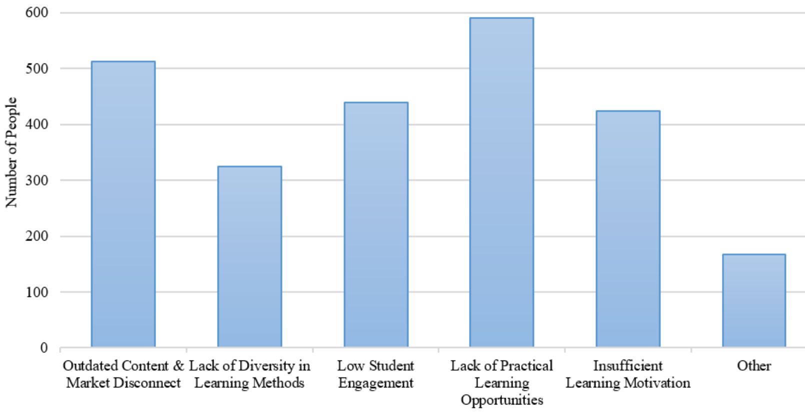

Fig. 1. Statistical table for the learning barriers of computer science students.

The survey of professional course learning among computer science students reveals several significant challenges faced by contemporary undergraduates. The foremost issue is "low student participation," indicating that students are not sufficiently engaged or committed to the learning process. The second major concern is the "lack of diversity in teaching methods," suggesting that traditional teaching approaches are no longer adequate to meet the needs of modern students, who require more varied and dynamic learning experiences. Additionally, the problem of "outdated teaching content out of touch with the market" highlights the inability of current curricula to keep pace with industry developments, leading to a disconnect between what students learn and the skills demanded by the job market. These findings underscore the urgent need for a new educational platform that better aligns with the cutting-edge developments in industry. It would ensure that students acquire relevant, practical skills, thereby narrowing the gap between theory and practice, as well as between the academic environment and the workplace.

3 Hardware Construction

The learning platform is built around the Jetson Nano embedded system, this section provides details.

3.1 Jetson Nano Motherboard

In this paper, we utilize NVIDIA's Jetson Nano embedded platform as the core motherboard to develop a cross-curricular intelligent vehicle learning platform based on a deep learning framework. The Jetson Nano motherboard is specifically designed for the next generation of autonomous machines. The platform features a built-in system-on-chip (SoC) capable of parallel processing a variety of neural networks, including TensorFlow, PyTorch, Caffe/Caffe2, Keras, and MXNet. These neural networks have extensive applications, supporting functions such as image classification, object detection, speech segmentation, and intelligent analysis, fully catering to the diverse learning needs of students.

3.2 Astra Pro Plus 3D Depth Camera

The project employs the Astra Pro Plus camera, which integrates an infrared camera, an infrared projector, and a depth computing processor. This module captures 3D information in real-time, endowing smart terminals with ultra-high object awareness capabilities. Such advanced features enable a wide range of applications, including human-computer interaction, facial recognition, 3D modeling, augmented reality (AR), security, and driver assistance systems. The depth computing processor processes these images, applying advanced algorithms to generate a depth image of the target scene. This allows for efficient and accurate 3D information acquisition, making it ideal for technologies such as smart vehicle environment detection and road recognition.

3.3 YDLIDAR G4 Radar

The YDLIDAR G4 radar is integrated into the smart car to achieve the high-frequency and high-precision distance measurements required by the vehicle's intelligent obstacle avoidance module. As depicted in Fig.2, the radar is a top-tier 360-degree 2D distance measurement device. It is based on advanced triangulation principles and combines cutting-edge optical, electrical, and algorithmic designs. The radar boasts high measurement resolution, strong penetration ability, robust anti-interference, and excellent anti-stealth capabilities, ensuring reliable and precise distance measurement. Moreover, working with data obtained from the YDLIDAR G4 radar requires students to master data processing techniques such as data cleaning and filtering, which further enhances their data analysis and processing skills.

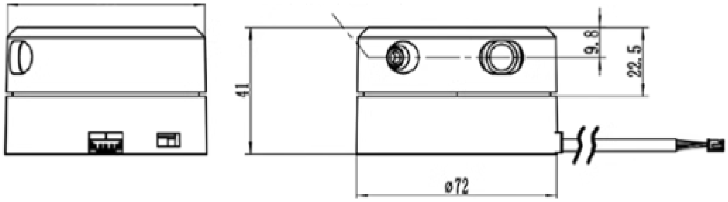

Fig. 2. YDLIDAR G4 Radar.

