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**SCHOOL OF ELECTRONIC ENGINEERING**

A Final Project report in

Simulation and exploration of THz TRNASMISSION LINES

By Mohammed AL shuaili

BACHELOR OF ENGINEERING

IN

ELECTRONIC AND COMPUTER ENGINEERING

MAJORING IN

THE INTERNET OF THINGS

Supervised by Dr Marissa Condon

# Acknowledgements

# Declaration

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Name: Mohammed Al shuaili Date: 8/2/2025

# Abstract

This Microsoft Word document file is intended to fulfil two purposes: *to act as a template* for the generation of a project report for the Final Year Projects in the School of Electronic Engineering’s undergraduate degrees and to give *examples and guidelines for the writing* of this report. It is suggested that you make a copy to act as the template for your document and that you keep a copy of the original (this document) to access the guidelines as required.

The abstract should briefly tell me, the reader, about this document. Basically, having read the abstract, the reader should be able to determine if it is worthwhile reading any further. The abstract should concentrate on the content of this document, not on the state of the art, or the wider implications of the research work of which this is a part. It should delimit the scope of the work by indicating how far you have gone. It should not, however, detail the document on a chapter-by-chapter basis. After looking at the abstract, a reader is likely to read the conclusions to see exactly what has been achieved. Abstracts are generally 100-250 words, and address a more technical audience. The abstract should include

* An introductory sentence that create interest and draws attention to the topic;
* The project definition and goals;
* The method of solution;
* The results; and,
* The conclusions.

Place the abstract on a separate page single spaced with no indentions.

(Even though the remainder of the document uses 1.5-line spacing, the text in this Roman numeral section is usually single-spaced). This is revision 2.0 of this document. We hope to continue to make improvements to this document as we gain experience of its use.

Table of Contents

[Acknowledgements ii](#_Toc443488856)

[Declaration ii](#_Toc443488857)

[Abstract iii](#_Toc443488858)

[Chapter 1 - Introduction 1](#_Toc443488859)

[1.1 Equipment and Software 2](#_Toc443488860)

[1.1.1 The Intelligent Camera (ICAM) 2](#_Toc443488861)

[1.2 Writing an academic report 2](#_Toc443488862)

[1.2.1 Issues in Technical Writing 2](#_Toc443488863)

[1.2.2 Figures and Diagrams 6](#_Toc443488864)

[1.2.3 The Document Structure 7](#_Toc443488865)

[1.2.4 Summary 9](#_Toc443488866)

[Chapter 2 - Technical Background 10](#_Toc443488867)

[2.1 Using Heading Styles 10](#_Toc443488868)

[2.1.1 Heading 1 Style 10](#_Toc443488869)

[2.1.2 Heading 2 Style 11](#_Toc443488870)

[2.1.3 Heading 3 Style 11](#_Toc443488871)

[2.1.4 Other Headings 11](#_Toc443488872)

[2.2 Summary 11](#_Toc443488873)

[Chapter 3 - Design of … 12](#_Toc443488874)

[Chapter 4- Implementation and Testing of … 13](#_Toc443488875)

[Chapter 5 - Results and Discussion 14](#_Toc443488876)

[Chapter 6 – Ethics 15](#_Toc443488877)

[Chapter 7 - Conclusions and Further Research 16](#_Toc443488878)

[References 17](#_Toc443488879)

[Appendix 1 18](#_Toc443488880)

[Glossary 19](#_Toc443488881)

[This table has been automatically generated using Heading styles (see Chapter 2) – please remove this note for your document; this table is indicative – check the marking rubric to ensure you have covered all the necessary content]

Table of Figures

[**Figure 1.1**. A Nice Picture. 1](#_Toc381621110)

[**Figure 2.1** A Sample Figure 10](#_Toc381621111)

# Chapter 1 - Introduction

The ability to use image motion is a basic low-level capability of the human vision system, and humans use this ability to the utmost. It allows humans to judge time to collision, to track objects and to achieve many other tasks such as 3-D object identification [1]. The development of motion estimation and description tools for the visually disabled could help with the various day-to-day tasks that they find are problematic. The qualitative estimation as well as qualitative interpretation of the motion in image sequences is an emerging research area with many different viewpoints available on how to automate the task [2, 3].



