ASSIGNMENT COVER PAGE

Programme	Course Code and Title
Bachelor of Computer Science (Hons)	CAI3034N Autonomous Mobile Robotics
Student's name / student's id	**Lecturer's name**
	Dr. Ooi Woi Seng

Date issued	Submission Deadline	Indicative Weighting
Week 4 (24/2/2025)	Week 8 (24/3/2025)	30%
Assignment 1 title	Robot Chase and Prediction	

This assessment assesses the following course learning outcomes

# as in Course Guide	UOWM KDU Penang University College Learning Outcome
CLO3	Implement intelligent control strategies, by programming autonomous mobile robots to perform complex tasks in dynamic environments including obstacle avoidance, planning and navigation, robotic mapping and self-localisation.(C3, PLO3)
# as in Course Guide	**University of Lincoln Learning Outcome**
CLO3	Implement intelligent control strategies, by programming autonomous mobile robots to perform complex tasks in dynamic environments including obstacle avoidance, planning and navigation, robotic mapping and self-localisation.(C3, PLO3)

Student's declaration

I certify that the work submitted for this assignment is my own and research sources are fully acknowledged.

Student's signature: Submission Date:

Dates and Mechanisms for Assessment Submission and Feedback

Mechanism for handout to students	CAMU LMS/ Microsoft Teams
Mechanism for submission of work by student	*Soft copy online submission via CAMU/* Microsoft *Teams*
Date by which work, feedback and marks will be returned to students	Week 10 (14/4/25 - 18/4/25)
Mechanism for return of assignment work, feedback and marks to students	Feedback will be provided by a marking template. This will be available to students via CAMU/ Microsoft Teams. The discussions at the walkthroughs will also provide informal feedback

COURSEWORK SUBMISSION GENERAL INFORMATION

Academic Integrity Statement

You must adhere to the university college regulations on academic conduct. Formal inquiry proceedings will be instigated if there is any suspicion of plagiarism or any other form of misconduct in your work. Students must **NOT** collude with other groups of students or plagiarise their work.

We practice zero tolerance towards plagiarism, and we use Turnitin to evaluate the similarity index. Your similarity index score must not exceed 20%.

Your tasks must be your own work. Unless the use of Artificial Intelligence (AI) is permitted in your assessment task, using AI to complete your assignment is a form of plagiarism.

Nature of the submission required

A soft copy of your assignment saved in **PDF version** should be submitted to lecturer, no later than the date and time stipulated on the cover sheet. In addition, an electronic copy of your work must be submitted to Turnitin. The first page of your report, immediately after the cover page, must be a page from Turnitin clearly showing your name and your Originality Score (Please refer to submission arrangement).

Diagrams may be used where they are helpful to support your arguments or description. If they are not your own work, the source must be referenced. Please help us to handle and mark your work efficiently.

Please take note for group submission, only **one submission per group**. This will contain both the group and individual elements. The individual element must be clearly labelled to indicate which group member completed the task.

Documentation guidelines

Student is required to submit a **soft copy** of the report and ensure that it uses the following formatted styles: 1) Font type: **Arial**, 2) Font size: **11 points**, 3) Line spacing: **Single spacing** and 4) Page layouts: **Justify**. Please make sure you have proper format alignment for all paragraphs, following standard writing style and use **Harvard citation style** for citation. Please include a **header** with the following information: **Student ID, Student name, Course code**, **and Assignment type**. Please also include a proper cover page for your submission which contains information about the students, assignment, course, and department with UOWM KDU Penang University College and University of Lincoln (UoL) logos on top (Please remove the UoL logo from the UCSWW programme). Also include page number at the footer page and a list of references, which is shown on the last page.

Penalties for Late Submission

For late submission of this Assignment, a penalty of a reduction by 10% of the maximum mark may be applicable for each Calendar Day or part thereof that the submission is late. An Assignment submitted more than **TEN** Calendar Days after the deadline will have a mark of zero recorded for this Assignment.

Submission arrangement

1. Cover page
2. Turnitin similarity report
3. Table of content
4. Main report
5. Reference list or bibliography list (whichever applicable)
6. Marking rubric (in landscape orientation)

File naming convention

Please make sure you save your filename with the following format:

- <Student Name>_coursecode_A1_Feb25.pdf

Assignment instructions/Background

Description

This assignment is an **individual assignment.** Each student must write and submit an individual report. The report should contain the full development steps of your algorithms, the problems that you overcame (or not) while conducting the experiments, and a copy of your source code for verification purposes.

Task: Robot Chase and Prediction (30%)

In this assignment, you will design and implement a predictive chasing algorithm using TurtleSim. One turtle will act as the predator, chasing multiple randomly moving prey turtles using a prediction-based approach. The predator will attempt to predict the future positions of the prey and chase them accordingly. When the predator touches a prey, both turtles will stick together and continue to chase the next turtle. This assignment will enhance your understanding on the prediction of movement, pathfinding, and coordination in robotics.

To complete this task successfully, it is important to understand ROS concepts such as nodes, topics, messages, services, and the ROS publish-subscribe paradigm. You will need to establish a ROS package, create publisher nodes responsible for generating random drive instructions, develop subscriber nodes to process the turtle trajectories, and create a launch file that initialises all the nodes essential for the task. This launch file should include the necessary turtlesim nodes to initiate the simulation.

