AMERICAN UNIVERSITY
OF PHNOM PENH
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Course Syllabus
ICT 361-Introduction to Robotics
3 Credits (3 Classroom Credit)

School Name:	*Digital Technologies*
Program Name:	*Degree & Major*
Semester:	*Fall 2025*
Class Schedule:	Wed/Fri: (001) 8:30-10:00; (002) 10:15-11:45
Classroom:	Emerging Tech Lab-Robotic and IoT
Prof.'s Name:	Mr. SENG Theara
Degree & Major:	Master in Electronics and Robotics
Contact Info:	Tel: 098 240 840 Email: t.seng@aupp.edu.kh
Office Location:	B5-Faculty Reception, Emerging Tech Lab-Robotic and IoT
Office Hours:	8:00AM-5:00PM

Note: *The syllabus is intended to provide guidance as to students' and the professor's obligations for this course. However, the professor reserves the right to modify syllabus items as needs arise, and students will be notified of any modifications.*

Course Description

This course introduces students to modern robotics through the lens of computer vision and AI- powered perception. Using the Mobile Robot and Raspberry Pi, students will explore how robots interpret the world through a camera, and how visual data can be used to drive intelligent behavior and decision-making. Students will build hands-on projects where the robot follows objects, recognizes faces and gestures, reacts to QR codes and markers, and even performs tasks based on visual cues, all without traditional range sensors. The course emphasizes practical implementation, creativity, and real-world relevance in smart robotics.

Table 1: Program Learning Outcomes (PLOs)

PLO Ref. #	**PLO Statement** By the end of the program, students will be able to:
1	Demonstrate advanced knowledge in ICT concepts.
2	Acquire expertise in ICT fields, enabling them to address complex ICT challenges effectively.
3	Develop critical thinking and problem-solving skills, applying them to analyze and resolve complex ICT-related issues and challenges
4	Cultivate effective communication and teamwork abilities, facilitating collaboration and knowledge sharing in multidisciplinary ICT environments.
5	Exemplify ethical responsibility and effective interpersonal skills, enabling them to collaborate professionally and make ethically informed decisions.

6	Excel in quantitative analysis, leverage cutting-edge information technology, and communicate effectively, enhancing their ICT problem-solving and communication abilities.
7	Demonstrate proficiency in executing technical tasks, practical applications, or laboratory experiments relevant to their chosen field of study.

Table 2: Course Learning Outcomes (CLOs)
[All sections of the same course must share the same CLOs.]

CLO Ref. #	CLO Statement By the end of the course, students will be able to:	CLO Class	PLO Ref. #
1	Set up and operate a Raspberry Pi-based mobile robot with an integrated camera.	Knowledge, Skill	1,2,3,4
2	Use OpenCV and MediaPipe to process visual input for object detection and tracking.	Knowledge, Skill	1,2,3,4
3	Implement vision-based navigation, line following, face recognition, and gesture control.	Knowledge, Skill	1,2,3,4,5
4	Integrate robot control logic with real-time camera data for autonomous movement.	Knowledge, Skill	1,2,3,4,5
5	Apply visual marker detection (ArUco, QR codes) to control robot tasks.	Knowledge, Skill	4,5,6
6	Build and present a full robotic system driven entirely by camera-based input.	Knowledge, Skill	4,5,6

Statement of relevance to Cambodia: *During the course there will be opportunities to relate the subject matter and assessments to the Cambodian context.*

Table 3: Course Assessments

[Use multiple types of assessment and provide rubrics for writing work.]

Assessment Task	% of Course, Grade	CLO Ref. #	Due Session #
Assignment	20%	1,2,3,4,5,6	Check Canvas
Quizzes	10%	1,2,3,4,5,6	Check Canvas
Mini Project	25%	1,2,3,4,5,6	Check Canvas
Midterm Exam	10%	1,2,3,4	Check Canvas
Final Project	20%	1,2,3,4,5,6	Check Canvas
Lab	15%	1,2,3,4,5,6	Check Canvas
TOTAL	100%		

Grading Scale: *You will receive a letter grade based on the AUPP grading scale.*

