The Hong Kong University of Science and Technology (Guangzhou)

UG Course Syllabus Template

[Course Title] Introduction to Embodied AI

[Course Code] AIAA 4220

[No. of Credits] 3

[Any pre-requisites] UFUG 1103 AND UFUG 2104

Name: [Instructor(s) Name] Junwei Liang

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Office Hours: [Specify Office Hours and Location]

Rm 304, E4 Office hours: Monday 04:30PM - 06:30PM

Course Description

[Briefly describe the course content, key topics or themes, objectives, methods of instruction, e.g., lectures, discussions, projects].

This course introduces the fundamentals of embodied AI. Students will explore key principles and algorithms to build modern autonomous embodied AI systems. Key topics include machine perception, planning and decision-making algorithms. Through this course, students will learn and practice the foundational principles, techniques, and tools to build new embodied autonomous AI systems. The course provides hands-on project experiences to facilitate student learning on embodied AI topics.

Intended Learning Outcomes (ILOs)

By the end of this course, students should be able to:

1. Demonstrate a fundamental understanding of embodied autonomous AI research and applications.

2. Understand the status of current embodied AI research and applications, including their limitations and future potential.

3. Understand several common designs of embodied AI systems.

4. Develop algorithms for robot perception and navigation

5. Demonstrate comprehension of key algorithms and models in embodied AI

6. Design and develop small AI projects using the learned techniques on real physical robots or in 3D simulation.

Assessment and Grading

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessments:

[List specific assessed tasks, exams, quizzes, their weightage, and due dates; perhaps, add a summary table as below, to precede the details for each assessment.]

Assessment Task	Contribution to Overall Course grade (%)	Due date
In-course Quizzes	25%	Due on the same day it is released
In-course Presentation	20%	20/10/2025
Machine Perception Group Project	20%	24/11/2025
Navigation Group Project	30%	24/11/2025
Attendance	5%	-

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
n-course Quizzes	ILO1, ILO2, ILO3, ILO5	This task directly assesses fundamental comprehension (ILO5) of core concepts, common system designs (ILO3), the overall field of embodied AI (ILO1), and the current state of research and its limitations (ILO2) through recall and theoretical application questions.
In-course Presentation	ILO1, ILO2, ILO3, ILO5	The presentation requires students to research, synthesize, and clearly articulate a topic, demonstrating a deep understanding of the field's applications (ILO1), critically evaluating the status, limitations, and future potential of specific systems (ILO2), and analyzing different design paradigms (ILO3).
Machine Perception Group Project	ILO4, ILO5, ILO6	This hands-on project focuses on the *Perception* component of the course. It assesses the student's ability to develop practical algorithms (ILO4), apply learned techniques and models (ILO5), and complete a small, self-contained AI system component in a simulation/robot environment (ILO6).
Navigation Group Project	ILO4, ILO5, ILO6	As the major project, this task focuses on the *Navigation, Planning, and Decision-Making* components. It requires students to develop comprehensive algorithms for robot navigation (ILO4), integrate and demonstrate advanced comprehension of models (ILO5), and successfully design and develop a full autonomous project (ILO6).

Grading Rubrics

Presentation Grading

1. Understanding & Content (40%)

This category evaluates the accuracy and depth of the presenters' knowledge of the paper.

- **5 (Excellent):** Demonstrates exceptional, in-depth understanding of the paper's core concepts, nuances, and implications. The explanation is flawless, insightful, and highly accurate.
- **4 (Very Good):** Shows a strong and accurate understanding of the material. The explanation is clear and correct, with only minor details lacking depth.
- **3 (Good):** Correctly presents the main ideas of the paper. The explanation is adequate but remains at a surface level, without demonstrating deeper comprehension.
- **2 (Fair):** The presentation contains some significant inaccuracies or omissions. The presenters' grasp of the key concepts is shaky or incomplete.
- **1 (Poor):** There is a fundamental misunderstanding of the paper's purpose and findings. The content is largely incorrect or confusing.

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2. Organization & Delivery (Part of Presentation & Communication - 20%)

This category assesses the structure of the presentation, time management, and the clarity of verbal communication.

- **5 (Excellent):** The presentation is perfectly structured, with a logical and compelling flow. Delivery is confident, engaging, and professional. Time management is flawless.
- **4 (Very Good):** The presentation is well-organized and easy to follow. Delivery is clear and professional. Good time management.
- **3 (Good):** The presentation has a discernible structure but could be organized more effectively. Delivery is clear but may be monotonous or rushed. Adheres to the time limit.
- **2 (Fair):** The structure is confusing, making the presentation difficult to follow. Delivery is hesitant or unclear. Poor time management.
- **1 (Poor):** The presentation is disorganized and chaotic. The delivery is unprofessional and detracts significantly from the content. Time limits are ignored.

