**Task**

You are challenged to design a vehicle that will compete in a timed challenge where you must navigate through a line pathway followed by a space that has no line but is enclosed by walls. Once activated, you should not touch your vehicle again, except for moving it from one state area to the next (i.e., lines to spaces).

Points are as follows:

Everybody starts with 180 points.

* -1 point for every second passed
* +1 point for each cm travelled
* +10 points for each transition that doesn't require physical interaction, but no points will be deducted for manual transitions
* -10 points each time a team must manually put their solution back on track

The highest score wins. Teams forfeit if they reach 0 points.

The focus of the challenge is to design a vehicle that can complete the following tasks:

* is automated
* Will not move until a button has been pressed
* can follow a line
* can navigate an enclosed space with no line/path
* can handle the transition from line tracking to space navigation (optional: without direct/hands-on interaction)

You are limited to the following resources:

* x2 motors
* x2 wheels
* x1 Arduino mega
* x3 distance sensors
* x2 sheets of A4 Cardboard
* x1 meter of masking tape
* x2 sticks of hot glue
* x1 button
* x1 H-bridge controller (tutorial coming)
* x2 servo motors (tutorial coming)
* x1 additional sensors for direct-free decision making

Required outputs:

1. A poster that documents your :

* visual thinking to come up with a concept for a vehicle that would complete the challenge, which includes conceptual tools such as sketching, brain mapping, and visual prototyping

2. A second poster that documents your

* lightweight specification, including process diagramming, documents, decision flow, CAD/Design files etc.
* The implement their design
* Resource consumption
* your review of your design against other solutions

3. Your implementation files, including videos of your solution meeting the different objectives.

4. Documentation where you evaluate your team mates and estimate how much work out of 100% they did.

## Rubric

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Knowledge, Comprehension & Application** |  |  |  |  |  |
| **CRITERIA** | **EXPECTATIONS** | **POSS** | **STUDENT** | **GIVEN** | **MULTI** | **TOTAL** |
| **Poster 1**  (small group) | You have **submitted a poster** which demonstrates the conceptualisation process, **your ability to describe and visually represent your ideas**, etc. This poster should include a clear description, sketches, mind mapping, card sorting and/or other forms of visual prototyping. | 2 | \_\_/2 | \_\_/2 | A x2  T x1 | A \_\_/ 4 T \_\_/ 2 |
| **Poster 2**  (small group) | You have **submitted a poster** that documents **lightweight specification** materials such as process diagrams and decision flows, CAD/Formal Designs, examples from implementation, resource consumption, and a brief review of the success of their solution. | 2 | \_\_/2 | \_\_/2 | A x2  T x1 | A \_\_/ 4 T \_\_/ 2 |
| **Implementation files**  (small group) | You have submitted **evidence of your implementation files** including code and videos of your working solution. Code solutions should be submitted in markdown format as well as INO. | 2 | \_\_/2 | \_\_/2 | A x2  T x1 | A \_\_/ 4 T \_\_/ 2 |
| **Team work review** | You have submitted evidence of your **team review documentation**, including evaluating your team mates. | 2 | \_\_/2 | \_\_/2 | A x2  T x1 | A \_\_/ 4 T \_\_/ 2 |
|  | **Analysis, Synthesis & Evaluation** |  | | **SUBTOTAL** | | **A \_ / 22**  **T \_ / 8** |
| **Conceptualisation** | Your evidence provided your **clear understanding of the conceptualisation process**, including idea generation, problem identification, and potential solutions. They should be able to **describe the process and its importance** in the development of a design solution. This includes the ability to **use relevant technology concepts, principles, and data to address the identified need, problem, or challenge**. Evidence of knowledge and understanding can be **showcased through various mediums**, such as written explanations, diagrams, or presentations, using appropriate metalanguage and referencing. | 4 | \_\_/4 | \_\_/4 | - | \_\_/ 4 |
| **Research and Design** | Your evidence demonstrates a **comprehensive understanding of the design process**, including decision-making, planning, and development stages. They should be able to **describe how the design process relates to the creation of effective and appropriate solutions**, considering ethical and sustainable applications of technology. Evidence should be provided through **written or visual documentation,** showcasing the application of technology concepts, strategies, and methodologies in the context of the design process. | 4 | \_\_/4 | \_\_/4 | - | \_\_/ 4 |
| **Implementation** | Your evidence demonstrates your ability to **effectively implement their design solution**, using appropriate techniques and approaches. This includes the creation of prototypes, the testing and evaluation of solutions, and iterative improvement based on feedback and review. Students should **provide evidence of their ability** to apply technology concepts and strategies, taking into account the impact of context on the implementation. Documentation, such as photographs, videos, or written records of the implementation process, should be presented to demonstrate the students' proficiency in executing their design solutions. | 4 | \_\_/4 | \_\_/4 | - | \_\_/ 4 |
| **Reflection** | Your evidence should showcase your capacity to **reflect on their own thinking and learning process**, as well as their interpersonal skills, including planning, time management, and collaboration. Evidence should include an evaluation of their design solutions and the development process, **highlighting areas of improvement, challenges faced, and lessons learned**. Students should also demonstrate the ability to adapt and refine their knowledge and understanding based on their reflections. | 4 | \_\_/4 | \_\_/4 | - | \_\_/ 4 |
|  | **Submission Guidelines** |  | | **SUBTOTAL** | | **\_\_ / 16** |
| **Overall submission quality** | **Assessment submission is ordered** and has a definite pattern to its construction. **The reader is not confused about the content in any given section and can follow the submission flow** easily. | 4 | \_\_/ 4 | \_\_/ 4 | A x2  T x1 | A \_\_/ 8 T \_\_/ 4 |
|  |  |  | | **SUBTOTAL** | | A \_\_/ 8 T \_\_/ 4 |
|  | DAYS LATE \_\_\_/7 = \_\_\_% |  |  | **FINAL** | | **A \_\_/48 T \_\_/40** |

