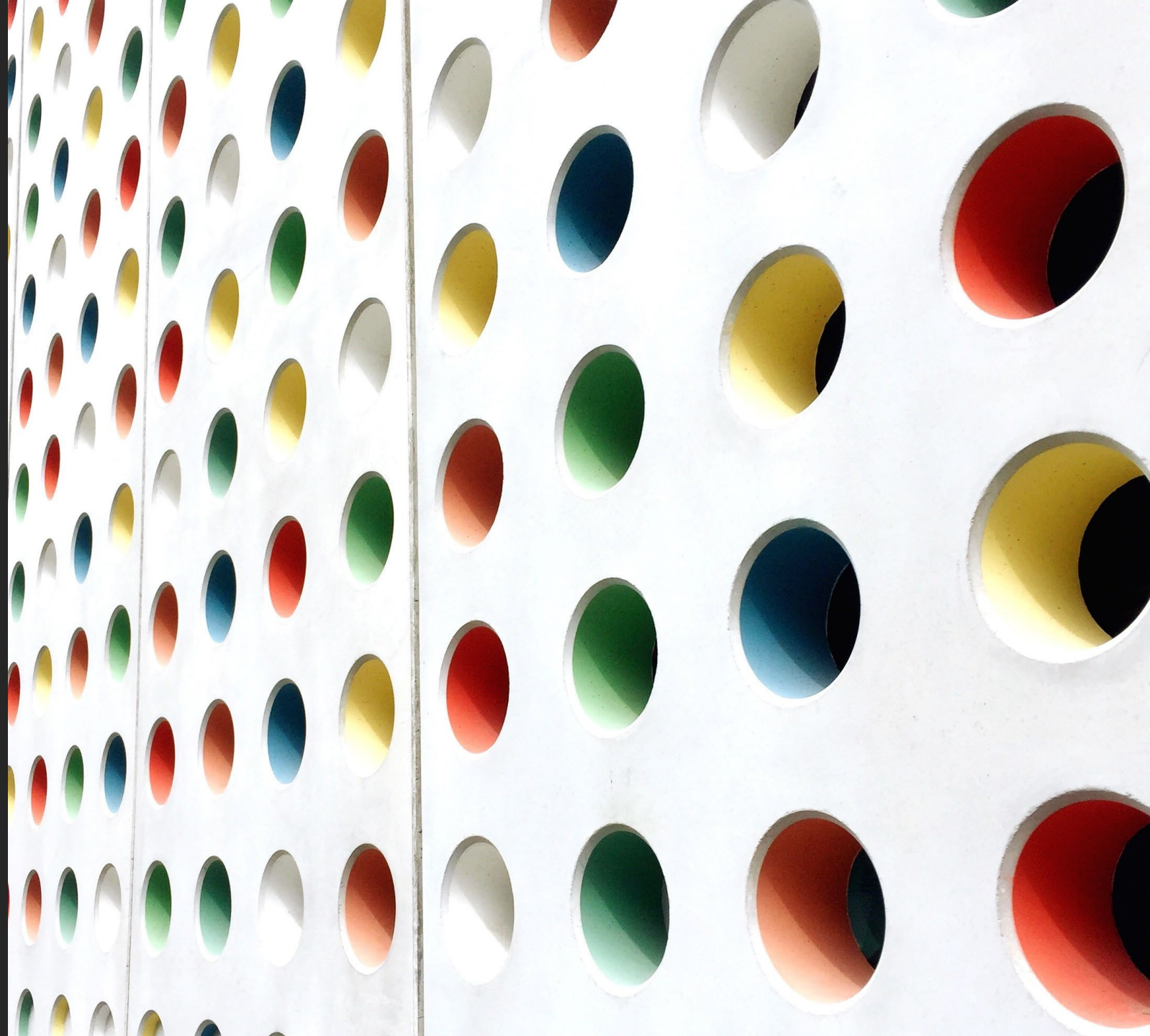
Writing Technical Reports

CG1112: ENGINEERING PRINCIPLES AND PRACTICE

Embedded Communication Engineering Module By The Centre For English Language & Communication (CELC).

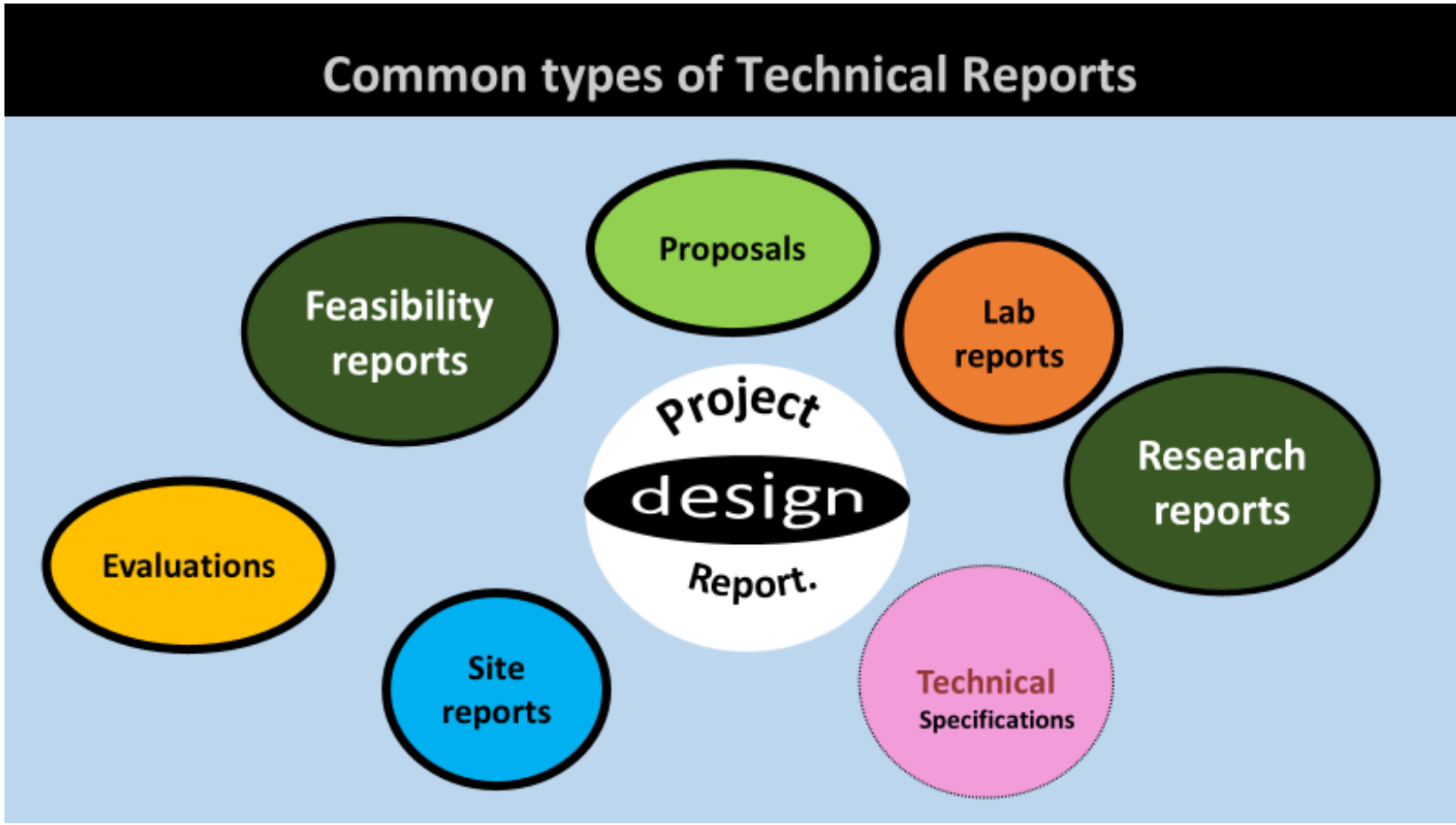


Writing a technical report

How to write your Project Design Report

How does your project design report fit into the world of engineering communication? What is it for?

