CS 556: Task-Sheet for Final Project

Your Name: _____

Your Teammates names :_____

Robot ID:_____

Final Project grading breakdown:

Final Project is 30% of your final grade for this course!

Steps:	Step A1 Partial Code Submission (Phase 1, 2)	Step A2: Partial Video Submission (Phase 1, 2)	Step B1: Final code submission (Phase 1, 2, 3, 4, improvements)	Step B2: Final Video (Phase 1, 2, 3, 4, improvements)	Step C: Demo Day	Step D1: Poster Submission	Step D2: Final Report Tasksheet Submission	Total
Points	50	50	50	50	100	100	100	500
Deadline	**Tuesday, 11/25** 11:59 PM	**Tuesday, 11/25** 11:59 PM	**Tuesday, 12/2** 11:59 PM	**Tuesday, 12/2** 11:59 PM	**Tuesday, 12/9** 11:59 PM	**Thursday, 12/11** 11:59 PM	**Thursday, 12/11** 11:59 PM	

Step A1 and B1 Partial/Final Code Submissions Criteria:

- Modularization: Is the code broken into modular functions? What new functions were added, and why?
- Commenting: Is the code well-documented with clear comments? Does each file contain a description header? Does each function include a pre-definition description?
- Parameter Settings: Which parameters are hard-coded? Where are these parameters defined in the codebase?

Step A2 and B2 Partial/Final Video Submissions Criteria:

- A full test of the robot on the maze, collecting three bins
- Spinning when picking the bins (black squares)
- Automatically traversing the maze
- Displaying the number of collected bins
- Returning to the charging station

Step C Robotic Demo Day Criteria:

- Task Performance Accuracy: How successfully does your robot perform the assigned tasks?
- Map traversing accuracy
- Obstacle avoidance accuracy
- Spinning 360
- OLED Counter Display
- Speed Adjustment
- Completion Rate: How many tasks were successfully completed?
- Collected trash count
- Goal Achievement: Did your robot successfully complete the tasks?
- Returning to the start state (charging station)
- Beep Announcement
- Timing: How long did it take your robot to complete the task?

Step D1 Poster Submission

- one-page PDF, 36×48 in landscape.
- Ensure that all sections listed in Section 8 below are included in your poster.
- Ensure all text is legible from a distance and the layout is clean and professional
- Utilize visuals, concise bullet points, and diagrams to effectively communicate your design.

Step D2 Final Report Tasksheet Criteria

- Clarity and Completeness: Are explanations clear, concise, and do they address all required questions and sections?
- Documentation: Are diagrams, testing plans, and other materials included and detailed enough for reproducibility?
- Innovation: Are creative solutions or unique features implemented in the design or problem-solving process?
- Error Handling: Are mechanisms for error detection, recovery, and robustness clearly described?
- Testing: Are testing methods, results, edge cases, and performance metrics documented and addressed?
- Collaboration: Was teamwork effective, with well-distributed tasks and good use of resources?
- Step D (Final report Tasksheet Submission) grading breakdown:

Steps:	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**2**	**3**	**4**	**5**	**6**	**7**	**Total**
Points:	5	5	30	5	5	10	15	10	5	5	5	100

Final Report Submission Guidelines

Format:

- Submit your team's project report as a first file in a **PDF** format. Your project report must be no longer than 4 pages (including the FSA diagram; and excluding the one-page poster) and must include the answers to sections 1 to 7.
- Submit your team's poster as a second file in a **PDF** format. Your poster must be one page long and must include the list of parts mentioned in section 8.
- **Each team member** must submit a copy to **Canvas**.
- Use **clear headings and subheadings** exactly as listed below.
- Ensure **proper grammar**, formatting, and use **only the active voice** throughout the report.

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1. Project Proposal (50 points)

1.1 Problem Statement (5 points)

Provide a **one-sentence** description of the task your robot performs (e.g., "Our robot performs automatic _____.")