**Figure 1.1**. A nice picture, the caption of which should be a brief stand-alone description of its content. Note that captions of figures are always *below* the figure, while captions for tables should always appear *above* the table. Also note how indentation and line spacing is used to distinguish the caption from the surrounding text.

Although motion analysis is in itself a division of computer vision, it also embodies a number of topics, etc. ... Note: Figure captions from MS Word were used, to allow the automatic creation of the table of images insert->caption. To reference the figure you can then use insert->cross reference, like see Figure 1.1. You can then update this figure without affecting the document.

It is also useful to use the numbering format above for figures where the chapter number is first, then the image number within the chapter. If your document becomes large and unworkable with Word then you can break down the document into a single document for each chapter. This numbering format allows you to insert figures into an early chapter without having to modify each subsequent chapter.

If you are inserting figures into a report, something to keep in mind is the image format when creating the image (It does not matter once inserted into Word):

* JPG/JPEG – Perfect for photos and spatially detailed images. Do not use for screen grabs or for line art figures or diagrams, as they will appear blocky.
* GIF – suitable for compression of low colour diagrams, such as figures, screen grabs etc. It should not cause any block effects on your images.
* BMP – fine for all diagram types – but usually very large images.
* EPS – excellent for line art/diagrams. Word does not display the high quality version on the screen, but they will print perfectly. Can be large if they contain images (use insert->picture->from file for this format).

## 1.1 Equipment and Software

### 1.1.1 The Intelligent Camera (ICAM)

The intelligent camera is a highly complicated piece of image processing equipment. It allows images to be captured into framestores and various image-processing operations to be …

## 1.2 Writing an academic report

In this and the following sections, a number of guidelines for the writing and presentation of an academic project report are given. These mostly reflect the author’s own experience of common mistakes made by students in their technical writing.

### 1.2.1 Issues in Technical Writing

**Paragraphs and Text structure**

There are two different ways of starting a new paragraph in the text. The first is to leave a blank line and start at the left margin. The second is to leave no blank line, but to indent by one tab space, except for the first paragraph of a section. Use *one approach or the other*, but not both at the same time or do not mix them in a document (as is deliberately done below).

Also on the topic of paragraphs, it is unusual to find a paragraph with just one sentence, or paragraphs more than a half of a page in length. It is usually a sign that you need to think about how you are presenting your ideas. On the other hand, a single paragraph is supposed to be about a single subject, so the subject above all else should dictate the length of a paragraph, so a two-page paragraph cannot be ruled out if the subject justifies it.

Another common mistake in relation to paragraphs is an author starting a new paragraph with a sentence containing pronouns such as “it” or “this”. Doing this usually means that you are carrying over the subject of a previous sentence. You should, instead, start a new paragraph by restating the subject in the first sentence. So, instead of starting a paragraph with “This is also the approach used in Feynman’s work”, you start it with “The Laplace method is also the approach used in Feynman’s work”. The reason is that a new paragraph is intended to indicate a new subject. If you use a pronoun, it indicates that you have not actually changed the subject because you are referring to some previously mentioned subject, and it may not be clear which one.

On the issue of spacing after headings, the spacing used for the heading of this subsection is about right. Any more and the heading looks like a disembodied spirit floating in thin air. Any less and the heading is difficult to distinguish from the text following it. Never leave more than one space at any point in your text, particularly in the middle of a sentence, but also after a full stop. Let the word processor sort out the appropriate spacing.

With regard to justification of paragraphs, text that is both right- and left-justified looks aesthetically pleasing, and is easier to read as the words are more spread out and differentiated. Never leave more than one space horizontally between words in your text, either in the middle of a sentence, or after a full stop. Let the word processor sort out the appropriate spacing.