Technical reports such as lab reports, feasibility reports, site reports, evaluations, proposals and technical specifications, communicate important information about the state, process, progress or the results of technical problems or research. These reports are formal documents that allow a variety of readers—from laymen to technical experts—to make informed decisions in the workplace.



Before you begin writing a technical report, think about who will be reading the report and why?

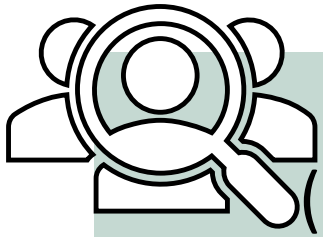
As the workplace includes people with a diverse range of skills, your reader may either have more, or less technical expertise than you. When you write a report, consider the needs and interests of your reader. How much technical knowledge do they have? Why are they reading the report? This will determine what type of language you use and how detailed or technical your descriptions and explanations need to be.

If the audience includes laymen, ensure that you keep technical jargon to a minimum and if necessary, provide a glossary.

Your audience for the Project Design Report consists of your CG1112 lecturers and your peers who have as much, if not more, technical knowledge than you. So, use specific technical terms where required and include the kind of detailed technical information that you have been asked to provide.

The audience

Who is reading the Report?



Mixed audience (including laypeople)

- Use less technical jargon
- Provide brief explanations and definitions of terms that might seem more ‘basic.
- Include a glossary, if necessary

Audience of engineers

e.g., The Design Report

- Use specific technical terms
- Include detailed technical information (as instructed in the project brief).

What do you already know about…

Writing a Technical Report?

Information Engineering Reports identify specific problems in order to provide a solution.

The report **communicates the process, progress and result of a specific project.**

Strong Technical Reports **communicate technical information quickly and easily.**

Your audience (readers) are usually technical readers with equal or greater technical competency.

What do you already know about…

putting together a Technical Report?

Use clear sections so that information they can be accessed easily.

Label, describe and explain graphic illustrations.

Write in complete sentences (continuous writing).

Use transitional words and phrases to ensure that your writing is coherent.

To sum up, aim to write a report that is:

Clear

Ensure that there are no ‘gaps’ in your explanations.

Describe and explain concepts logically and progressively.

Specific

Use precise terms and figures to support your ideas.

Avoid generalizations and vague terms.

For example, avoid ending lists with: ‘etcetera’ or ‘and so on.’

Easy to read

Follow the given format.

Allow readers to locate the information they need quickly.

Writing in a Team

Assign roles: Who will be responsible for …?

Agree on a common and consistent style.

- Do you write Figures 3 to 8 OR Figures 3 through 8?
- Will you provide a legend for tables and diagrams, or will you label them?

Ensure that you are all aware of the stylistic requirements before you begin.

E.g., font, spacing, pagination, format for equations.

Structure

your Project Design Report

The structure of the Project Design Report

Front Matter: Title Page

Sections

1. System Functionalities
2. Review of State of the Art
3. System Architecture
4. Component Design
5. Project Plan

Sections

Back Matter: References

Important points to note

1. EACH section should start with a brief overview that introduces the focus.

   This can be very brief (1/2 sentences) but must be written in complete sentences, i.e. continuous writing.

2. Lists can be useful but if you overuse them, your report will read like a series of lists. This will make it difficult to understand.

3. All illustrations should be clearly captioned, labelled and described in the text.

Front Matter: Title Page

CG1112 Engineering Principle and Practice
Semester 2 2020/2021

"TITLE"
Design Report
Team: __-__-__

Name	Student #	Sub-Team	Role

The 1st section of the Project Design Report

1. System Functionalities

2. Review of State of the Art

3. System Architecture

4. Component Design

5. Project Plan

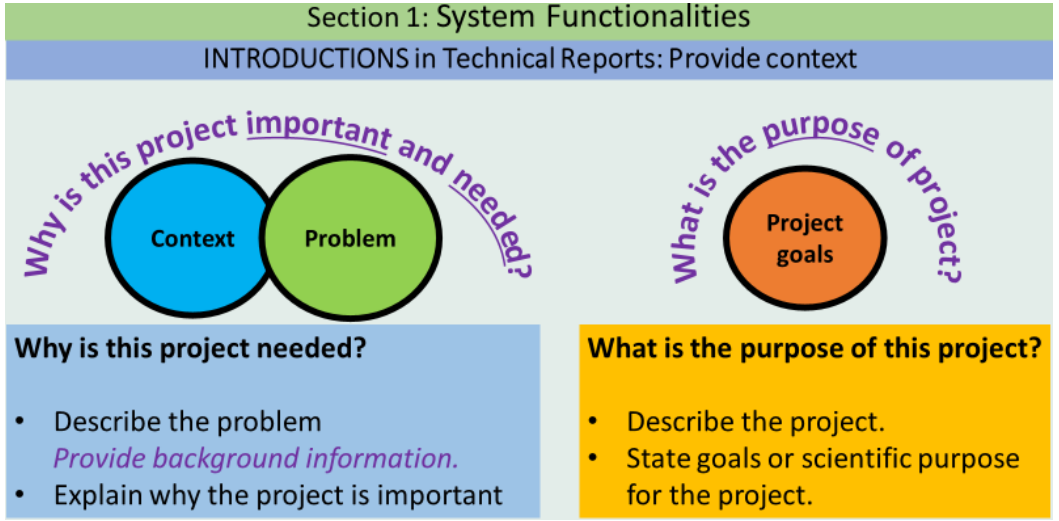
INTRODUCTIONS in Technical Reports: Provide context (General)

The introduction of an Engineering Project Design report introduces a context for the project that is described in the report.

It typically consists of a description of the context (background information) which leads directly to a description of the problem. The discussion of the problem should include the technical background of the problem—for example, you could explain how existing technical solutions do not adequately resolve the problem.

This discussion of problems and inadequate solutions should allow you to highlight the significance of your project and so, lead you to state your goals and how your project will overcome such inadequacies. This is where you should provide should a concise description of the technical specifications of your project design.

Remember this is an introduction and you will revisit this information in the later sections of the report, so keep it brief!



Section 1: System Functionalities

What is it? *Introduction*

Brief and concise **introduction**. (Problem and context)

1. State overall aims of the project. *Concise overview*.

2. Describe what you are going do to realize these aims. *Snapshot of methodology*

3. Describe system functionalities (features and functions of your Alex).

So, what exactly should you put into Section 1?

- Begin by stating briefly, the overall aims of your project. This is the Overview for Section 1.
- **Each of the 5 sections of the report will require an Overview** like this. The rest of the section may be presented as lists but the Overview should always be written in continuous writing.
- Next, provide a summative description of your plan of action. In other words, explain what you are going to do and how you are going to do it.
- Finally, provide specific descriptions of the features and functions of your ALEX. If you have an illustration of your design, include this. However, remember that this illustration will have to be carefully labelled and captioned.

→*Optional: Include a figure of an overview of the design*

Recommended length: Between ½ to ¾ pages

Keep it brief!

