CG1111 Engineering Principles and Practice 1
The A-maze-ing Race Project: Report Writing

Engineering Information Reports

Task Instruction

You are expected to write a concise and well-organized report to describe and explain the design of your *mBot* for the A-maze-ing Race Project.

Your report should include:

- a cover page with your Studio Group Number, Section Number, Team Number and names of team members.
- a description of the overall algorithm supported by infographics such as pseudocode and flowcharts
- a description of the implementation of subsystems such as algorithms for keeping *mBot* straight, audio processing circuit design and algorithms, colour sensing algorithms, end-of-maze detection algorithm
- steps taken for calibration
- work division
- significant difficulties and steps taken to rectify those challenges

Purpose and audience

This report is a typical kind of **engineering information report** that is written to present results obtained from a project on a given engineering topic. It is common for engineers to report information on a process or an operation of a device or technology in the form of a written report.

Engineering information reports are targeted at **technical readers** of equal or greater competence than yourself. In this case, your target readers are your instructors and team members. These reports are written for easy communication of information, writers usually use sections with numbered headings and subheadings, and figures and tables to present data.

Report structure

Your report should be structured according to the given components.

Section 1 Overall algorithm of *mBot*

You should provide a very brief overview at the beginning of this section by describing the purpose of the project and outlining the overall algorithm of mBot. Describe and explain the algorithm using a diagram and explain how each part in the algorithm is connected.

When providing a **figure**, refer to the figure in the text and describe the parts of the figure. Insert the figure after the text with a caption beneath.

Language focus

When describing and explaining the algorithm, use **present tense**.

Example

Fig. 1. illustrates the overall algorithm of *mBot* that allows it to overcome the challenges while completing the maze race. The first stage/part of the algorithm is to….

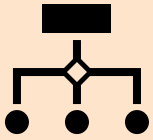

Fig. 1. Overall algorithm of *mBot*

Phrases that you can use when referring to figures or tables

Fig. 1/Table 1 shows/indicates/illustrates/presents/displays

As shown/indicated/illustrated/seen in Fig. 1/ Table 1, ….

…. is illustrated in Fig. 1/ Table 1.

Section 2 Implementation of subsystems in *mBot*

You should provide a very brief overview at the beginning of this section by outlining the number of subsystems and their uses. You may begin this section by saying "This section describes various subsystems in mBot which include….."

You may divide this section into **sub-sections** depending on the number of subsystems you describe and use sub-headings to help your audience to navigate each sub-section. In each sub-section, describe the function of each subsystem and the parts or commands used in that subsystem. Explain clearly how the parts are connected or commands are used.

Language focus

When describing the parts used in each subsystem and explaining the connections among parts, use **present tense**. Simply put, you use present tense to **describe how the mBot works.**

Defining relative clauses are used to give **essential information** about a noun in order to understand who or what is being referred to. (a noun + a relative pronoun + the rest of a clause)

Non-defining relative clauses are used to give **extra information** about a noun without defining the person or the thing being referred to. (a noun + **a comma** + a relative pronoun + the rest of clause)

Examples

In each of the examples, the relative clause is underlined while the thing being referred to is in bold.

Defining relative clauses

"The navigation of the robot is based on **waypoints** generated (which are generated) by an offline global path-planning algorithm. Each waypoint contains the information of the desire position with **a specific configuration** that the robot should achieve. [1]"

Non-defining relative clause

"The hHoneycomb robot consists of **four hexagonal blocks**, each of which undergoes rotational movement and the platform attains multiple configurations [1]."

To understand the comparison between defining and non-defining clauses, you can read the information from the link: https://dictionary.cambridge.org/grammar/british-grammar/relative-clauses-defining-and-non-defining.

Passive voice is commonly used when emphasizing the topic or issue rather than the doer. The use of passive voice can also enhance coherence, i.e. the logical flow of ideas.

Example

"The hHoneycomb robot consists of *four hexagonal blocks*, each of which undergoes rotational movement and the platform attains multiple configurations. To have a relative planar motion among *two blocks*, *the blocks* **can be connected** by a mechanical hinge with the joint axis perpendicular to XY plane [1]."

To emphasize the topic 'blocks' throughout the text, the writer uses "to + verb phrase" (indicating a purpose) followed by a passive construction in the final sentence.

When providing **commands**, refer to the commands in the text and describe the purpose of the commands and reasons why these commands could tackle a particular challenge. Insert the commands after the text.

Section 3 Steps taken for calibration

You should provide a very brief overview at the beginning of this section by listing the major calibrations. Describe the major calibrations in detail and explain why you made those adjustments.

Language focus

When describing specific calibrations at certain points of the implementation process which happened in the past and reporting the results of the calibrations, use **past tense**.

When indicating the implications of the calibrations, use **present perfect tense**.

Section 4 Work division

You should list the roles and responsibilities of each team member.

Language focus

When describing your roles and responsibilities in a completed project, use **past tense**.

Section 5 Challenges and actions taken

You should identify significant challenges and describe the strategies adopted to resolve those challenges. Focus on the **engineering challenges** rather than obstacles encountered related to team and time management.

To help your readers understand how you tackled each problem, you may **address one challenge and its remedial strategy** in one paragraph or sub-section.