**Problems with Punctuation**

Another very common problem in student dissertations is the improper use and abuse of punctuation. Understand the proper use of all the common punctuation marks: the full stop, comma, colon, semicolon and apostrophe. The general spacing rule for the first four of these is NO space before the punctuation and ONE space after it. Note “cat’s food” and “the pair of cats’ bed” for the use of the possessive in singular and plural. Also “its” is a possessive pronoun (an exception to the “cat’s” rule) and “it’s” is a contraction of “it is”.

Note the use of brackets in the paragraph above: no spaces between the word nearest the bracket and the bracket itself and one space outside the bracket (with the exception of a punctuation mark like the colon above).

**Verbs**

Verbs are the ‘work-horses’ of your writing, so it is important to get the person, number and tense correct. On the question of the person of a verb, when do you use the first person? Well, the answer is, *very* seldom, at least in technical literature. You normally use the passive voice unless you *know* otherwise ⎯ and then you know, so you don’t need to worry.

Mostly the number of a verb will be clear: “There *is* an egg …”, or “There *are* oranges …”. However, watch out for the tricky cases where you have a singular thing that is a collection of other things. So it is correct to say: “The box of oranges is heavy”, not “The box of oranges are heavy”.

Be particularly careful about the tense of verbs used in technical documents. When you are referring to something in the present document, either before the present point in the document or after it, you must use the *present tense*, as you are referring to a part of the document that clearly exists in the present. So you should write “This point *is* further elaborated in Section 4.6 below”. Do not use “was” or “will be” in this context. The present tense is also used for things that were true in the past and continue to be true. For example: “Each time we run this experiment we get the same result”. On the other hand, use the past tense of a particular event that happened in the past. For example, “On the last run of the experiment, the apparatus exploded”.

Finally, every sentence should have one and only one main clause: if there is no main clause, it is not a sentence, and if there are two, then two separate sentences have been run together without proper punctuation, and the meaning will be quite confusing to the reader.

**Acronyms**

A discipline which greatly enhances the readability of text is the proper use of acronyms, particularly three letter acronyms (TLAs), as they are the most common variety. With word processors there is often no excuse for the very extensive use of TLAs. An overuse of them is a sign of laziness or a desire to impress by obscuration. It is often just as easy to say the original phrase as it is to say the TLA, and it is always easy to use global substitution in a word processor to remove them from text. An extreme case of the misuse of a TLA is the one for the World Wide Web (a phrase with three syllables), which is “WWW” (which has six syllables).

If you have got to use TLAs, the first time you do so, please spell out the complete phrase and follow it with the TLA in brackets, as above, not the other way around. (Note that I did not say “If you have got to use *them*” at the beginning of this paragraph).

**Other Common Writing Issues**

The general rule for numbers, particular straightforward ones like “one”, “five” and “five billion” is that you spell them out. However, you might say “$1 billion”, but definitely not “$1,000,000.00”. Generally you should write a single-digit number as a word, and a multi-digit number with digits. If you use as a guideline the aim that you would always try to make it easy for the reader to quickly and clearly understand what you are trying to communicate to them, then you cannot go far wrong.

On a related point, always use “few” for discrete or countable items, and “less” for continuous quantities. For example: “There were fewer eggs in the fridge than I recalled, and also less milk”.

If you wish to highlight something in the text of your dissertation, use *italics*. They are very effective. Use **bold** only to highlight headings and *never* use underlining as (i) it cuts off the descenders of letters and makes a word difficult to read and (ii) when it extends over several words, it tends to make them look joined together and difficult for the brain to separate. If you really want to “SCREAM” at your reader, use capitals, but do not combine them with italics or bold, and remember that your reader may not appreciate it.

The proper use of numbered or bulleted points is a skill. It is bad to either under- or over- use them. There are different conventions for how to use them, but the best is probably to consider all the bulleted points as sub-clauses of a single sentence and use capitals and punctuation appropriately. For example, bullet points

1. should not start with a capital letter,
2. should be ended with a comma,
3. should have the verb present if it changes from one to the next,
4. should not be indented more than one tab space, and
5. should have the last one terminated with a full stop, if appropriate.