Section 1: System Functionalities

Example text

1. State overall aims of the project. *Concise overview*.

Title it: Overview

The robotic vehicle is designed to simulate a search-and-rescue (SAR) robot that may be remotely controlled and operated …

2. Describe what you are going do to realize these aims. *Snapshot of methodology*

To achieve this aim, the robot's movement will be manually and remotely controlled by*….(describe the key features and functions and how they are connected)*

3. Describe system functionalities (features and functions of your Alex).

1. **Moving Straight**

The straight movements are implemented in two steps: 1) map out the environment using the LIDAR…. 2) activate the motors for both wheels forward…

2. **Turning left and right** …

3. **Identifying objects** …

Language point: Tenses

Section 1: System Functionalities

The tenses you use in a technical report are determined by the message you wish to communicate. Use the present tense to describe the overall aims of the project and to describe system functionalities. You may want to use the future tense to describe your plan of action. Note, however, the convention is to use the present tense. The future tense is used sparingly in technical reports.

1. Overall aims of the project.	Present tense
Project Objectives	This report **aims** to…
2. Communicating what you aim to do	Future tense
Plan of action	Alex **will move** through…
3. Describe system functionalities.	**Present tense**
Features and functions	The Doppler Lidar **provides** highly accurate… Our Doppler lidar **uses** three laser beams…

Language point: What do we do with Acronyms?

Section 1: System Functionalities

Now let's look at another language point. What do we do with Acronyms? When you mention a term for the first time, write it out in full followed by the acronym in brackets. Add an **s** to denote the plural form.
When you wish to refer specifically to a component, you may need to include a definite article. Check the conventions within your discipline as some terms will not require an article. For indefinite articles, consider the first letter of the acronym. You say: ***an*** *RPi* and ***an*** *OCU* because of the vowel sound at the beginning of the acronym.

1. First use	Spell out in full, then write acronym in ( )
Examples	Raspberry Pi (RPi) , operating control unit (OCU), Search and rescue (SAR) robots
2. Add 's' to denote plural	OCU (singular) OCUs (plural)
Awkward for RPi	*RPi computers or RPi devices*
3. Definite articles	Check conventions within the discipline
Referring to a specific component	the RPi, the LiDAR, the OCU
4. Indefinite articles	Corresponds with the first letter of the Acronym
Referring generally to the device	an RPi, an OCU, a LiDar

Language point: What do we do with Acronyms?

Section 1: System Functionalities

1. First use — Spell out in full, then write acronym in ( )

Examples Raspberry Pi (RPi) , operating control unit (OCU), Search and rescue (SAR) robots

2. Add ‘s’ to denote plural — OCU (singular) OCUs (plural)

Awkward for RPi *RPi computers or RPi devices*

3. Definite articles — Check conventions within the discipline

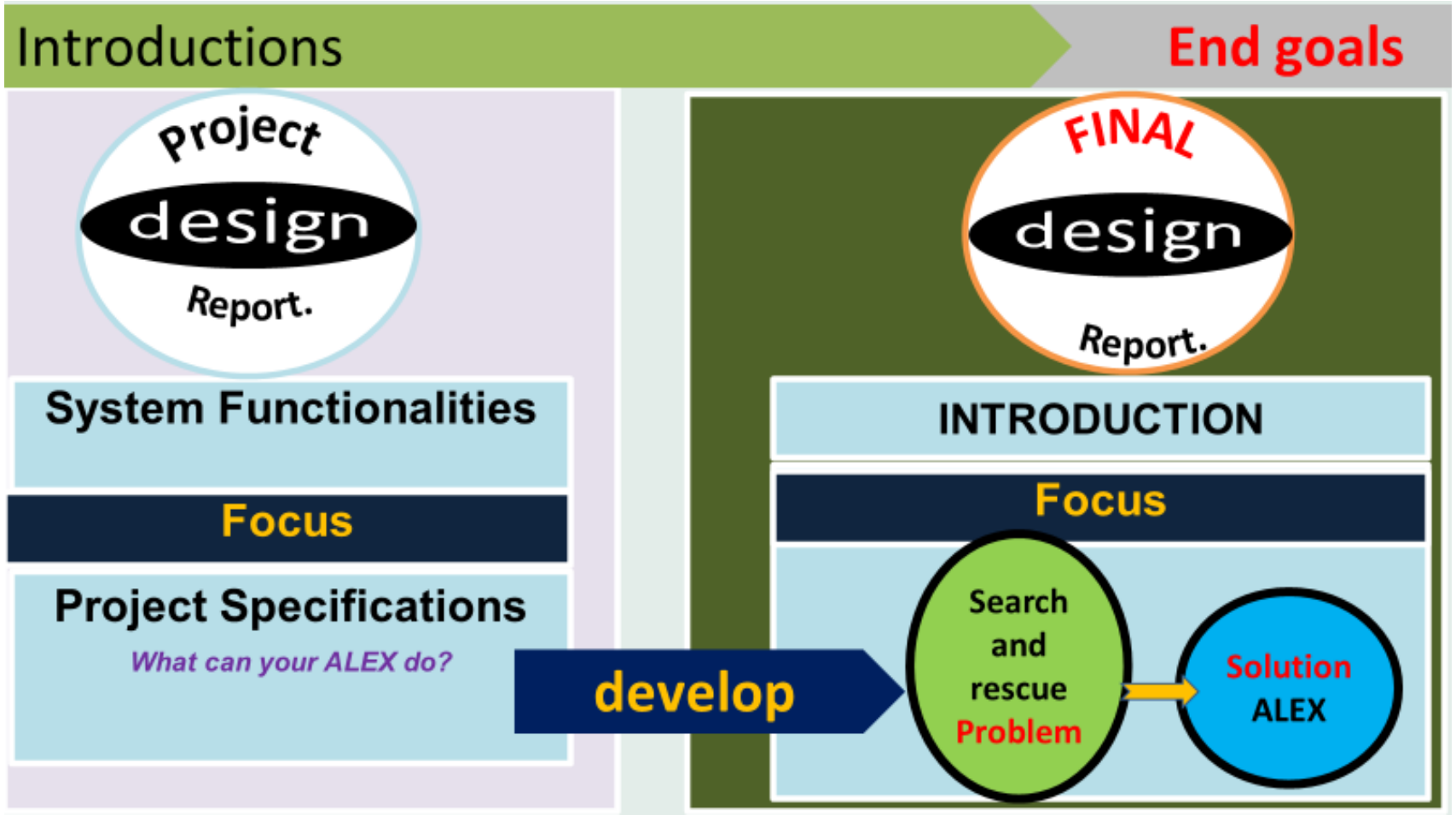
Referring to a specific component the RPi, the LiDAR, the OCU

4. Indefinite articles — Corresponds with the first letter of the Acronym

Referring generally to the device an RPi, an OCU, a LiDar

As you are still working and developing your project, the Project Design Report you have been tasked to write is a very short account of the first stages of your project design. Towards the end of the semester, you will be required to write a second report. The Final Design Report. This report will require an Introduction that describes the problem-solution structure we just discussed more closely.

In this report, you need to focus primarily on what Alex can do. What are your robot's System Functionalities?



The 2nd section of the Project Design Report

1. System Functionalities

2. Review of State of the Art

3. System Architecture

4. Component Design

5. Project Plan

Section 2. Review of State of the Art

What is it? *Brief Literature Review*

1a. Briefly state the purpose of your project.
1b. Concise description of the technical specifications of your project (Alex).

2. Provide technical descriptions of 2 existing solutions. **(sub)Title it: Name of Solution**

Details to include in the description of the 2 solutions **(tele-operating SAR robots)**

1. Brief Description
2. System Functionalities
3. Hardware
   Software
4. Summary of Strengths & Weaknesses

Cite all sources

Section 2. Review of State of the Art

Example text

1. State purpose of your project and then describe it.

The purpose of Alex is a remote rescue robot whose objective is to map out the area. There will be three fundamental functions that Alex is able to perform. The key components are: ….