## Rubric sections

##### Section 1: Knowledge Comprehension and Application

This section of the rubric consists of the required elements of the assignment. Students should take special care to include ALL these elements as they are often extended in the following sections

##### Section 2: Analysis, Synthesis, and Evaluation.

This section will evaluate your ability to include critical thinking and justification elements into your work. Often the requirements for extension are not explicitly given, so it will be up to you to decide how best to demonstrate what you have learned beyond the required unit goals and curriculum. Items such as 3D models, pictures, drawings, diagrammatic responses, notes, evidence of problem-solving, advanced programming concepts, elegant responses, media, etc., are all available options.

##### Section 3: Submission Guidelines

Students are expected to provide a submission that fulfils the requirements listed in style guides while also submitting at an appropriate quality. Be aware that points in this section could be 2- or 4-point items. Treat them accordingly.

## Submission

All submission items should be stored in an appropriate format. For example, code must be stored in a programmatical format so it can be evaluated (**images of code or code copied and pasted into a document may not be marked**)

Evidence of working material must be recorded where appropriate. For example, to show how your robot meets a requirement, you must submit a recording of it completing that requirement. Similarly, if you need to show how your program can download a file from the internet and crack a password, you must submit a recording of it doing that.

Ask the teacher if you are unsure if an element needs to be recorded**.**

All materials must be submitted to Google Classroom.

Students are responsible for keeping backups/master copies.

## **Scoring Notes**

Formatting for all typed/written assessments should be as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Google Doc** | 11-12 Pt | 1.15-1.5 Line Spacing | 1 Space between paragraphs | Spelling and Grammar “Soft Limit” | In-Text Citations with footnotes | Title Page/Slide:   * Name * Date * Class * Aim * Assessment title |
| **Slides** | 10-12 pt. font text  14-24 pt. font titles | 1.0 1.15 Line Spacing | Bullet Points Preferred | Word Count per slide >100-110 “Soft Limit.” | Approved Templates and Themes |
| **Python** | We apply the following style guide to Python files. However, in general, most programs follow this overall layout.    [PEP 8: The Style Guide for Python Code](https://pep8.org/) | | | | | |
| **Arduino**  **C/C++** | We apply the following style guide to C/C++ files. However, in general most programs follow this broad layout.    I accept both K&R and K&R alternative bracing format. As long as it is consistent in your file.  [Arduino Style Guide for Creating Libraries | Arduino Documentation | Arduino Documentation](https://docs.arduino.cc/learn/contributions/arduino-library-style-guide) | | | | | |
| **Markdown** | We apply the following style guide to markdown documents. However, in general, most documents follow some variation of the following layout:    <https://github.com/google/styleguide/blob/gh-pages/docguide/style.md> | | | | | |

