Micro-Mouse Design Report

Please note that you are required to use the Microsoft form when preparing your report: it imposes strict formatting that must not be changed and enforces character limits for each section. **Do not disable the "Protect Form" functionality in Microsoft Word**. After completion you should convert the document to PDF for final submission.

If the form misbehaves then prepare your content in a separate application, then use copy and paste to populate it.

Student number:

Brief description of design task (max. 600 characters)

A short outline of the task identified and the problem it is intended to solve.

Visual aids for this report

Any figures, images, or other graphics can be placed in this section and be referred to in the rest of the text. This can include excerpts of Stateflow or Simulink block diagrams. Note that you can only insert a single graphic file here, so prepare your content separately, convert to an image, and insert as required.

Design criteria and constraints (max. 1000 characters)

These are fundamental elements in the engineering design process. Criteria are the desired features, functions, and performance standards that a design must meet, while constraints are the limitations or restrictions that must be considered during the design process.

Main design assumptions with justification (max. 1000 characters)

Design assumptions are fundamental beliefs or statements about a system, its environment, or its users, that are taken as true without proof during the design process. Justification involves providing reasons and evidence to support these assumptions, explaining why they are reasonable and necessary for the design to proceed.

Design process description (max. 1000 characters)

The design process is a structured approach, often iterative, used to solve problems and develop solutions. It typically involves identifying a need, researching the problem, brainstorming ideas, creating prototypes, testing, and refining the design until it meets the desired outcome.

Design implementation (max. 1000 characters)

Design implementation describes the process of translating a design into a functional reality. It's the stage where the theoretical design is brought to life, whether it's a software application, a physical product, or a system.

Design evaluation and testing (max. 1000 characters)

Evaluation and testing is crucial for ensuring a design meets its objectives and user needs. This process involves assessing a design's feasibility, desirability, and viability, and identifying areas for improvement before it gets deployed.

Instructions

This report should document a structured design process that you conducted in relation to the micro-mouse project. You should explicitly be demonstrating use of methods presented to you in EEE3088F. The main purpose is to provide sufficient evidence for us to claim your proficiency in the ECSA Design Graduate Attribute (GA3), which is required to pass the course and complete your BSc(Eng) programme.

You can choose any design task for which you can confidently present evidence of design thinking. Without being prescriptive, some examples might be to design, build, and test:

1. a more realistic and operationally useful Simulink model of the micro-mouse motor drive system
2. a realistic Simulink model for time-of-flight distance measurements that function specifically in a maze environment
3. Simulink model enhancements that accommodate a realistic perturbation such as friction, wheel slip, variable robot load (mass), operation on an inclined plane, or other
4. processes for signal conditioning on measurements (e.g. improving IMU performance through calibration and noise modelling)
5. a process for smoothing robot hardware motion (e.g. prediction and filtering of actuation signals)
6. a Kalman filter-type algorithm for combining measurements and actuator signals in a structured manner
7. a coordinated turn procedure that permits 90 degree turns of the robot even with significant forward velocity
8. a method to acquire odometry by implementing rotary encoders on the wheels
9. a method for making the robot follow a predetermined trajectory
10. an overall improved micro-mouse simulator for in-the-loop algorithm development.

The task for which you provide evidence need not align with any submission milestone, and it does not have to be novel or earth shattering. However, the approach taken and the reporting thereof must follow formal design processes at the level required and must be objectively evaluated.

In essence, you should think of a micro-mouse related problem, approach it in a design-oriented manner, implement and test a proposed solution, and document the process you followed and the outcomes.

The format for this design report is very constrained. You are given limited space to present information relevant to each evaluation criterion, and each section will be evaluated for evidence it provides of your design thinking skills. A guide to the purpose of each section is as follows:

- **Brief description of design task**: A short outline of the task identified and the problem it is intended to solve.
- **Visual aids for this report**: Any figures, images, or other graphics can be placed in this section and be referred to in the rest of the text. This can include excerpts of Stateflow or Simulink block diagrams.
- **Design criteria and constraints**: These are fundamental elements in the engineering design process. Criteria are the desired features, functions, and performance standards that a design must meet, while constraints are the limitations or restrictions that must be considered during the design process.
- **Main design assumptions with justification**: Design assumptions are fundamental beliefs or statements about a system, its environment, or its users, that are taken as true without proof

during the design process. Justification involves providing reasons and evidence to support these assumptions, explaining why they are reasonable and necessary for the design to proceed.