2. Lit review: Describe two Existing Solutions

**(sub)Title it: _*Name of SAR robot*

1. Duck-bot (Rescue Robot)

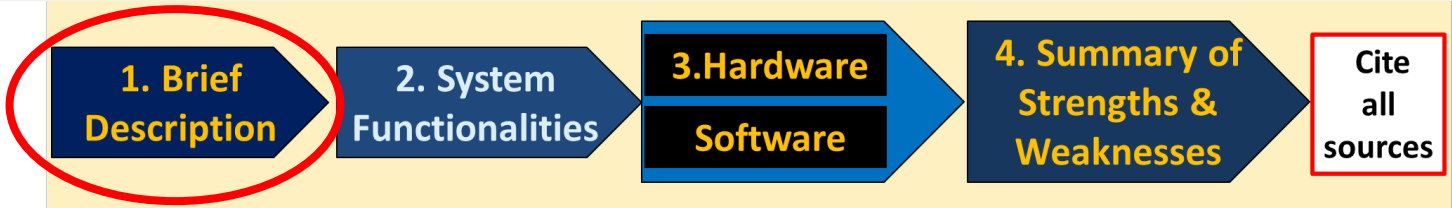
Duck-bot is a search-and-rescue robot created to assist _____by _____. It can be remote-controlled …

**(sub)Title it: _*Name of SAR robot*

2. Or2-bot (Rescue Robot)

Or2-bot is a robot designed to manage_____. It was first deployed in _____where it was used to _____.

Remember to include details for 2-4



Highlight only the details of the two robots that are relevant to your Alex.

Recommended length: About 1 page

Keep it brief!

Review of the State of the Art

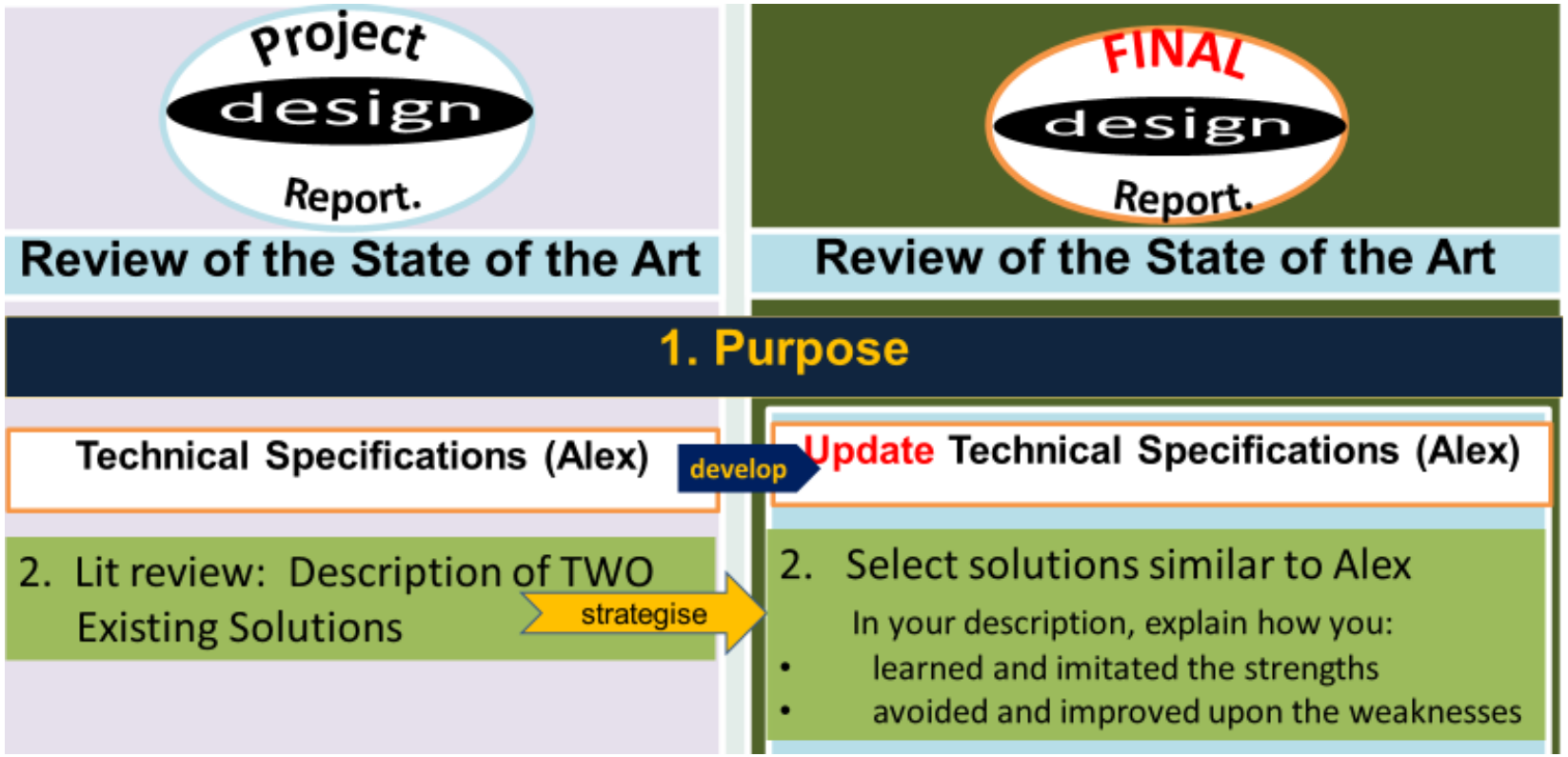
End goals

In the final report, the purpose of your project will probably remain the same. However, it is likely that you will improve on your project design.
This will require you to update your description of the technical specifications of your Alex.

Finally, your review of the two Search and Rescue robots will need to be more strategic in the final report.

In your final report, you will be expected to explain what you learned from robots that are similar in design and how you avoided and improved upon the weaknesses of these two examples.

It is worth keeping these requirements in mind as you complete your project.



Review of the State of the Art

End goals

Review of the State of the Art

Review of the State of the Art

1. Purpose

Technical Specifications (Alex)

develop

Update Technical Specifications (Alex)

2. Lit review: Description of TWO Existing Solutions

strategise

2. Select solutions similar to Alex

In your description, explain how you:

- learned and imitated the strengths
- avoided and improved upon the weaknesses

Language point: Tenses for a Literature Review

Section 2: Review of the State of the Art

Providing background information	Past tense
	Thisbot ***was designed*** to help… Whichbot ***was developed*** in 2015…
Describing system functionalities	**Present tense**
Features and functions	Thisbot **is** capable of generating… Whichbot **offers** greater bandwith…

Language point: Paraphrasing secondary sources

Section 2: Review of the State of the Art

Acknowledge sources using **in-text citations** in the main text of your Report

Rescue missions in underground coal mines are different from rescuing on the ground; thus, researchers have done much work, and many successful applications of rescue robots have been developed and applied [3].

Kasprzyczak et al. [4] designed a pneumatic robot named GMRI…

[3] Reddy, A.H.; Kalyan, B.; Murthy, C.S. "Mine Rescue Robot System—*A Review*," *Procedia Earth Planet. Sci*. 2015, *11*, 457–462.

[4] Kasprzyczak, L.; Trenczek, S.; Cader, M. "Robot for monitoring hazardous environments as a mechatronic product," *J. Autom. Mob. Robot. Intell. Syst.* 2012, *6*, 57–64.