Whatever you do, make sure that the beginning of the sentence *can make sense with each of the bullet points taken alone*.

On the subject of boxes used to enclose text or diagrams. These are basically *bad* news. Very occasionally they may be used to separate something from the text around it, but in a formal document like an academic report or a paper, they are not appropriate. Normally a font like Times Roman 12 point is used for the main text of a dissertation. If you want text to be differentiated, such as extracts from a programming language, the convention is that you use a fixed spacing font like Courier to do this. Be sparing with the number of fonts used, as the visual distraction can get in the way of your communication with the reader.

Watch out for sentences that have no main clause – look again at the first sentence in the paragraph above. This is a BIG mistake. You cannot make sense without a main clause. It is quite acceptable to speak informally without being too pedantic about your sentence and grammatical structure. However, in writing and particularly in formal technical writing, which is most of the writing that you will do in your career, *it is not acceptable*. Also watch out for very long sentences with several subordinate clauses. Do your best to make sentences as short and direct as possible. Your readers will thank you.

Insure that slang or “text-speak” is *never* used in a technical report. Contractions (indicated by an apostrophe) can sometimes be appropriate.

The rule for indicating a quotation embedded in the text is that you use quotation marks, or so called double quotes, i.e. “ ”. You normally only use single quotes or ‘ ’ when you want to indicate direct speech within a quotation, though there are alternative usage styles in this respect. Whatever style you use, you must at least be consistent. If you wish to quote several lines of text, it is usually done as follows:

*... the study of autonomy and [a] system’s descriptions in general cannot be distinguished from the study of the describer’s properties ... the system and observer appear as an inseparable duo.* [11, p.63]

Notice the use of vertical space between the quoted text and the main text, and also the ellipses “...” (three dots only) to indicate material in the original text that is omitted here. Also notice the use of square brackets to indicate text that had to be inserted into the extracted material in order for it to make sense here. Note that quotation marks are not used to show that this is a quotation – this is shown by the indentation and the italics, and a reference is given. Do not use quotations at the beginning of each chapter to “set the scene”. It’s very difficult to strike just the right note for the context of a typical dissertation and it looks like you are posing if you get it wrong. It’s the sort of thing that computer scientists do, and get away with, but it usually looks out of place in an engineering dissertation.

On the question of the use of capitals, a person’s name is always capitalised, even if it appears in a made-up word or physical unit. Thus we have capitals in Gaussian and Laplacian, but not gradient, and similarly in Ohm, Siemen and Tesla, but not meter or second. So while it is the convention that the standard SI units that are based on people’s names such as: ohm, ampere, pascal, siemens and tesla are written in lower case when used as words, the first letter of symbols for units derived from the name of a person is written in upper case: Ω, A, Hz, Pa, S and T. This is not so with non-personal units such as meter, kilogram or second which have lower case symbols[[1]](#footnote-1). Proper nouns like Oak and Ash are capitalised, but not common nouns like tree or beetle. Otherwise use common sense and restraint. For example, use “the University” when referring to DCU, but “the university” when referring to the general concept of a university. If in doubt, use lower case. It looks better. Note that the first letters in a phrase that is going to be represented by a three letter acronym (TLA) do not need to be capitalised, although sometimes they are. It depends on how specific the phrase is (essentially whether or not it is a proper noun phrase).

Please inform yourself on the respective uses of the hyphen and dash.[[2]](#footnote-2)

Learn the appropriate use of “which” and “that”. They are not interchangeable and have subtle effects on the meaning being conveyed. If in doubt use “that” – you are more likely to be correct.

Learn what a “hanging preposition” is. An example is: “This is the car that we are going to drive in”. It will read much better if you say: “This is the car in which we are going to drive”. (Please don’t make the mistake of using “in which” and leaving in the preposition “in” at the end as well. This is not good.)