1.2 Sensors (5 points)

List all sensors used in your project (e.g., ultrasonic, IR). For each sensor, explain its specific purpose.

1.3 Behaviors, Automation, and Control Architecture (30 points)

STATES:

- List all **high-level behaviors** and as states (e.g., State 1: Wandering, State 2: Obstacle Avoidance, …), as well as each **low-level behavior** (e.g., State 10: Completion feedback, State 11: error alerts).
- Clearly label each as "**State X: [Behavior Name]**".
- Explain each state's functionality or role.
- For each state, specify if the behavior is adaptable to **dynamic goals** (e.g., random start/obstacles/…) or **hard-coded** (e.g., fixed start point/…).

TRANSITIONS:

- List all **conditions** or **events** that trigger transitions between states.
- Format: "**State X → State Y; IF [condition/event]**".

1.4 Finite State Automata (FSA) Diagram (5 points)

- Include a **full-page diagram** showing all states and transitions in your robot's architecture.

1.5 Control Architecture (5 points)

- Present your robot's **control architecture** (e.g., reactive, behavior-based).
- List **all controllers** you used within your final project code, their tasks, and justification for using them (e.g., P, PD, PID).
- Explain what each controller **controls**, why it's used, and what kind of **error** it minimizes.

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2. Integration of Semester Modules (10 points)

Explain how the modules you have learned about in this course were integrated into your robot's design and functionality for the final project. Be specific, for example, clarify if:

- From **Lab 6** and **Lab 7**, we used Go-To-Goal and Go-To-Angle to navigate within the maze …
    - Or, from **Lab 1**, we used navigation primitives for movements
- If a black line on the floor is detected, from **Lab 9,** we incorporated the line following feature with high speed while avoiding obstacles
- If no black line is available, from **Lab 5,** we applied wall-following using a PD controller for navigation and for obstacle avoidance
- From **lab 11**: we used automatic particle filters for localization with high accuracy (88% and above)
    - Or, from **Lab 3**: we used odometry for localization
- etc…

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3. Challenges, Error Handling, and Reliability (15 points)

Describe two major challenges your team encountered.

- Explain how each challenge affected your system (e.g., noisy sensor data, actuator failure,...).
- Describe the specific **error-handling mechanisms** implemented.
- Discuss how reliably your robot responds to **unforeseen events** or **recovers from failures**.

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4. Testing and Validation (10 points)

Detail your testing strategy:

- Describe the **methods** used and **performance metrics** tracked.
- Explain how you tested for **edge cases** and what modifications were made to address them.

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5. Innovation and Creativity (5 points)

Highlight any **unique features** or **innovative solutions** beyond course or lab requirements that you have incorporated in your code for the final project.

- Mention any creative problem-solving strategies your team employed.

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6. Communication and Team Collaboration (5 points)

Reflect on team dynamics:

- How were tasks and responsibilities distributed?
- Describe how your team maintained **effective communication and collaboration** throughout the project.

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7. Use of Resources (5 points)

Comment on how your team used available resources:

- For example, **lecture notes, instructors' feedback, office hours**, **class discussions on Canvas**, **online materials**, or **AI assistants**.
- Highlight which resources were most valuable and how they contributed to your progress.

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8. Poster Submission (100 points)

Each team must design a **research-style one-page poster** summarizing their project. The poster should be exported to **PDF** for submission. The **poster size must be 36 x 48 inches (landscape orientation)**.

Your poster should include the following sections, clearly labeled (each item 10 points):

- **Project Title and Team Members**
- **Problem Statement / Objectives**
- **Sensors and Hardware Used**
- **Behaviors, Automation, and Control Architecture** (with FSA diagram if possible)
- **Integration of Semester Modules**
- **Challenges and Solutions**
- **Testing, Results, and Validation**
- **Innovation and Future Work**
- **Acknowledgments and References**
- **At least two figures (your designed controller, and one from your FSA) You may additional figure of your robot if space allows**