Table 4: Course Outline

Session *[1.5 hr]*	**CLO Ref. #**	**Topic**	**Lesson Learning Outcome (LLO)** The lesson enables students to:	**T&L Method**	**Material**
1	1,2	ESP32 Setup	• Understand ESP32 Hardware • Install and configure ESP32 • Setup Arduino IDE • Testing with LED .	Demo + guided setup	In Canvas & GitHub
2	1,3	Motor Control and Servo Control	• Control DC motors using motor drivers • Practice with the Robot Control • Understand PWM (Pulse Width Modulation) for motor control.	Demo + Assignment	In Canvas & GitHub
3	1,2,3	Remote Control	• Introduction to Joystick and Button • Using Joystick and Button with Arduino IDE • Using Joystick and Button to move the Robot	Code-along + Assignment	In Canvas & GitHub
4	1,2	Remote Control Lab	• Using Joystick and Button to move the Robot • Working on LAB1	Mini-lecture + lab	In Canvas & GitHub
5	1,2,3,5	IR Remote Control	• Introduction to IR Remote • Interface IR Remote with ESP32 • Serial Printing of the IR Remote data on ESP32	Mini-lecture+ Assignment	In Canvas & GitHub
6	1,2,3	IR Remote Control Lab	• Using IR Remote To move the Robot • Working on LAB2 for the IR Remote Control	App demo + lab	In Canvas & GitHub
7	1,2,3,5	Dabble Mobile App	• Introduction to Mobile app Dabble • Interface Dabble with ESP32 • Serial printing of Dabble Data on Arduino IDE	Mini Lecture+ Quiz	In Canvas & GitHub
8	1,4	Dabble Mobile App	• Using Mobile App button and Joystick to move the robot • Working on LAB3 using Mobile app to control the robot	Studio build	In Canvas & GitHub

9	2,3,4	Radar System	• Introduction to Ultrasonic and Servo Motor • Processing with Ultrasonic and Servo Motor	Mini-lecture & Assignment	In Canvas & GitHub
10	3,4,5	Radar System Lab	• Control the servo Motor • Reading the data from the ultrasonic sensor • Working the radar system Lab4	Presentations	In Canvas & GitHub
11	2,3,5	Web Server Robotic	• Introduction to web server • Using webserver to control robot and Servo Motor • Reading the ultrasonic data and send it to webserver	Live config + lab	In Canvas & GitHub
12	1,2,3 ,5	Web Server Robotic Lab	• Combine Ultrasonic with Servo Motor • Apply color masks to detect specific colors. • Track moving color objects.	Demo + lab + Quiz	In Canvas & GitHub
13	2,3,5	Serial Monitor	• Using Serial Monitor with ESP32 • Data Receive from the Serial Monitor • Using Serial Monitor to control the robot direction and Speed.	Flow demo + lab	In Canvas & GitHub
14	1,2,3 ,5	Midterm	• Evaluate understanding of fundamental topics. • Demonstrate practical implementation • Identify areas for improvement.	Walkthrough	In Canvas & GitHub
15	2,5	Raspberry pi Setup	• Raspberry Pi Setup • Library Installation and IP Configuration	Demo + Assignment	In Canvas & GitHub
16	1,2	Finger Count Detection	• Camera Setup and webserver View • Using MediaPipe with camera to detect the finger Counter • Using Finger Count Detection to control the direction of the robot	Mini-lecture + Assignment	In Canvas & GitHub
17	2,4,5	Finger Count Detection Lab	• Camera to detect the finger count using MediaPipe • Finger Counter with robot Control Lab	Lab	In Canvas & GitHub