### 1.2.2 Figures and Diagrams

Feel free to use figures as liberally as possible to illustrate and clarify your argument, “if in doubt, illustrate”. Handle them carefully, however. If a diagram is three quarters of a page in size, give it the whole page. Do not leave fragments of sentences or paragraphs lurking at the top or bottom of otherwise-used pages to encourage the unwary reader to loose their train of thought. *Every* diagram should have a number (as in “Figure 3”), and it should have a caption, which is a stand-alone explanation of it. A diagram should not rely on the text for its explanation. Remember, after the abstract and the conclusions, the casual reader will next look at your diagrams. That may indeed be all they ever see of your beautifully crafted literary work. Communicate with them through your images.

A diagram should always appear *after* the section in the main text, which refers to it, never before. Insure that the diagram is referred to in the text (otherwise why is it there?). It should be the full width of a page and its caption should be in the same font as the main text, albeit possibly at a smaller point size and with single line spacing.

### 1.2.3 The Document Structure

The major components of the document structure should be evident from the structure of this document. However, there are some subtleties about the structure of individual chapters that should be pointed out.

Firstly, every chapter should have an introduction and a summary. The introduction need not be labelled as such, but it should be there, between the chapter heading and the first named section. This means that by just looking at the start or end of each chapter one can tell if that chapter is something one might want to read. Also, the summary at the end of a chapter should put that chapter into the context of the next one, providing links from each to the next that will help the reader to follow your train of thought. Sections, on the other hand, do not need such structure, but should themselves provide “signposts” to the overall structure of the document. Sections follow immediately one after another without requiring a page break, except where not to have a page break would split a heading and its associated text across two different pages. Chapters, on the other hand, should *always* start on a new page, without exception.

Chapter 1 should contain a general introduction to the state-of-the-art in the area being addressed in the project, including a discussion on the (recent) history of development with reference to the relevant literature in the area. It should introduce the particular issues being addressed in this project as well as giving an outline of the problem being solved or the approach being taken. It should also outline, chapter by chapter, the structure of the dissertation and its content.[[3]](#footnote-3) (See also the note below about footnotes[[4]](#footnote-4)).

Later chapters should deal with issues of analysis (the theoretical background, a critique of current research, a clear description of the problem or task in hand) and of synthesis (the approaches used towards achieving specified objectives, establishing solutions, design methods and possibly simulation exercises. There should be some substantial element of implementation involving hardware, software or system design, development and integration, dealing with trade-offs, constraints, innovations, and so on. It may also be appropriate to design and run test experiments, acquiring and processing results.

Finally there should be represented in the report, substantial contributions towards an evaluation of the outcome of all this design and implementation work. You should discuss the results achieved and evaluate the outcomes in terms of the original objectives set for the project. In particular you should demonstrate that you are able to see the overall merit of your particular work in the context of the chosen field and determine possible future directions that further work in this area might usefully take. Your examiners under the headings of “literature survey”, “design detail” and results and conclusions evaluate the content of your dissertation. These headings are intended to represent the elements mentioned above as appropriate.

One area that some students fall down on is the area of references. The guideline here is quite simple: either you did the work and wrote the text, or *someone else did*. For any element of your report, even the tiniest element, which falls into the latter category, you must provide as complete a reference as possible, so that another researcher can easily access exactly the same source of information as you have. The desired form for the reference data is usually that used in IEEE journals. Please examine carefully the references used in this document in the References section after section 6 that includes an example of how to reference a document from the Internet.