3.4 iFLYTEK Six-Channel Microphone Array

As shown in Fig.3, the six-channel microphone array comprises six microphones, allowing the system to sample and process the spatial characteristics of the sound field. This array can perform tasks such as sound source localization, background noise suppression, interference mitigation, reverberation and echo reduction, and signal extraction and separation. This module supports sound source localization and human-machine dialogue, requiring students to have a foundational understanding of digital signal processing and array signal processing techniques.

To meet the diverse learning needs of users, the platform is equipped with a variety of essential components. It includes a stable Linux operating system[4], an integrated ROS system, and the OpenCV library [5]. Additionally, the system features the Python programming language, known for its concise syntax and extensive library resources, and the PyTorch deep learning framework, which drives exploration in the fields of machine learning and artificial intelligence. This combination of tools creates a learning environment that is both flexible and powerful, fostering the comprehensive development of technical skills.

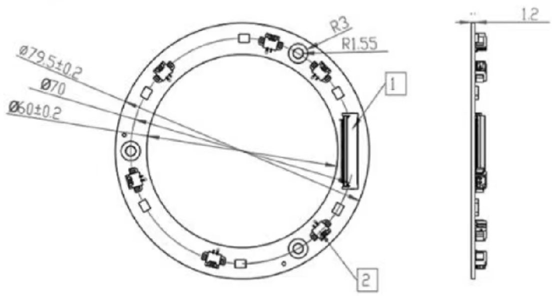

Fig. 3. Six-channel microphone array of iFLYTEK.

4 Implementation Results

To thoroughly assess the effectiveness of the cross-curricular intelligent vehicle learning platform, a survey was conducted to evaluate its impact on the education of computer science majors and the benefits of its implementation. The results of this survey are presented in Fig. 4 and 5 below.

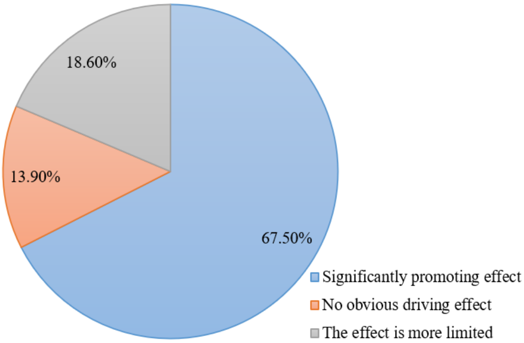

Fig. 4. Diversified views of computer science undergraduates on the effectiveness of the promotion of the intelligent vehicle learning platform.

Fig. 4 illustrates the feedback and opinions of computer science students at the university regarding the adoption of the smart car learning platform. The results show that 67.5% of students believe the system has significantly enhanced their learning, with these students highly recognizing its value in improving cross-curricular learning and facilitating the integration of theory and practice. Approximately 18.6% of students feel that the system has a positive impact, though to a lesser extent, while only 13.9% indicated that the system did not substantially contribute to their learning.

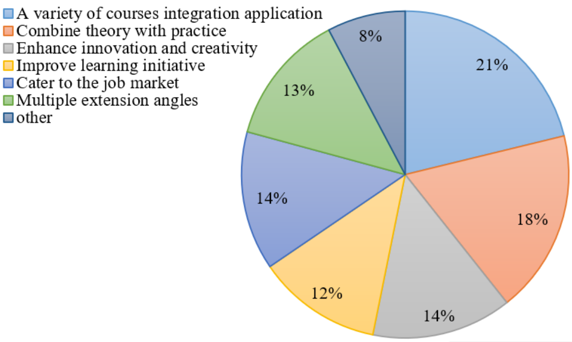

Fig. 5. The main advantages of the intelligent vehicle learning platform survey.

Most respondents highlighted the platform's significant advantages in combining theoretical knowledge with practical application and integrating various courses. Additionally, they noted benefits such as fostering innovation and creativity (14%), enhancing student engagement (12%), and aligning with employment market demands (14%).

Based on these findings, this paper concludes that introducing the smart car learning platform into the current training system for university computer science students offers substantial advantages. This initiative not only meets the diverse learning needs of students and enhances their overall competency, but also promotes the innovation and development of computer science education, laying a solid foundation for cultivating more talented individuals with strong innovation and practical skills.

5 Conclusion

To address the issue of the current higher education curriculum system lagging and classroom teaching being disconnected from market demands, this paper proposes a cross-curricular intelligent vehicle learning platform based on a deep learning framework. This platform offers students a comprehensive environment for both learning and practical application. It not only integrates cutting-edge technologies such as computer vision, deep learning, and artificial intelligence but also effectively applies this knowledge to real-world problem-solving scenarios. As a result, students can master theoretical concepts while actively engaging in experimental operations, data analysis, and model tuning. This approach significantly enhances their cross-curricular learning abilities, innovative thinking, and practical problem-solving skills.

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