Examples from:

[1] J. Zhao et al, "A Search-and-Rescue Robot System for Remotely Sensing the Underground Coal Mine Environment," *Sensors*, vol. 17, (10), pp. 2426, 2017. [Online]. Available doi:10.3390/s171024262

The 3rd section of the Project Design Report

1. System Functionalities

2. Review of State of the Art

3. System Architecture

4. Component Design

5. Project Plan

Section 3: System Architecture

What is it? ***Diagram***

Focus: Diagram of project System Architecture

1. Introduce your diagram

Example*: Figure 3 illustrates…*

2. Provide a brief and clear description of the structural design of your system.
   a. Describe the diagram clearly.
   b. Explain how essential components (hardware/software) communicate with each other
   c. Describe steps involved.

★*Refer consistently to the diagram in your descriptions.*

Example*:*

The Raspberry Pi functions as…It communicates information obtained from … to

3. Include your diagram **after** the text.
   Number and label all components clearly.

Section 3: System Architecture

What is it? ***Diagram***

Focus: Diagram of project System Architecture

1. To begin this section, write an overview sentence that introduces your diagram.
2. Next provide a detailed description of the diagram.
3. You may have to state what appears to be obvious to you—such as the blue boxes represent a specific component. Remember that what seems obvious to your team—the designers of the project—may not be as apparent to the reader.
4. Make it easy for your reader by providing a detailed description of the diagram before proving a detailed explanation of how the essential components communicate with each other.
5. Then, describe the steps involved in this communication.
6. *Only include your diagram after you have provided the introductory text.*

1. Introduce your diagram

***Example**: Figure 3 illustrates…*

2. Provide a brief and clear description of the structural design of your system.
   a. Describe the diagram clearly.
   b. Explain how essential components (hardware/software) communicate with each other
   c. Describe steps involved.

★*Refer consistently to the diagram in your descriptions.*

***Example**:*

The Raspberry Pi functions as…It communicates information obtained from … to

3. Include your diagram **after** the text.
   Number and label all components clearly.

Section 3: System Architecture

Example

Introduce the diagram with a summative sentence

Describe the diagram clearly

Explain how components communicate with each other

Describe the steps involved.

Highlight key features.

Figure 3 illustrates/shows …

The yellow boxes represent ____while the blue boxes represent_____.

The motor is controlled by the _____.

The XXX program captures the rotation of YYY and communicates this information to ZZZ. The XXX motor acts as a_____ between the XXX and the _____. It converts _____ and sends it to _____. After processing this data, XXX will send a command to _____ causing the XXX to adjust _____.

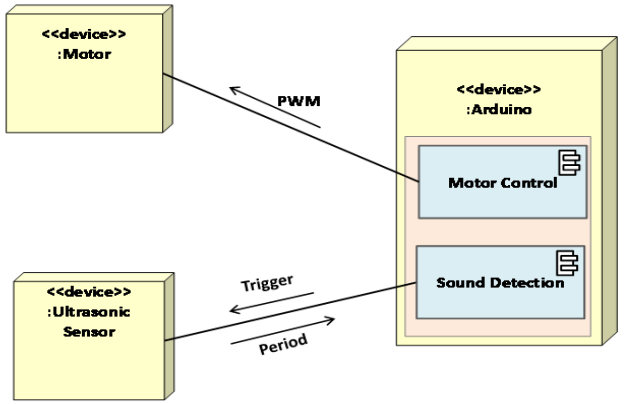


Figure 3: Alex's System Architecture

Style point: Using Figures and Tables

Always precede the figure/table with a description and analyses of the illustration.
Begin with a summative sentence: Figure 3 shows…

Describe the parts and explain how they are connected.
Analyze and interpret numerical data (if featured).
Highlight significant elements in the illustration.

Name each component clearly.

Label everything clearly, even arrows.

Label the diagram. Give it a descriptive title.

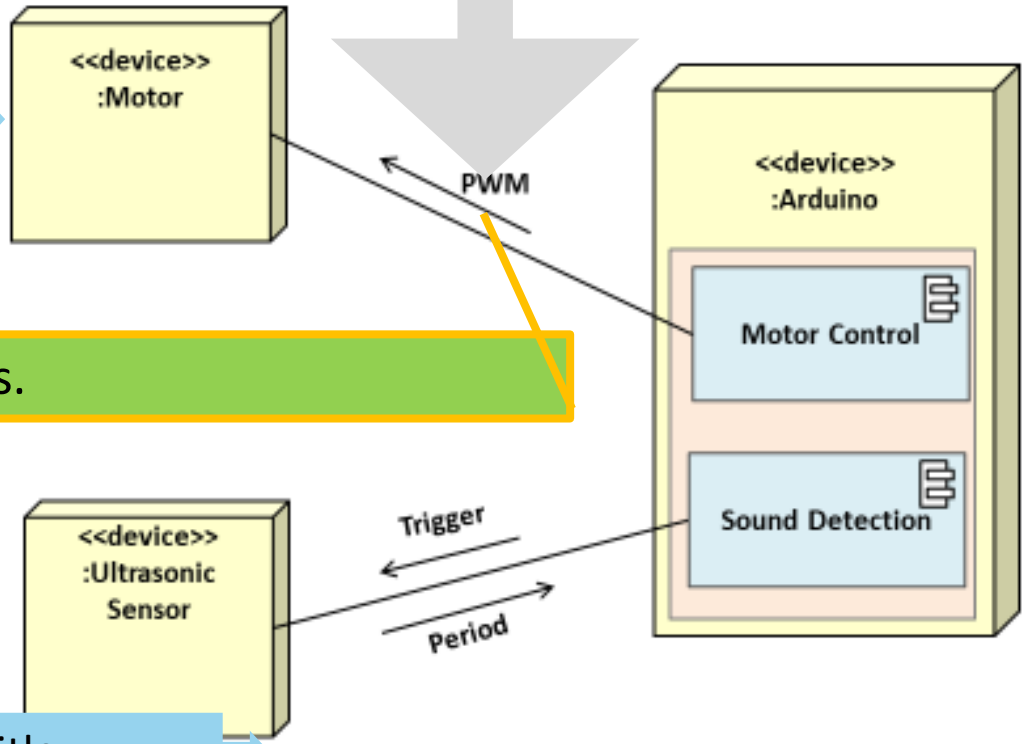


Figure 3: Alex's System Architecture

Language point: Prepositions

Your description of the system architecture will require you to explain how individual parts are connected and how they communicate.
It is thus important to use precise prepositions of place and direction to indicate the location or direction of information and data.

Prepositions commonly used for describing component parts		
Preposition	**The location/direction it indicates**	**Example**
around	on every side OR encircling	• the plate revolves **around** the cable… • arms rotate **around** the wheels
between	the space along 2 points	• The communication **between** the laptop and the robot… • a spring mechanism is placed **between** the arm and the side track
for	length of time how far something goes purpose/function	• **for** about 2 hours • **for** 1/5 kilometres • The sensor system is used **for** detecting… • **for** distance measurement… • designed **for** tensioning the track…
on	indicates a point on a surface	• propelling the robot **on** ramps… • This camera is installed **on** a spring…
with	having OR working together	• a helical gear set **with** a ratio of 2.56… • the beginner driver works **with** Adora

Language point: Prepositions

Section 3: System Architecture

This slide provides a few examples of how prepostions are used to describe System Architecture.