- **Design process description**: The design process is a structured approach, often iterative, used to solve problems and develop solutions. It typically involves identifying a need, researching the problem, brainstorming ideas, creating prototypes, testing, and refining the design until it meets the desired outcome.
- **Design implementation**: Design implementation describes the process of translating a design into a functional reality. It's the stage where the theoretical design is brought to life, whether it's a software application, a physical product, or a system.
- **Design evaluation and testing**: Evaluation and testing is crucial for ensuring a design meets its objectives and user needs. This process involves assessing a design's feasibility, desirability, and viability, and identifying areas for improvement before it gets deployed.

The marking rubric for these reports is as follows:

Topic (weight)	Unacceptable (0)	Marginal (1)	Acceptable (2)	Exceptional (3)
Visual aids for this report (3)	Visual aids are unclear, confusing, or difficult to understand. Fails to effectively communicate design elements due to poor visual presentation	Visual aids are somewhat effective, but unclear or confusing in parts. May lead to misinterpretation of design elements due to poor visual presentation	Visual aids are clear and effectively communicate design elements. Meets minimum requirements for visual clarity and presentation	Visual aids are highly effective, clear, and engaging. Exceeds expectations for visual communication skills, creativity, and presentation
Design criteria and constraints (3)	Fails to identify or acknowledge critical design constraints. Ignores fundamental principles that limit design	Partially identifies some, but not all, critical constraints. Assumes factors without thorough consideration of limitations	Clearly identifies and justifies relevant design constraints. Demonstrates consideration of limitations or trade-offs in design decisions	Thoroughly identifies all critical constraints. Consistently considers design principles that account for limitations and trade-offs
Main design assumptions with justification (3)	Assumptions not identified or justified. Ignores critical variables and constraints	Lacks clear identification or justification of assumptions. Assumptions not thoroughly explored and considered	Assumptions clearly identified and justified. Consistently applied problem constraints with evidence to support	Assumptions rigorously identified and justified through thorough analysis. Assumptions explicitly made

				explicit and transparent
Design process description (3)	Lacks clear description of design process. Fails to demonstrate understanding of design methodology	Partially describes design process but lacks detail. Fails to identify key steps or decisions in the design process	Clearly describes main stages of the design process. Demonstrates understanding of key design concepts and principles	Comprehensive description of the entire design process. Clearly explains thought processes, decisions, and trade-offs
Design implementation (3)	Does not demonstrate successful implementation of design. Fails to demonstrate functional or effective design solution	Partially implements design, but with significant flaws. Fails to demonstrate clear and consistent implementation of design	Demonstrates successful implementation of basic design elements. Shows clear and consistent execution of design principles	Seamlessly implements design elements with attention to detail. Demonstrates exceptional execution of design principles
Design evaluation and testing (3)	Ignores or fails to evaluate design thoroughly. Fails to test and validate design assumptions	Partially evaluates design, but with significant limitations. Fails to test and validate design assumptions, or tests are not comprehensive	Consistently evaluates design for functionality and usability. Tests and validates design assumptions	Thoroughly evaluates design for all aspects. Validates design assumptions through rigorous testing and analysis

A discretionary further 2 points will be awarded for overall quality of the work and coherence of the report.

Note that to satisfy the GA assessment you will be required to get at least 1.5 marks out of 3 for every topic category in the rubric (i.e. no “Unacceptable” anywhere in the report, and “Marginal” is only permitted if an additional 0.5 marks is added via the rubric). This is separate from the mark that you receive, and a passing mark does not indicate that you’ve successfully attained the relevant GA.