Beware of over-using quotations. Only very seldom does anyone say something in such a beautiful and succinct way that you cannot possibly paraphrase them (and of course appropriately reference them) without loss of meaning. Also, if you cannot put someone else’s ideas into your own words, it may be a sign that you haves not fully understood the ideas involved ⎯ you have not “made them your own” or taken “possession” of them.[[5]](#footnote-5)

Most modern word processors have a spelling checker and some a grammar checker. Use them. They are not always right, but they may catch many of your errors. It’s quite impolite to ask another person to read your work if you have not at least done them the courtesy of spell-checking it and grammar-checking it yourself. On the other hand, our brain is often not capable of seeing our own mistakes: for example, we unconsciously fill in missing words that are glaringly obvious to others. Be prepared to proof-read the work of others, and have your work proof-read in return if you wish to make a good impression on and communicate effectively with your readers. Consider using a free tool like Grammarly but be careful of uploading any of your documents to untrustworthy sites as the documents can find themselves being sold on to others.

### 1.2.4 Summary

In this section we try to present a personal view of important technical and structural aspects of writing an engineering dissertation. I suppose the most important thing to keep in mind is the mechanism of reading: the eye flows across the text, picking out familiar patterns for the brain to interpret. Anything you do to disrupt that flow will slow the reader down and allow them to lose their train of thought. On the other hand, if you feed the brain too much dense material, it will suffer from indigestion. Write with the intention of most effectively communicating with your audience, considering their interest, motivation, background and ability to assimilate your ideas.

In the next chapter, some of the Word styles that are used in this template to assist in giving an appropriate presentation of the text are treated.

# Chapter 2 - Technical Background

In this chapter, the basis structure of the heading system used in this prototype is presented. The approach is based on the style functionality of Microsoft Word. You are free to adapt these styles to your own use, but the ones selected are quite clear and sufficient for most purposes. Only three levels of numbered headings are described here, as the convention is that you do not number headings at deeper levels than this. If you need more than three levels, perhaps you need to rethink your chapter structure.

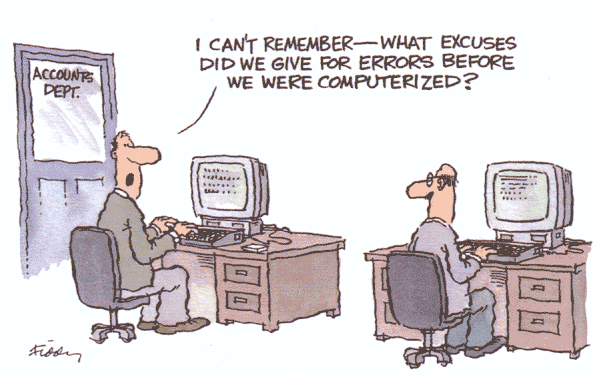


Figure 2.1 A Sample Figure

Defining numbered headings as Word headings makes them available for the automatically generated table of contents. This is an important factor in the generation of a complex document where a small change near the beginning of a chapter or document can have very substantial knock-on effects. It is also possible to automate other aspects of your document generation, such as tables of figures, references and the index. Consult the Help information for more information on these.

## 2.1 Using Heading Styles

### 2.1.1 Heading 1 Style

The “Chapter 2” which appears at the top of this page is part of the heading system but does not need to appear in the table of contents (TOC). Consequently, it is just formatted as normally. The heading is formatted as style Heading 1 and this means that it will appear in the TOC. (This is an example of a correct, but inappropriate use of a TLA).

### 2.1.2 Heading 2 Style

The “2.1 Using Heading Styles” text at the start of this section is an example of the Heading 2 style. It is slightly smaller than the Heading 1 style and it appears indented in the TOC.

### 2.1.3 Heading 3 Style

The text “2.1.3 Heading 3 Style” which is the heading for this subsection, is an example of the Heading 3 style. Again it is slightly smaller than the previous one, though still bigger than the twelve point main text.

### 2.1.4 Other Headings

Notice that in the previous chapter, un-numbered headings are also used. It is sufficient to use 12 point bold for these headings, where required.

## 2.2 Summary

Some important points on headings

* You can update the tables in this document by pressing on the table and pressing the “F9” key and choosing update table.
* In this document Abstract, TOC, Appendices etc. are defined as “Heading” so that the chapter number is not placed in front of those titles.
* Be careful when you type a new heading that the body of text that you are writing after the heading is defined as “normal” otherwise your entire text will appear in the table of contents!
* If Word has problems with the size of your document, break it into different documents, one for each chapter. Remember that when you are printing the entire document at the end that you can specify a start page number for each chapter and that you can create an automatic table of contents for each chapter and cut-and-paste it to the start of your document.