Use accurate **prepositions of place and direction** to describe your structural design

Examples of preposition use

The communication **between** the OCU and the search-and-rescue robot is **through** a 1-km fiber-optic cable …

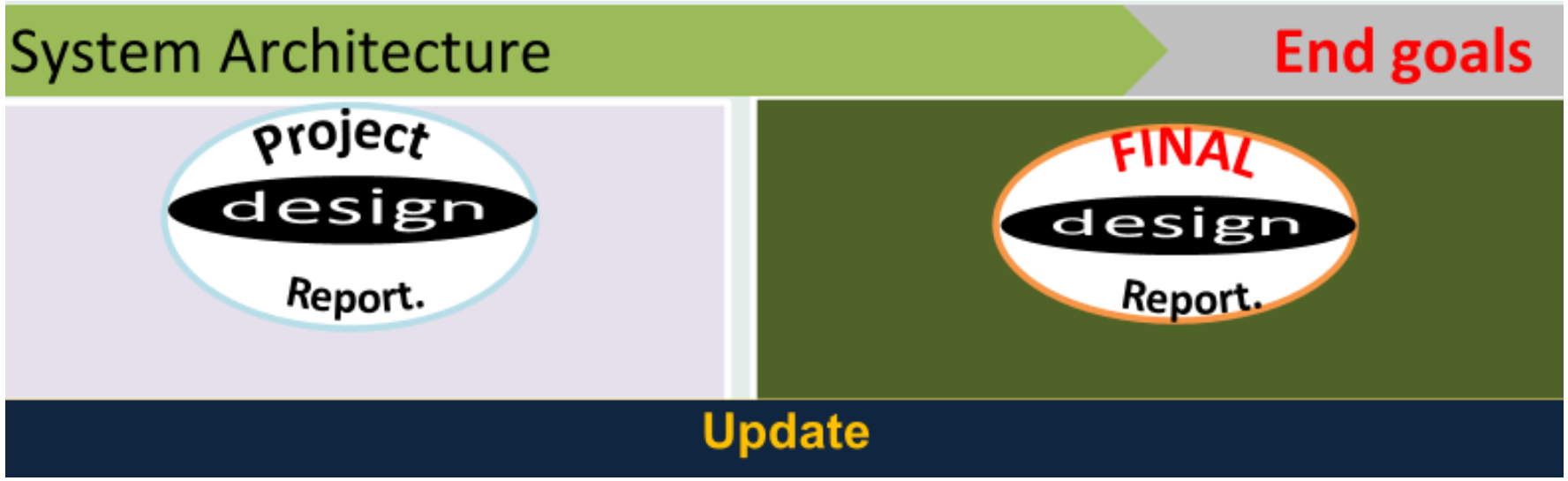
The fiber-optic cable reel spool **on** the plate can revolve **around** the fiber-optic cable box's axis smoothly **by** a small pulling force (shown in Figure 7),

The Tri-wheel consists of three wheels which are arranged as an upright triangle with two **on** the ground and one **above.**

System Architecture

End goals

As you will probably develop a more complex design in the coming weeks, the system architecture for the final design report will probably need to be updated.
Keep careful notes as you develop your Alex—this will make the task of putting this section together in the final report less painful. Now let's move on to the most technical section in the report.



The 4th section of the Project Design Report

1. System Functionalities

2. Review of State of the Art

3. System Architecture

4. Component Design

5. Project Plan

Section 4 describes and explains the steps needed to solve the problem. Begin with a concise overview of the overall function of the design and explain how it interacts with other components.
Next, list the high-level algorithm or steps needed to solve the problem. This should be brief.
Follow this with a more detailed description of the algorithm. Expand the more complicated steps.
Provide illustrations to help support your descriptions where possible.

Section 4: Component Design

Focus : Technical detail about the components and subcomponents

1. Overview

Explain overall function and how it interacts with other components

2. Describe the steps needed to solve the problem (high level algorithm).

3. Expand the more complicated steps. Provide information (data) and hardware components).

4. Provide illustrations where possible (e.g., formula, charts, diagrams)

Section 4: Component Design

Example

As with the 3 preceding sections, begin with a brief overview of the components. Next, provide the high-level steps, finally describe the high-level steps in detail. Use sub-headings to indicate the 2 sub-sections, *High-level steps* and *Further Breakdown of Steps*, as shown.

1. Brief overview of the components.

2. High level algorithm

3. Detailed breakdown of algorithm

Section 4: Component Design

This section will focus on the XXX, and how it establishes communication with the YYY. The primary purpose of the XXX in Alex is ____. The algorithm _____ is represented _____.

High level steps:

1. Initialisation and calibration
2. Receive user command

Further Breakdown of Steps:

1. Initialisation and calibration

During initialization, Alex is turned on, and the XXX and the YYY would be connected at a baud rate of _____bps.

Language point: Parallel structures and lists

As you might have noticed, the descriptions provided for Section 4 in the given example were presented as a list.
As this section requires you to list steps in a sequential order, let's learn how we can make your lists more readable.
The first important point to note is that lists should follow a parallel structure.
Parallel structures are easier for readers to process as the reader's eye (and ear) is primed for the pattern of the information.
Now let's look at the embedded list in Example 1: *The robot can climb, able to roll, glide and also spinning*. This sentence is difficult to read, is ungrammatical and confusing.
Example 2 uses a parallel structure—which means using the same grammatical pattern or structure—*The robot can climb, roll, glide and spin*--vastly improves the readability of this sentence.
In short, to create parallel structures, simply repeat grammatical patterns by using the same grammatical structure.

Example of parallel structure

Example 1: The robot can climb, able to roll, glide and also spinning.

Example 2: The robot **can** climb, roll, glide and spin.

Use the same grammatical structure.

Language point: Parallel structures and lists

Section 4: Component Design

How to use parallel phrasing in lists.

Notice that each item on the list is a verb.
It is also in the past tense.
This repeated and expected pattern makes for faster reading

start with the same part of speech (noun/verb)

use the same verb tense (present/past)

use the same sentence type (statement/question)

use the same voice (passive/active)

Use numbered lists when the items in the list must be:

- **ordered** in a specific sequence.
- **communicated** chronologically.
- **referred** to at a later point.

Use **bulleted lists** when:

- You can arrange the points in any order.
- You want to emphasize the points.
- You want to enhance the readability of your text.

Warning! Do not overuse!

A list must be supplemented with explanatory text that explains what it is and why it is necessary. A series of lists does not provide enough information.

Language point: Lists

Section 4: Component Design

Use parallel structures.

Keep your list on one page (Do not let it spill over to the next page).

Include 2-8 items in one list. Do not have more than 8—makes it difficult for the reader to focus.

Use a signal phrase to introduce your list (must contain Subject and verb).

Warning! Do not overuse!

A list must be supplemented with explanatory text that explains what it is and why it is necessary. A series of lists does not provide enough information.

Language point: Lists

Run-in Lists

Section 4: Component Design

A run-in list consists of a list of numbered items within a sentence. To create such a list, use a signal phrase and put a colon at the end of it, before the list begins. End each item of the list with a semi-colon and as always, ensure that you use a parallel structure.

The signal phrase should end with a colon

Finally, the rescuers were familiar with the robot system and gave us some advice, which is summarized as follows:(1) **the** robot is heavy and inconvenient to transport, and its weight **should be** reduced; (2) **the** rescuers advised that the robot **should be** assembled with more than 4 cameras to observe every perspective easily; (3) **the** robot **should be** much faster on the roadway to save rescue time; (4) they needed a much conciser and easier interactive interface for their understanding.

Use **parallel phrasing**.

Separate items on the list with semicolons

Example from:
J. Zhao et al, "A Search-and-Rescue Robot System for Remotely Sensing the Underground Coal Mine Environment," *Sensors*, vol. 17, (10), pp. 2426, 2017. [Online]. Available doi:10.3390/s171024262

Language point: Numbered Lists

Numbered lists are particularly useful for describing a set of items in order. For this reason, numbered lists are very common in technical reports. If you wish to use numbered lists in this Section, ensure that you follow these guidelines.

Introduce the list with a signal phrase

The test results of MINBOT II are also listed for comparison:

(1) Mobility: With the help of support legs, the robot could go up and down stairs and pass the barriers (shown in Figure 26b,c). The robot could climb about a 26 slope (shown in Figure 26e).