Language focus

When describing the challenges encountered and your solutions during the completed project, use **past tense.**

When describing the implications of your solutions which are still true**, use present perfect tense.**

Points to ponder:

Should we present information in point form?

When presenting information in point form, you are leaving your readers to connect the ideas themselves. If you decide to present information in point form, you should be very confident that your readers are able to understand the flow of ideas effectively without any difficulty.

Paragraph development is essential to guide your readers to the focus of your message. To help your readers understand your ideas, it would be better to articulate your ideas in paragraphs. A coherent paragraph should include a **topic sentence** which introduces the focus and **supporting sentences** to elaborate that focus.

Should we use "we" in the report?

Personalization is not highly appreciated in academic or technical writing because the topic or issue is more important than the doer. Since the focus is usually on the topic or issue, **passive voice** is commonly used. You can use "we", "our team" or "the team" when you build an author's identity in relation to your readers. You may develop a strong sense of authorship in the last two sections.

Should we use present tense throughout the report?

Although present tense is the most common tense in academic and technical writing, you need to analyse the context in order to use appropriate tense in your sentence.

You should use **present tense** to:

- describe facts and general truths
- refer to tables or figures (e.g. "Fig. 1. **shows**…..)
- describe components, parts or processes and their functions (e.g. "The sensor **emits** light pulses which **are reflected** off surrounding obstacles and back into its detection unit.")

You should use **past tense** to:

- report specific findings of a previous study or research to support your ideas
- describe findings of a completed project at a particular time in the past (e.g. "The mBot **was placed** in the middle of the track in the first run….")

You should use **present perfect tense** to:

- describe the implications of your completed actions which are still valid (e.g. "This calibration **has allowed/ resulted in ….**")
- refer to the implications of previous studies or research which are still relevant (e.g. Research studies [1]-[3] in the field **have proved/ indicated** that….)

Our tables and figures are self-explanatory. Should we still pretext the tables and figures?

You have to ask yourself if your readers will be able to interpret the tables and figures without any difficulty. Your readers might misinterpret or might not bother to interpret the information or results if you do not articulate your explanation or interpretation for them.

When presenting a text along with a table or figure, include a **location and summary statement** to provide reference to the table or figure and introduce the contents of the table or figure. Provide **highlighting statements** to drawing attention to the important elements from the visual information, followed by the **commentary of the table or figure** that explains the rationale and/or provides implications.

Insert the table or figure with an **informative caption**. If the table or figure is from a secondary source, cite the source (e.g. [X]) at the end of the caption.

As shown in Fig 2, two side IR proximity sensors are mounted on the bottom of the *mBot* for the detection of the black strip at each waypoint challenge. **(location and summary statement).** These two sensors are used to emit IR signals and receive reflected signals so that the *mBot* can…. **(highlighting statements).** When the *mBot* is in motion, the sensors on the bottom will…. When the *mBot* arrives at a black strip, the sensors will …… Then the *mBot* will…. **(commentary).**

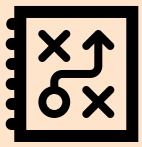

Fig. 2. Two IR proximity sensors functions as a line tracker sensor [X]

Tables and figures should be numbered separately and in the sequence in which they are referred to in the text. Each table or figure must present the key information or results, while the less important information is presented in a **legend**. A table legend is presented above the table as the information in a table is viewed from top to bottom. A figure legend is presented below the figure because the information in a figure is viewed from bottom to top.

Should we incorporate sources in the report?

To enhance and support your ideas, you may incorporate sources. You may present relevant facts or statistics to serve as evidence to support the rationale of your design. Using an authority or expert on a topic to support your rationale can lend credibility to your design.

You need to determine the purpose of that source and how to best incorporate it into your report. Quoting, paraphrasing and summarizing are **legitimate ways of incorporating sources** in a report.

Quoting is the use of exact wording found in a source. **Paraphrasing** is to rephrase the information from a source in your own words. **Summarizing** is to highlight the essential points in a shortened version. These three main ways of integrating sources will be discussed in detail when you proceed to CG1112 in Semester 2.

To practice **academic integrity**, all information including tables and figures taken from secondary sources must be correctly referenced. Every source used must be cited in the **IEEE citation style.**

The two components of a referencing style include:

- citations in the text
- a list of references in the final section

Example of a reference list entry in the IEEE citation style (Journal article)

[#] A.A. Author and B.B. Author, "Title of article", *Title of Journal*, vol. #, pp. page numbers, Month year.

[2] A.K.M. Mahtab Hossain and Wee-Seng Soh, "A Survey of Calibration-free Indoor Positioning Systems," *Computer Communications*, Elsevier, vol. 66, pp. 1-13, July 2015.

Refer to the *IEEE Reference Guide* uploaded on *LumiNUS* or click this link (https://libguides.nus.edu.sg/c.php?g=145626&p=955413) to access the IEEE citation guide from the *NUS Library*'s website.

References

[1] R. Parween, Y, Shi, K, Parasuraman, A. Vengadesh and V. Sivanatham, "Modeling and Analysis of hHoneycomb—A Polyhex Inspired Reconfigurable Tiling Robot." Energiesl, vol. 12, iss.13, June 2019.

[2] A.K.M. Mahtab Hossain and Wee-Seng Soh, "A Survey of Calibration-free Indoor Positioning Systems," *Computer Communications*, Elsevier, vol. 66, pp. 1-13, July 2015.