“Soft Limits” are not rigidly defined limits and will be assessed on a case-by-case basis. Ask for clarification on specific tasks

## Possible Scoring Groups are out of 2 or 4 Points.

##### 2-Point Criteria - Knowledge and Understanding

Criteria assessed as 2-Points are classified as Knowledge and Understanding criteria. These will examine and evaluate a student’s ability to effectively state facts and define terms and concepts. Analysis and synthesis of the information will not be assessed through these criteria.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **0 Points** | **1 Point** | **2 Points** |
| **2 Point Criteria** | **Not present** or **not able to be assessed** as the required criteria | Item is presented but **does not meet expectations** for quality, rigour, or detail. | Item is presented and **does meet expectations** for quality, rigour, or detail |

##### 4-Point Criteria - Analysis and Synthesis and Expert Review

To show true mastery of your developing skills, students must show that they can go beyond simple repetition of the given tasks or an explanation of processes. Students will demonstrate their ability to show higher-order thinking through analysis, evaluation, or linking multiple fields of learning to solve problems in novel ways.

## Analysis and Synthesis

Analysis and Synthesis components evaluate a student’s ability to effectively review data and understandings and develop these into a coherent and relevant statement. Analysis refers to the generating of thoughts from interpreting the data. In contrast, synthesis combines experience from one area with other pertinent knowledge to develop an original and compelling solution.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **0 Points** | **1 Point** | **2 Points** | **3 Points** | **4 Points** |
| **4 Point Criteria** | **Not present** or **not able to be assessed** as the required criteria | Evidence is presented and explained. However, it **does not show appropriate evidence of higher-order thinking** such as analysis, evaluation, or synthesis. | Evidence is presented and **shows appropriate evidence of higher-order thinking** such as analysis, evaluation, or synthesis. | Evidence is presented and **exceeds expectations for evidence of higher-order thinking** such as analysis, evaluation, or synthesis.  **-or-**  Item is presented and shows appropriate evidence of higher-order thinking such as analysis, evaluation, or synthesis and **exceeds expectations for quality or rigour** of understanding of the selected mastery. | Evidence is presented and **exceeds expectations for evidence of higher-order thinking** such as analysis, evaluation, or synthesis. **Additionally, this item exceeds expectations for quality or rigour** of understanding of the selected mastery. |

##### Expert Review

Expert Reviews evaluate a student’s ability to build solutions using the skills taught during the semester. Criteria assessed as 4-Points are classified as Analysis and Synthesis criteria. These will examine and evaluate a student’s ability to effectively review data and understandings and develop these into a coherent and relevant statement. Analysis refers to the generating of thoughts from interpreting the data. In contrast, synthesis combines experience from one area with other pertinent knowledge to develop an original and compelling solution.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **0 Points** | **1 Point** | **2 Points** | **3 Points** | **4 Points** |
| **4 Point Criteria** | **Not present** or **not able to be assessed** as the required criteria | Evidence is presented and broadly solves the problem. However**, the evidence does not show appropriate mastery** upon review. | Evidence is presented and broadly solves the problem. On review, it **does show appropriate evidence** of mastery. | Evidence is presented and solves the specific problem. On review, the evidence **shows understanding beyond expected mastery**.  **-or-**  Item is presented and broadly solves the problem. On review, it does show appropriate evidence of mastery and is **done so in a well-constructed or design method** that clearly shows higher levels of understanding**.** | Evidence is presented and solves the specific problem. On review, **the evidence shows understanding well beyond expected mastery** and is **done so in a well-constructed or designed method** that clearly indicates higher levels of understanding. |

##### Multiplier

Criteria will be combined with a **Multiplier**. While each criterion will be scored on the 0-1-2-4 scale, the multiplier will attach relevant worth to each criterion. Be aware of these multipliers and dedicate appropriate time to ensure you achieve your best result.

## Achievement Standards:

## Evidence of higher-order learning:

What is it that I mean by “higher-order thinking”?

It means I want you to go beyond replicating what we do in class. I want you to dig into your brain and understand why you did something, what about it was great, and what could be improved.

Why is this important? Reflective thinkers can go beyond what they are taught and can customise their learning to ben