(2) Communication: The communication ability was tested when the robot was under remote telecontrol mode and semi-automatic mode. Including the enforceability and reliability of communication between the robots and OCU. The images, sounds, command messages and environmental information could be transmitted correctly.

(3) Battery supply capacity: All the components of the MSRBOTS are powered by the batteries...

Indent the list so that the sequence of numbers is apparent.

Use **parallel structures**.

Example from:

J. Zhao et al, "A Search-and-Rescue Robot System for Remotely Sensing the Underground Coal Mine Environment," *Sensors*, vol. 17, (10), pp. 2426, 2017. [Online]. Available doi:10.3390/s171024262

Language point: Bulletted Lists

As bulleted lists do not indicate a sequential order, they are not appropriate for describing high- level steps. However, you may wish to use a bulleted list in another part of your report as they do help highlight information to the reader. If you do so, follow these guidelines.

Use the lowercase if the items in the list are not complete sentences

Introduce the list with a signal phrase
All signal phrases must have a subject and a verb but they do not have to be complete sentences.

The term design project must allow students to design a solution using
- mechanical engineering principles;
- electrical engineering knowledge;
- software/programming basics.

If the signal phrase is an incomplete sentence, do not use any punctuation at the end of it.

Indent the list. The white space will help enhance the readability of your list.

Use semicolons between items and a full stop at the end of the list.

Language point:Lists

Section 4: Component Design

Bulletted Lists

Introduce the list with a signal phrase
All signal phrases must have a subject and a verb but they do not have to be complete sentences.

Use the lowercase if the items in the list are not complete sentences

The term design project must allow students to incorporate the following elements into their solution:

- mechanical engineering principles;
- electrical engineering knowledge;
- software/programming basics.

If the signal phrase is a complete sentence, place a colon at the end of it.

Indent the list. The white space will help enhance the readability of your list.

Use semicolons between items and a period at the end of the list.

Example from:
J. Zhao et al, "A Search-and-Rescue Robot System for Remotely Sensing the Underground Coal Mine Environment," *Sensors*, vol. 17, (10), pp. 2426, 2017. [Online]. Available doi:10.3390/s171024262

Component Design

End goals

Section 4: Component Design → develop

1. High level steps (algorithm)
2. Detailed Breakdown of Algorithm

Section 4: Hardware Design

- Photo with components labeled
- Additions you made [optional]

Section 5. Firmware Design

- High level algorithm (Arduino)
- Communications protocol
- Notes on software [optional]

Section 6. Software Design

i. High level algorithm (Pi)
   a) Teleoperation
   b) Autonomous

1. Notes on software [optional]

The 5th section of the Project Design Report

1. System Functionalities
2. Review of State of the Art
3. System Architecture
4. Component Design

5. Project Plan

Section 5: Project Plan

What is it? ***Timeline***

Focus: Project Timeline

1. Overview — *Introduce the table:* Table 1 below lists the goals for each…

2. Table: Timeline of deliverables.

Week	Set goals	Action done by	Milestones/Submissions completed	Remarks
1	Movement functions: – Go straight, turn left/right – User commands to control Alex remotely Integrate Extra Sensors Ultrasound, IR sensor and IMU to Arduino and Raspberry Pi LIDAR mounted onto Alex	Hardware Sub-Team: xxx and xxx	Week 8	Design of Alex with additional motors

Provide specific goals.

Style : Figures and Tables

Section 5: Project Plan

Figures should be numbered separately and in the sequence in which they are referred to in the text.
The first figure is Figure 1, the next Figure 2, and so on, in sequence.

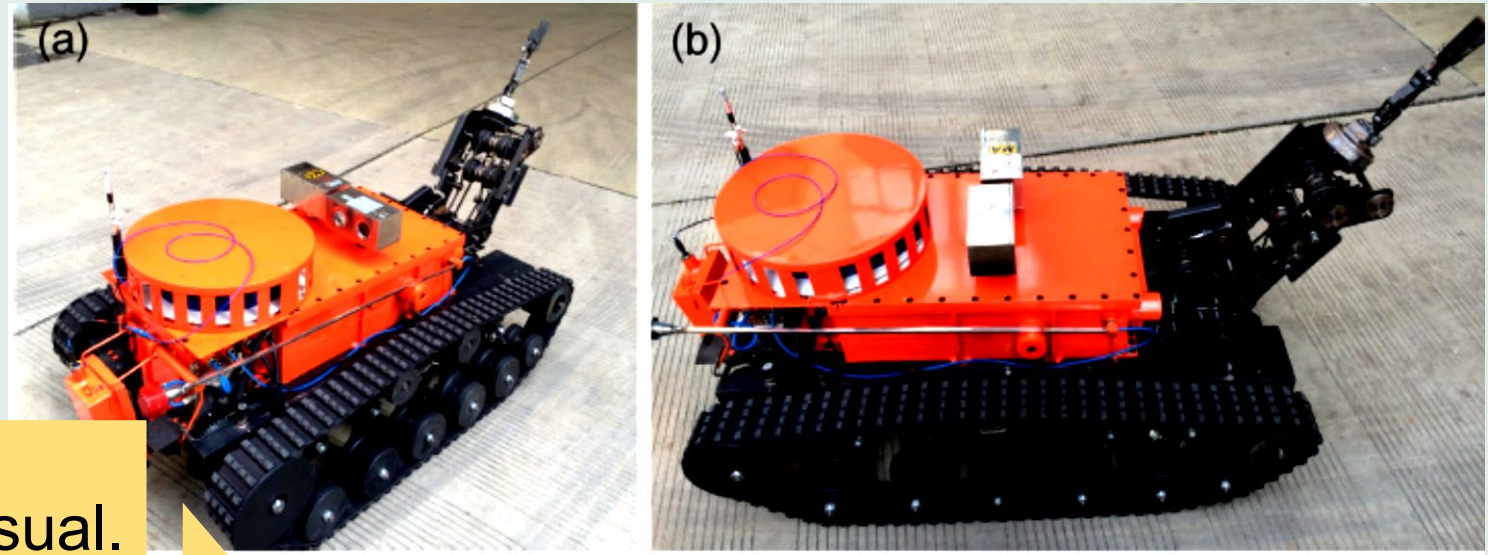


Figure 3. The coal mine search-and-rescue robot is shown in (a,b).

The title should appear **below** the visual.

- Give all figures/diagrams a number and title.
- The title should be descriptive.

If you take a figure from a secondary source, cite it.

Example from:
J. Zhao et al, "A Search-and-Rescue Robot System for Remotely Sensing the Underground Coal Mine Environment," *Sensors*, vol. 17, (10), pp. 2426, 2017. [Online]. Available doi:10.3390/s171024262

Style : Figures and Tables

Section 5: Project Plan

The title should appear **above** the visual.

- Give all tables a number and title.
- The title should be descriptive.

Table 3. The MSRBOTS testing results.

Items	MSRBOTS	MINBOT II	Units
Height of vertical obstacle	0.15	0.5	m
Continuous steps	0.12 × 0.4	no data	m
Climbing angle	26	no data	°
Wading depth	0.3	no data	m
Ditch width	0.4	0.6	m
Communication distance	2000	1000	m
Power supply time	5	no data	h

Tables should be numbered separately and in the sequence in which they are referred to in the text.
The first table referred to is Table 1, the next Table 2, and so on, in sequence.

Cite the source—if you take a figure from a secondary source.

Example from:
J. Zhao et al, "A Search-and-Rescue Robot System for Remotely Sensing the Underground Coal Mine Environment," *Sensors*, vol. 17, (10), pp. 2426, 2017. [Online]. Available doi:10.3390/s171024262

What is formal language in technical writing?