# Chapter 3 - Design of …

# Chapter 4- Implementation and Testing of …

# Chapter 5 - Results and Discussion

# Chapter 6 – Ethics

# Chapter 7 - Conclusions and Further Research

The conclusions chapter is very important in your report. It must conclude your work! It is not a summary of the work in the previous chapters; it must give insight into the value of your work, inform the readers of the impact of your work and should provide directions for future research on your report topic. This chapter allows you a chance to document your own opinions and insights while displaying ingenuity and imagination in choosing possible implementation applications or future directions of your own work.

The conclusions should include a clear statement of the success criteria and if they were met. It should describe your work and your contributions to research.

# References

[1] Nagel, H-H, “Extending the orientated smoothness constraint into the temporal domain”, *Proc 1st European Conference on Computer vision (Antibes, France),* April 1990.

[2] Horn, B.K.P and Schunck, B.G. “Determining Optical Flow”, *Artificial Intelligence*, pp185-203, 1987.

[3] Ullman, S. *The Interpretation of visual motion,* Cambridge, MA; MIT Press, 1979. pp99-107.

[4][[6]](#footnote-6) Sun Microsystems Inc., "Java 2 SDK Documentation – Version 1.4.1" <http://java.sun.com/j2se/1.4.1/docs/index.html>, 2002. (20 June 2003).

**IMPORTANT NOTE ON REFERENCES**

One area on which many students fall down is the area of references. The guideline here is quite simple: either you did the work and wrote the text, or *someone else did*. For any single sentence of your dissertation or report that falls into the latter category, you must provide as complete a reference as possible, so that another student or reader can easily access exactly the same source of information as you have. The desired form for the reference data is usually that used in IEEE journals. Please examine carefully the references used above in this document, which include an example of how to reference a document from the Internet.

Please delete this note when using this document as a template. More recent versions of MS Word will allow you to ‘Manage your Sources’ under the ‘References’ tab and Bibtex is great if you are using Latex to prepare your document.

# Appendix 1

You should put into an appendix, material which is required to be present with your dissertation, but which would interrupt the flow of the text if presented in the main body of the document.

# Glossary

If required.

1. See <https://en.wikipedia.org/wiki/International_System_of_Units> [↑](#footnote-ref-1)
2. See <https://en.wikipedia.org/wiki/Hyphen> [↑](#footnote-ref-2)
3. It is very important to remember that at ALL times you should use the present tense when referring to other parts of this document. You do NOT say that something “will be” discussed in a later chapter or that it “was” discussed in an earlier chapter. These other chapters exist, now, before us, in this document and “are”. Equally, when referring to a procedure, or approach that could be taken at any time, one uses the present tense. When referring to the particular results that you actually achieved on a particular occasion in the past, then you use the past tense. [↑](#footnote-ref-3)
4. Normally, single spacing is used for footnotes and endnotes (if present). Note also the spacing between footnotes and the smaller point size. [↑](#footnote-ref-4)
5. That, by the way, is a dash. It is used in a sentence to separate two ideas, similarly to the way that you would use brackets, but where the ideas have equal merit. (You use brackets where an idea is tangential or subsidiary to the main message you are conveying in your sentence). The dash is different from brackets in that you can have one dash, but need pairs of brackets. The dash is also like a comma, giving a brief pause, except that unlike a comma, it does more than indicate a pause, it also separates ideas. It should be distinguished from a much shorter horizontal line, viz. a “-”, called a hyphen, which is used to join words together, or indicate a splitting of a long word at the end of a line. [↑](#footnote-ref-5)
6. Web references should include the URL, the author, the document/article title, when it was written and should also contain the date at which the reference was valid, i.e. when you used it last. [↑](#footnote-ref-6)