Hints:

- In turtlesim, the linear and angular velocity of the turtle can be modified to control its movement. This can be achieved by publishing message on the topic turtle1/cmd_vel (turtle1 is the name of the turtle node). The required type of message is Twist, which belongs to the geometry_msgs package.
- The command rosmsg show geometry_msgs/Twist can be used to see the structure of Twist message. The Twist message contains two vectors: One for linear velocity and the other one for angular velocity. In order to work with any of these variables, a variable with the message type Twist has to be declared.
- A Python script can be used to start this publisher node and declare it as a publisher on the topic turtle1/cmd_vel.
- The information about the topic, e.g., the type of messages to publish on this topic, can be obtained by using the command rostopic info turtle1/cmd_vel.
- Define the subscriber node and declare it as subscriber to the topic turtle1/pose.
- Use the command rostopic info turtle1/pose to get information about the topic and see the required type of message for this topic. The required type of message is Pose, which belongs to the turtlesim.msg package.
- Use the command rosmsg show turtlesim/Pose to see the structure of the Pose message. The structure contains five variables, with a focus on variables *x* and *y*.

To obtain credit for this assessment you will need to demonstrate the various components of your work to the module instructor and be ready to answer questions related to the development of the solution.

Deadline

The deadline for report submission of this assignment is on 24/3/2025 **(Week 8)**

REPORT COMPONENT (100%)

<table>
<tr><th colspan="8">CAI3034N Autonomous Mobile Robotics
MARKING RUBRIC
ASSIGNMENT 1
Assignment Weighting (30%)</th></tr>
<tr><th rowspan="2">LEARNING OUTCOME</th><th rowspan="2">MARKING CRITERIA</th><th colspan="6">SCALE</th></tr>
<tr><th>Fail
(0-49)</th><th>3rd Class
(50-59)</th><th>2nd Lower Class
(60-69)</th><th>2nd Upper Class
(70-79)</th><th>1st Class
(80-100)</th><th>YOUR MARKS/COMMENTS</th></tr>
<tr><td rowspan="3">CO3: Implement intelligent control strategies, by programming autonomous mobile robots to perform complex tasks in dynamic environments including obstacle avoidance, planning and navigation, robotic mapping and self-localisation.(C3, PLO3)</td><td>Algorithm development
(40%)</td><td>• ROS package is created but without launch file. Neither publisher nor subscriber nodes are created.
• Fail to create and program multiple turtles to move.
• The predator turtle fails to catch turtles, with the prediction and chasing logic not working.</td><td>• ROS package is created but without launch file. Only publisher node is created.
• Multiple turtles are created to move but fail to avoid collision with borders and among the turtles.
• The predator turtle catches some other turtles but struggles with predictions or sticking to them.</td><td>• ROS package and launch file are created. Publisher and subscriber nodes are created but with major flaws.
• Multiple turtles are created to move across the environment but fail to avoid collision with the borders or among the turtles.
• The predator turtle catches most other turtles, with minor issues in prediction or movement.</td><td>• ROS package and launch file are created. Publisher and subscriber nodes are created but with minor error.
• Multiple turtles are created to move across the environment and avoid collision with borders and among the turtles but with minor error.
• The predator turtle catches all other turtles, with minor issues in prediction or movement.</td><td>• ROS package and launch file are created. Publisher and subscriber nodes are created with no error.
• Multiple turtles are created to move across the environment, and avoid collision with borders and among the turtles with no error.
• The predator turtle catches all other turtles, sticking to each and chasing the next with smooth, accurate predictions.</td><td></td></tr>
<tr><td>Documentation
(50%)</td><td>• Content is inaccurate. Information is incomplete, inaccurate, or not presented in a logical order, making it difficult to follow.
• Do not provide details about techniques used in navigation, path prediction, and collision avoidance.
• No results and discussion.</td><td>• Content is either questionable or incomplete. Information is not presented in a logical order, making it difficult to follow.
• Little explanation on the techniques used in navigation, path prediction, and collision avoidance.
• Results are presented but poorly discussed.</td><td>• Content is accurate but some required information is missing and/or not presented in a logical order, making it difficult to follow.
• Reasonable explanation on the techniques used in navigation, path prediction, and collision avoidance.
• Results are presented with reasonable discussion.</td><td>• Content is accurate but some required information is missing and/or not presented in a logical order, but it is still generally easy to follow.
• Good explanation on the techniques used in navigation, path prediction, and collision avoidance.
• Results are presented with good discussion.</td><td>• Content is accurate and all required information is presented in a logical order.
• Excellence explanation on the techniques used in navigation, path prediction, and collision avoidance.
• Results and discussion are very well presented which give the reader important information that goes beyond the obvious or predictable.</td><td></td></tr>
<tr><td>Code quality
(10%)</td><td>• Very poor program structure and without code comments.</td><td>• Poor program structure but with some code comments.</td><td>• Clear program structure and appropriate comments.</td><td>• The program code is well structured and commented.</td><td>• The program code is efficient, well structured, and commented.</td><td></td></tr>
<tr><td colspan="7">Overall score (100%)</td><td></td></tr>
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