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3. Quality of Visual Aids (Part of Presentation & Communication - 10%)

This category evaluates the effectiveness and professionalism of the slides or other visual materials.

- **5 (Excellent):** Slides are professional, visually engaging, and significantly enhance the audience's understanding. They use graphics effectively and are free of clutter and text walls.
- **4 (Very Good):** Slides are well-designed, clear, and effectively support the presentation content.
- **3 (Good):** Slides are functional and readable but are visually basic, text-heavy, or do not add much value beyond the spoken words.
- **2 (Fair):** Slides are cluttered, distracting, or contain errors. They make the content more difficult to understand.
- **1 (Poor):** Slides are unprofessional, messy, and actively hinder communication and comprehension.

4. Critical Analysis & Discussion (30%)

This category evaluates the ability to go beyond summarizing the paper by providing critical insights and effectively managing the Q&A discussion.

- **5 (Excellent):** The presentation includes insightful analysis of the paper's strengths, weaknesses, and broader impact. The Q&A is handled with mastery, providing thoughtful answers that demonstrate a deep, critical command of the topic.
- **4 (Very Good):** The presentation includes some original analysis or critique. The presenters answer questions accurately and confidently during the Q&A.
- **3 (Good):** The presentation is primarily a summary with little to no critical analysis. Presenters can answer direct, factual questions but struggle with those requiring deeper analysis or speculation.
- **2 (Fair):** No critical analysis is present. Answers during the Q&A are vague, repeat slide content, or show a limited ability to discuss the topic beyond the surface.
- **1 (Poor):** The presenters show no evidence of critical thinking about the paper. They are unable to answer questions effectively or engage in any meaningful discussion.

Grading for Group projects:
The grading for group projects will be based on the performance on the leaderboard, as well as peer reviews, and reviews by the TA and the teacher. Students, TAs and the teacher will vote on the project solutions with the best ideas.

Final Grade Descriptors:

[As appropriate to the course and aligned with university standards]

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Demonstrates a comprehensive grasp of key algorithms and models (ILO5), resulting in a project solution that is robust, highly efficient, and innovative. The development of perception/navigation algorithms (ILO4) goes beyond expected performance metrics, showcasing significant technical creativity. The final system (ILO6) is flawlessly executed, fully documented, and presents novel insights or sophisticated extensions to the problem.
B	Good Performance	Shows strong knowledge and understanding of the required algorithms and models (ILO5), successfully implementing core functionality with good overall quality and performance. The developed algorithms (ILO4) are sound and effective, meeting all specified requirements with minor, non-critical limitations. The final system (ILO6) is well-designed, functional, and the group demonstrates the ability to analyze and troubleshoot effectively.
C	Satisfactory Performance	Possesses adequate knowledge of the core subject matter (ILO5) and is competent in addressing familiar parts of the problem. The implementation meets the minimum functional requirements, but the algorithms (ILO4) may lack efficiency or robustness. The final system (ILO6) is functional but may have noticeable limitations or deficiencies in design, documentation, or performance compared to expected outcomes.
D	Marginal Pass	Has threshold knowledge of the core subject matter (ILO5), with significant struggles in implementing or applying key algorithms (ILO4). The project achieves only marginal functionality, often

		requiring manual intervention, and fails to meet several core specifications. The final system (ILO6) demonstrates weak technical execution, poor design choices, and very limited ability to handle unexpected scenarios.
F	Fail	Demonstrates insufficient understanding of the fundamental algorithms and models (ILO5) necessary for the project. The implementation is non-functional, incomplete, or fails to address the core problem (ILO4). The final system (ILO6) does not meet the minimal requirements for a working AI project, showing minimal effort or a complete lack of critical problem-solving skills.

Course AI Policy

We encourage you to use ChatGPT to solve the homework assignment problems (because likely in the future everyone will use it for coding). However, you will need to declare using ChatGPT/LLMs in the homework README, as well as the prompts you use. But you are not allowed to use LLM for in-class test.

Communication and Feedback

The grades of the quizzes will be available near the end of the semester. The Q&A for each quiz is delivered during the lectures.

Resubmission Policy

All work needs to be submitted on time.

Required Texts and Materials

Required a GPU machine with at least 6GB GPU memory to run all the projects. This has been delivered to the class in the first lecture.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST(GZ)'s Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Regulations for Academic Integrity and Student Conduct for the University's definition of plagiarism and ways to avoid cheating and plagiarism.