A Cross-Curricular Educational System for Hexapod Robots Based on Jason Nano

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Abstract. Traditional education systems often place excessive emphasis on single-discipline knowledge, overlooking the cultivation of students' comprehensive abilities. Currently, higher education lacks a system that offers students a well-rounded, in-depth, and personalized learning experience with ample development opportunities. To address this issue, this paper proposes a cross-curricular educational system for hexapod robots based on Jason Nano. This system integrates multiple disciplines, including advanced mathematics, basic analog electronic circuits, basic digital electronic circuits, Python, and C language. By implementing this multidisciplinary approach, the system aims to enhance students' mathematical logic, programming skills, algorithm design, and hands-on practical abilities. It also promotes the mastery and application of both foundational and specialized courses, enabling students to integrate knowledge from various disciplines in practical scenarios and develop a more comprehensive and systematic understanding.

Keywords: Cross-curricular Educational System, Hexapod Robots, Jason Nano.

1 Introduction

In the current education sector, the traditional system tends to focus on narrow, one-dimensional knowledge. As noted in several studies [1][2][3], this approach places excessive emphasis on subject-specific knowledge, leaving students with only a basic understanding, which hinders their ability to apply knowledge flexibly in practice [1]. This system often neglects the integrated application of multidisciplinary courses, the development of students' diverse skills [2], and the cultivation of comprehensive literacy [3]. For instance, essential abilities such as innovation, critical thinking, and practical skills are often overlooked, as highlighted in other studies [4][5]. As a result, students may struggle to cope with and solve complex real-world problems. Additionally, the education system's focus on standardized teaching and assessment often disregards individual differences and personalized needs, leading to a lack of interest among students [4] and stifling their innovative thinking [5], which is crucial for targeted learning.

This paper presents a cross-curricular educational system for hexapod robots based on Jason Nano, designed for higher education. The system aims to enhance students'

D. Hu et al. (eds.), *Proceedings of the 2024 5th International Conference on Modern Education and Information Management (ICMEIM 2024)*, Atlantis Highlights in Social Sciences, Education and Humanities 29,
https://doi.org/10.2991/978-94-6463-568-3_19

hands-on skills, innovative thinking, and problem-solving abilities through multidisciplinary integration, ultimately cultivating their overall competencies.

2 Industry Actuality

To gain a deeper understanding of students' perspectives on the current educational model and the cross-curricular education system, this paper conducted a survey among 248 communication engineering majors, focusing on their views regarding higher education practices and cross-curricular approaches.

What do you think are the problems with the current education system? [multiple choices]

Option	Total	Proportion
Single teaching method	215	86.69%
The curriculum content is out of touch with actual needs	144	58.06%
Lack of systematic training for cross-curriculum integration	220	88.71%
Lack of individualized education	200	80.65%
The cultivation of innovation ability is insufficient	188	75.81%
This topic is valid to fill in the number of people	248	

Fig. 1. A survey of the problems existing in the current education system.

As shown in Fig. 1, the statistical results of the questionnaire survey reveal several significant issues within the current education system, with the lack of systematic cross-curricular integration being particularly prominent. According to the survey, 88.71% of respondents believe that the current higher education system lacks adequate training for cross-curricular integration. This proportion significantly exceeds concerns about other issues, such as a single teaching method, lack of personalized education, and insufficient cultivation of innovative abilities. This highlights that systematic training in cross-curricular integration has become a critical issue that urgently needs to be addressed.

To meet the current demand for a more robust higher education curriculum, this paper proposes a cross-curricular educational system for hexapod robots based on Jason Nano. This system can be integrated with industry-academic practice courses, as well as comprehensive practical training courses in electronic information and communication engineering, to enhance students' mastery and application of both foundational and specialized knowledge, thereby forming a more complete and systematic professional knowledge framework.

3 A Cross-curricular Educational System for Hexapod Robots Based on Jason Nano

The system utilizes the Jetson Nano embedded platform as the core motherboard to develop a cross-curricular educational system for hexapod robots. Figure 2 illustrates the system's block diagram.

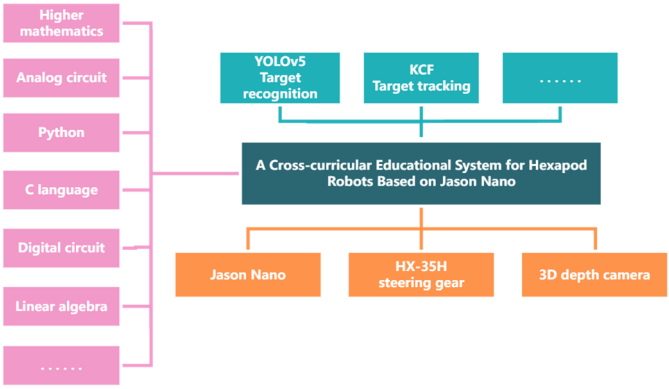

Fig. 2. Block diagram of a cross-curricular educational system for hexapod robots based on Jason Nano.

The Jetson Nano, an embedded system developed by NVIDIA for the next generation of autonomous machines, is a global leader in visual computing technology. It features a powerful quad-core 64-bit ARM CPU and an integrated 128-core NVIDIA GPU, delivering impressive floating-point computing power of up to 472 GFLOPS. This motherboard not only offers outstanding performance but also excellent energy efficiency, capable of smoothly handling modern AI workloads, including running multiple neural networks in parallel and processing real-time data from high-definition sensors. This makes it a powerful and reliable learning platform for educational systems.

Fig. 3. High voltage steering gear based on HX-35H bus.