18	1,4	Line Detection with HSV	• Understand the HSV • Using to detect the black Line • Understand the ROI Concept	Mini Lecture	In Canvas & GitHub
19	3,4,5	Mini Project	• Line Following Robot Testing	Demo	In Canvas & GitHub
20	3,4,5	Mini Project	• Line Following Robot Testing	Demo	In Canvas & GitHub
21	3,4,5	Mini Project	• Line Following Robot Testing	Demo	In Canvas & GitHub
22	2,3,4	Target Detection	• Detect and track custom objects. • Use bounding boxes to mark targets. • Apply filtering and localization techniques.	Guided lab	In Canvas & GitHub
23	2,3,4	YOLOv8-lite	• Understand YOLO architecture and performance. • Use YOLOv8-lite for object detection on Raspberry Pi. • Interpret detection output (Class, confidence, position).	Studio lab	In Canvas & GitHub
24	2,3,4	Mini Project 2	• Line Following with Object Detection and QR code Implementation	Demo	In Canvas & GitHub
25	2,3,4	Mini Project 2	• Line Following with Object Detection and QR code Implementation	Demo	In Canvas & GitHub
26	2,3,5	Prototype Verification	• Perform system integration and end-to-end verification their prototype • Execute function, performance, and reliability tests • Debug hardware and software interactions	Experiment	In Canvas & GitHub
27	2,3,5	Prototype Verification	• Perform system integration and end-to-end verification their prototype • Execute function, performance, and reliability tests • Debug hardware and software interactions	Experiment	In Canvas & GitHub

28	2,3,5	Prototype Verification	• Perform system integration and end-to-end verification their prototype • Execute function, performance, and reliability tests • Debug hardware and software interactions	Experiment	In Canvas & GitHub
29	1,4,5	Final Project Testing	• Integrate camera, sensors, motors, and logic. • Perform unit and system testing. • Refine algorithms based on test feedback.	Design studio	In Canvas & GitHub
30	2,3,4,5	Final Project Presentation	• Presentation Final Project	Presentation	In Canvas & GitHub

Materials

Required Textbook

- ***Yahboom Education (2023).*** Raspbot V2 Robot: Python and ROS-based Smart Robot Learning Guide. *Yahboom Official Documentation.*

Supplementary References

- ***Wyatt Newman (2017).*** A Systematic Approach to Learning Robot Programming with ROS. *CRC Press.*
- ***Yahboom Education (2024).*** ROS and Computer Vision Tutorials for Raspbot V2. *(Available online through Yahboom Wiki & GitHub).*
- ***Lentin Joseph (2020).*** Robot Operating System (ROS) for Absolute Beginners. *Apress.*

Class Policy

Preparation

While we will have lectures, you are encouraged to be active in your learning and engage your classmates. The required reading may be demanding, challenging, and rigorous. However, we will devote class time to discussion and in-class activities. This will ensure that you maximize your opportunities to ask questions and engage your classmates through group activities. As such, ***it is important you do the reading before each class and come prepared to discuss the material.***

Behavior

Professional courtesy and etiquette are required at all times in the classroom. Please respect the right of other students not to be disturbed, distracted, or interrupted in their learning by your behavior. This includes:

- Punctuality reflects that you are respectful of everyone in class.
- Interruptions, private conversation, note passing, and texting are not allowed.
- Cell phones should be turned off or on silent mode.
- Electronic devices will be exclusively used for course related work.
- Participation in class discussion is an essential part of the class.

At the discretion of the professor, violations of the above may result in a penalty such as a grade reduction, being asked to leave class for the day, withdrawal from the course, and/or

disciplinary action under the Student Code of Conduct.

Communication

It is essential for students to communicate to the instructor any needs, concerns, or questions as early as possible. I have posted certain office hours when I will be available to meet. If you need to meet outside of those times, you can always contact me for an appointment. Please note that any pertinent issues MUST be addressed early in the course before they become a serious hindrance to your coursework. Please do not hesitate to contact me if you have any concerns.

Attendance

Student attendance is essential for maximizing the value of the academic experience. Any student who is absent for 25% or more of class time will fail the class automatically.

Academic Integrity

Academic dishonesty will not be tolerated and is considered a serious offense. Academic integrity is a basic principle that requires all students to take credit only for the ideas and efforts that are their own. For incidents of plagiarism, the student will receive a warning, failure on the assignment, failure of the course, suspension, or expulsion—as determined by the professor and school dean. The professor may set up Turnitin for plagiarism check on specific Canvas assignments.

Students with Disability

AUPP is committed to making reasonable accommodations for students with disabilities. Students with any type of impairment that may make it difficult to succeed in this course are encouraged to inform the teacher as soon as possible in writing or through a private meeting. Any information will be kept confidential. Please note, however, that accommodation can only be granted in cases of a documented disability, and that you must request an accommodation before it can be given on any assignment, exam, or in-class activity.

More policies *can be found in the AUPP Academic and Student Policies & Regulations.*