Achieving IOT Expertise through the Development of Custom Control Systems Exercises with XIPU AI

School of Internet of Things

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1. Background

In IoT engineering education, control systems form a foundational component, involving complex concepts such as Laplace transforms, transfer functions, and PID controllers. These topics are essential for understanding real-world IoT applications, yet students often struggle due to limited classroom time and insufficient exposure to diverse problem scenarios. In the IOT201TC Control Technology of IoT module, students reported difficulties in grasping abstract theories and applying them independently. To address these challenges, XIPU AI was introduced as a learning assistant, shifting students from passive problem-solving to actively designing and solving their own control system problems.

2. Solutions

This case implemented an AI-supported, student-designed problem project in the IOT201TC module. Key strategies included:

1. **Student-generated problem design:** Students created control system problems based on real-world IoT scenarios, applying core control theories in authentic contexts.
2. **XIPU AI as a personalized learning assistant:** AI supported brainstorming, modeling, controller design, and solution validation, offering immediate feedback and explanations.
3. **Process-oriented learning and reflection:** Students documented each step of their work, reflecting on how AI influenced their understanding and decisions.
4. **Clear AI usage guidelines:** AI was positioned as a support tool, reinforcing independent thinking rather than replacing it.
5. **Simulation and presentation-based assessment:** AI-assisted simulations and presentations helped students consolidate and communicate their learning outcomes.

3. Outcomes and Benefits

Student feedback indicated increased engagement and deeper understanding of control systems concepts. Designing their own problems with AI support helped students build confidence in applying theory to practice. The project also strengthened self-directed learning, analytical skills, and engineering thinking. While the open-ended nature of the task was challenging, students reported that AI feedback reduced frustration and enhanced motivation.

4. Replicability and Promotion Value

This case is highly replicable across engineering and technology-related modules. The combination of student-designed problems, AI support, and process-oriented assessment offers a scalable model for AI integration in engineering education.

5. Next Steps

Future plans include providing more scaffolded examples, increasing collaborative elements, and further strengthening students' AI literacy and engineering competencies.