Language point: Formal, objective register

Sections1-5

Focus on the technical process and facts

Minimize the use of the first person (***I, we***) and possessive pronouns (***mine, ours***)

Example 1A: Included in this section, are **our** considerations for the software development of XX.

Example 1B: This section, describes plans for the software development of XX.

Focus on the action not the doer

Example 2A: Through the remote laptop, we can control the RPi as if we had a direct connection to it.

Example 2B: The RPi may be controlled directly through the remote laptop.

★**Avoid** statements of opinion and feeling: E.g. “I think,” “We feel,” “In our opinion.”

Important Language point: Formal, objective register

The advice to avoid personal and possessive pronouns should not prevent you from using *we* and *ours* in descriptive sentences that will become overly complex if a more passive sentence structure is used.

The most important guideline in this case is to ask if the personal or possessive pronoun allows you to communicate the idea more clearly. If the answer is 'yes,' then you should go ahead and use the personal or possessive pronoun.

However, avoid using subjective language: *I think*, *We feel*, etc.

Minimize the use of the first person (***I, we***) and possessive pronouns (***mine, ours***) where possible.

Language point: Formal, objective register

Avoid slang and overly informal language. Keep your writing simple but formal.

Formal	Informal	Slang
Some of the research presented was **inaccurate.**	Some of the research presented was **wrong.**	Some of the research presented was **off.**
The start-up company has filed for **bankruptcy.**	The start-up company is **broke**.	The start-up company has **gone bust.** The start-up company has **gone kaput.** **Avoid figurative language.**
The research was **insubstantial**. The word **insubstantial** is formal but **subjective** and needs to be complemented with objective evidence.	The research was **lousy**. **Avoid subjective language.**	The research was so **basic**. **Avoid current slang.**
When you are young, you should **try everything, no matter how misguided or dangerous.**	When you are young, you **should go wild.**	When you are young, **YOLO.** **Avoid internet slang.**

Language point: Formal, objective register

Avoid slang and overly informal language. Keep your writing simple but formal.

Formal	Informal	Slang
The workers will have to cut **10 000 tonnes** (provide an accurate number) of steel. **Formal writing is precise and specific.**	The workers will have to cut **a lot of** steel. This is too vague to be formal.	The workers will have to cut **massive amounts** of steel. **Exaggerated language (or hyperbole) signals an informal register.**
The theory is **flawed** and **contributes little to the current discussion.** **Formal writing must appear objective and measured.**	The theory is **nonsensical** and **useless**. **Biased language is dismissive and signals an informal register.**	The theory is **rubbish**. **Casual language often oversimplifies.**
In summary, several studies have **concluded** that the biodiversity of the world's rainforests must be **safeguarded**.	**In a nutshell**, several studies **hold the view** that we must **stand guard** over the biodiversity of the world's rainforests. Idiomatic phrases and clichés signal a more informal register.	**To wrap up**, many studies **have done the math to let us know** that we must try to **keep** the biodiversity of the rainforests in the world.

Project Plan

End goals

Section 5: Project Plan

7. Lessons Learnt—Conclusion

Detailed project timeline

List in specific **detail every task** you need to complete in order to complete the project.

evaluate

reflect

1. Two biggest mistakes made

2. Two important lessons learned.

Back Matter: References

Use the IEEE style guide to format your references.

The title, **References,** should be left justified or Centred.

Use a hanging indent so that the sequence of numbers is easy to see.

List references numerically in the order that they appeared in the main text of the report. Use square brackets for the numbers.

References

[1] M. Patil, "Corporate Medicine: The Economics of Physician-Owned Specialty Hospitals," *The Science in Society Review (NUS)*, vol. 7, pp. 22-23, Spring 2010.

[2] The NHS Confederation. (2014, May 10). *Challenging bureaucracy* [Online]. Available: http://www.nhsconfed.org/~/media/Confederation/Files/ Publications/Documents/challenging-bureaucracy.pdf

[3] J. M. Eng, "New results in linear filtering," J. Basic Eng., vol.83, pp.95-108, Mar. 1999.

[4] E. R. Smith, "A Two-Tiered Healthcare System: Is there anything new?" *Canadian Journal of Cardiology*, vol. 23, no. 11, pp. 915–916, Sep. 2007.

A quick guide to IEEE Referencing

Numbering.
1. Use square brackets.
2. The number given should correspond to the number in the in-text citation.

Author name
1. Use initials for the author's first name.
2. Spell out the surname in full.

Italicize book titles and journal titles

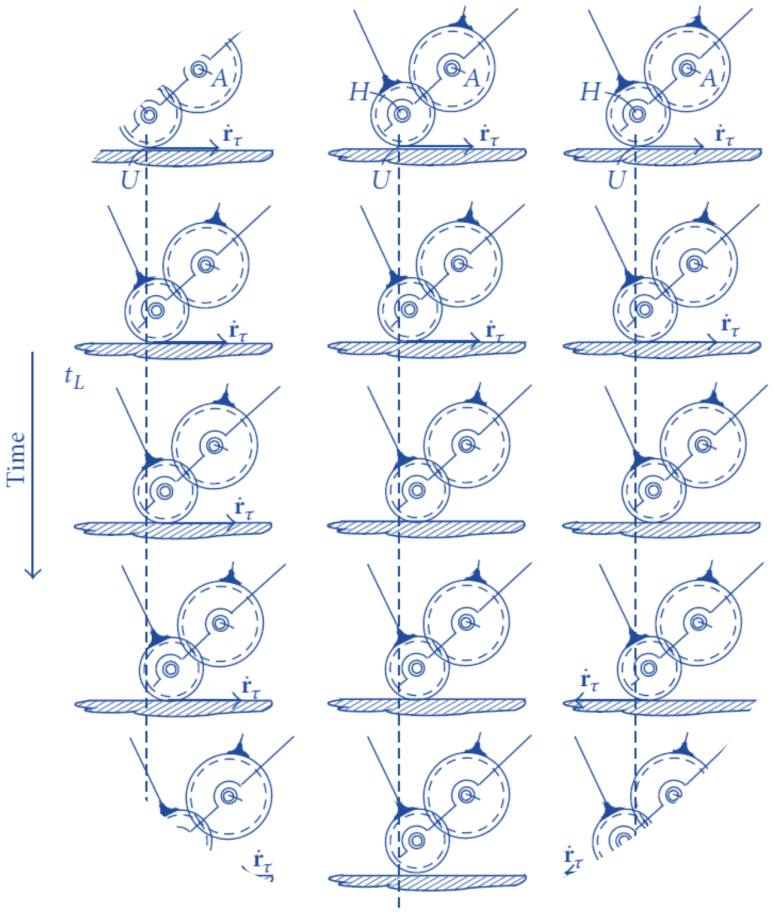
[1] N. Dunbar, *Arduino Software Internals: A Complete Guide to how Your Arduino Language and Hardware Work Together*. (1st 2020. ed.) 2020.

Indent the second line

State the edition

State the year of publication.

For more help on IEEE references
See: https://libguides.nus.edu.sg/c.php?g=145626&p=955413 OR
https://libguides.murdoch.edu.au/IEEE/home



Key points to remember

- Focus on presenting information clearly.
- Use formal academic language.
- Be concise and precise.

When will you see your CELC tutors?

WEEK 8

12 MARCH

WORKSHOP 1

Drafting the Project Design Report →Final Design Report

Week 12

9 APRIL

WORKSHOP 2

Peer-review:
Evaluate another team's Final Design Report

WEEK 13

12-16 APRIL

CONSULTATION WITH TUTOR

FINAL DESIGN REPORT

Good luck with your Project Design Report!