As shown in Fig. 3, the HX-35H, a single-axis servo with 35KG high torque, provides robust power support for the robot, ensuring excellent performance across various application scenarios. Its unique low-profile and compact design not only make the servo easy to integrate into the robot, but also enhance the robot's aesthetics and bionic qualities, offering students a broader design space. Precise control can be achieved through the UART serial port command, allowing the HX-35H servo to accurately rotate to the target position within a specified time. Additionally, the servo supports flexible adjustment of rotation speed, further accommodating the diverse application and debugging needs of students.

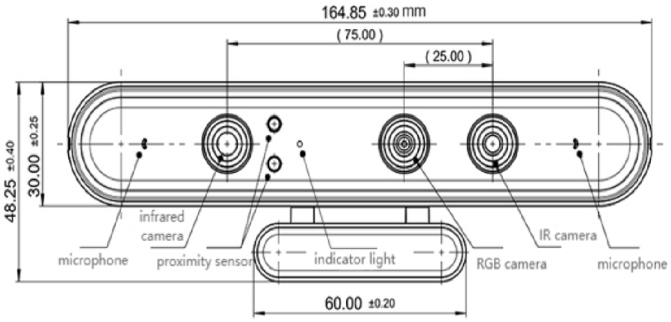

Fig. 4. 3D depth camera.

As shown in Fig. 4, the system incorporates a high-precision, low-power depth camera based on monocular structured light 3D imaging technology, enabling the robot to capture high-definition visual images and video data. This allows for real-time acquisition of three-dimensional information and adds object perception capabilities to intelligent systems. This technology supports various application scenarios, including human-computer interaction, face recognition, 3D modeling, augmented reality (AR), security, and assisted driving.

In this system, the "hexapod robots" serve not only as technical tools but also as vehicles for knowledge and platforms for practical learning. During the process of designing and debugging the robots, students must apply a solid foundation in mathematical logic to tackle challenges such as spatial geometry and algorithm optimization. Additionally, a strong understanding of analog electronic circuits is crucial for students to comprehend the working principles of the robot's sensors and actuators. The learning and application of programming languages empower students to transform their creativity into tangible robot behaviors, allowing them to experience the transition from theory to practice.

4 Implementation Effect

The all-around development and deep learning of students often result from the effective implementation of a cross-curricular education system. The system proposed in this paper embodies this concept in practice. By seamlessly integrating knowledge from

mathematics, analog electronic circuits, programming languages, and other multidisciplinary courses, it provides a pathway for students to explore the depth and breadth of various subjects.

The cross-curricular educational system for hexapod robots, based on the Jason Nano platform, offers a comprehensive learning environment that combines theoretical knowledge, hands-on practice, and innovative exploration. This approach significantly enhances students' learning experiences, sparks their interest, and helps them master foundational knowledge while developing the ability to solve complex problems. It equips students to confidently face the challenges of a diverse and rapidly changing future.

To assess and enhance students' learning satisfaction with the platform, Fig. 5 presents a survey on the effectiveness of the cross-curricular education system for communication engineering majors. As shown in the figure, the cross-curricular educational system for hexapod robots based on Jason Nano emphasizes the integration of multidisciplinary courses and the development of students' comprehensive abilities and interdisciplinary thinking. Additionally, the system prioritizes personalized education and the cultivation of innovative skills, which are crucial factors in improving the quality of education and promoting students' holistic development.

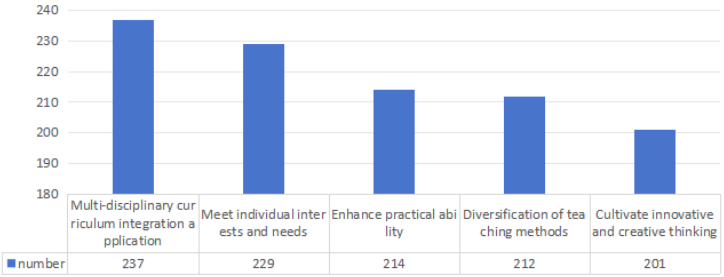

Fig. 5. Survey of views on cross-curricular educational systems.

Furthermore, this cross-curricular education model encourages students to apply multidisciplinary knowledge flexibly to analyze and solve various problems and challenges. In discipline competitions, whether it involves design optimization requiring precise calculations, rapid program debugging, or troubleshooting electronic circuits, students consistently demonstrate strong interdisciplinary problem-solving skills. Cultivating these abilities not only enhances students' expertise in specific fields but also fosters innovative thinking, teamwork, and problem-solving capabilities, laying a solid foundation for future academic research and professional careers.

5 Conclusion

To address the issue of traditional higher education systems focusing on single-discipline knowledge while neglecting the development of students' comprehensive skills, this paper proposes a cross-curricular educational system for hexapod robots based on

the Jason Nano platform. This innovative educational system integrates multidisciplinary knowledge with hands-on practice, effectively blending concepts from various fields. Through the design and implementation of hexapod robots, the system offers students a holistic learning experience that bridges theory and practice, as well as single-discipline and cross-curricular education. The complexity and diversity of this system present students with numerous challenges and problem-solving opportunities, fostering their practical skills and enhancing their ability to tackle real-world issues.

Funding

This paper is supported by the 2024 China National University Student Innovation & Entrepreneurship Development Program project “A Deep Interactive Hexapod Robots Playmate for Deaf Children Based on Jetson Nano”, project number : 202410395007, Minjiang University 2023 Teaching Research and Construction Project (University-Level Key Project) (MJUJG202323379), Fujian Natural Science Foundation Project (2023J05243), Guiding Project of Fujian Provincial Department of Science and Technology (2021H0054).

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