



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

INTRODUCTION TO RESEARCH METHODOLOGY

FINAL YEAR
PROJECT
School of
Electrical
Engineering

Some contents adapted from “Problem Formulation and Research Design”, Marzuki Khalid, 2012.

Edited by FYP Committee of SEE, 2018

OUTLINE

- ❖ Concepts of Research
- ❖ Conducting Research
- ❖ Writing Research Report
- ❖ Conclusion

OUTCOMES

After this class, you should have a **general idea** of:

- ✓ What **academic research** is about
- ✓ How to avoid doing bad research
- ✓ How to start a research
- ✓ How to **formulate a good research problem** at your level
- ✓ How to **prepare a good research proposal** (FYP1 report)
- ✓ How to **write a good research report** (FYP2 report)

WHAT IS RESEARCH?

Concepts
of
Research

WHAT DO YOU THINK?

Which of these can be classified as research?

- 1) Mr Tom prepared a paper on “*Computer Usage in Secondary Schools*” after reviewing literature on the subject available in his university library and called it a piece of research.
- 2) Mr Ann says that he has researched and completed a document which gives information about the age of his students, their SPM results, their parents income and distance of their schools from the District office.
- 3) Ms Jerry participated in a workshop on curriculum development and prepared what she calls, a research report on the curriculum for building technicians. She did this through a literature survey on the subject and by discussing with the participants of the workshop.

THE TRUTH IS...

- None of the above examples can be classified under the name research.

WHY ?

You will know it when you have understood the concept of the term “**RESEARCH**”.

LET'S THINK AGAIN..

Consider the following case:

- An engineer of a car producing company was concerned with the complaints received from the car users that the car they produce have some **problems with rating sound** at the dash board and the rear passenger seat after few thousand kilometers of driving.
- He obtained information from the company workers to **identify the various factors influencing the problem**.
- He then **formulated the problem and generated hypotheses** (guesses).
- He constructed a checklist and **obtained requisite information** from a representative sample of cars.
- He **analyzed the collected data**, **interpreted the results in the light of his hypotheses** and reached **conclusions**.

CAN YOU NOTICE THAT..

- ✓ The engineer went through a sequence of steps which were in order and thus systematic.
- ✓ He did not just jump at the conclusions, but used a scientific method of inquiry in reaching at conclusions.

The two important characteristics of
“**RESEARCH**” are:

- 1) It is **systematic**.
- 2) It follows a **scientific method of enquiry**.

DEFINITION OF RESEARCH

- **Hunting for facts or truth about a subject.**
- **Organized scientific investigations to solve problems, test hypotheses, develop or invent new products.**

AGAIN, WHAT IS RESEARCH?

Research is systematic, because it follows certain steps that are logical in order. These steps are:

1. **Understanding the nature of problem** to be studied and identifying the related area of knowledge.
2. **Reviewing literature** to understand how others have approached or dealt with the problem.
3. **Collecting data** in an organized and controlled manner so as to arrive at valid decisions.
4. **Analyzing data** appropriate to the problem.
5. **Drawing conclusions** and making generalizations.

WHAT IS HIGH QUALITY RESEARCH?

- It is based on the work of others.
- It can be replicated (duplicated).
- It is generalizable to other settings.
- It is based on some logical rationale and tied to theory.
- It is doable!
- It generates new questions or is cyclical in nature.
- It is incremental.
- It is apolitical activity that should be undertaken.

THEN, WHAT IS BAD RESEARCH?

- The opposites of what have been discussed.
- Looking for something when it simply is not to be found.
- **Plagiarizing** other people's work.
- **Falsifying data** to prove a point.
- Misrepresenting information and misleading participants.

WHY DO WE NEED RESEARCH?

- ✓ To get PhDs, Masters, and **Bachelors** degree.
- ✓ To provide solutions to complex problems.
- ✓ To investigate laws of nature.
- ✓ To make new discoveries.
- ✓ To develop new products.
- ✓ To save costs.
- ✓ To improve our life.
- ✓ Human desires.

RESEARCH ACTIVITIES IN ENGINEERING

- Involve in the development of new algorithms/techniques/methodologies.
- Involve in the confirmation of newly proposed algorithms (applications to benchmark problems or laboratory equipment).
- Involve in the design of new products/circuits.
- Involve in comparing a number of different methodologies.

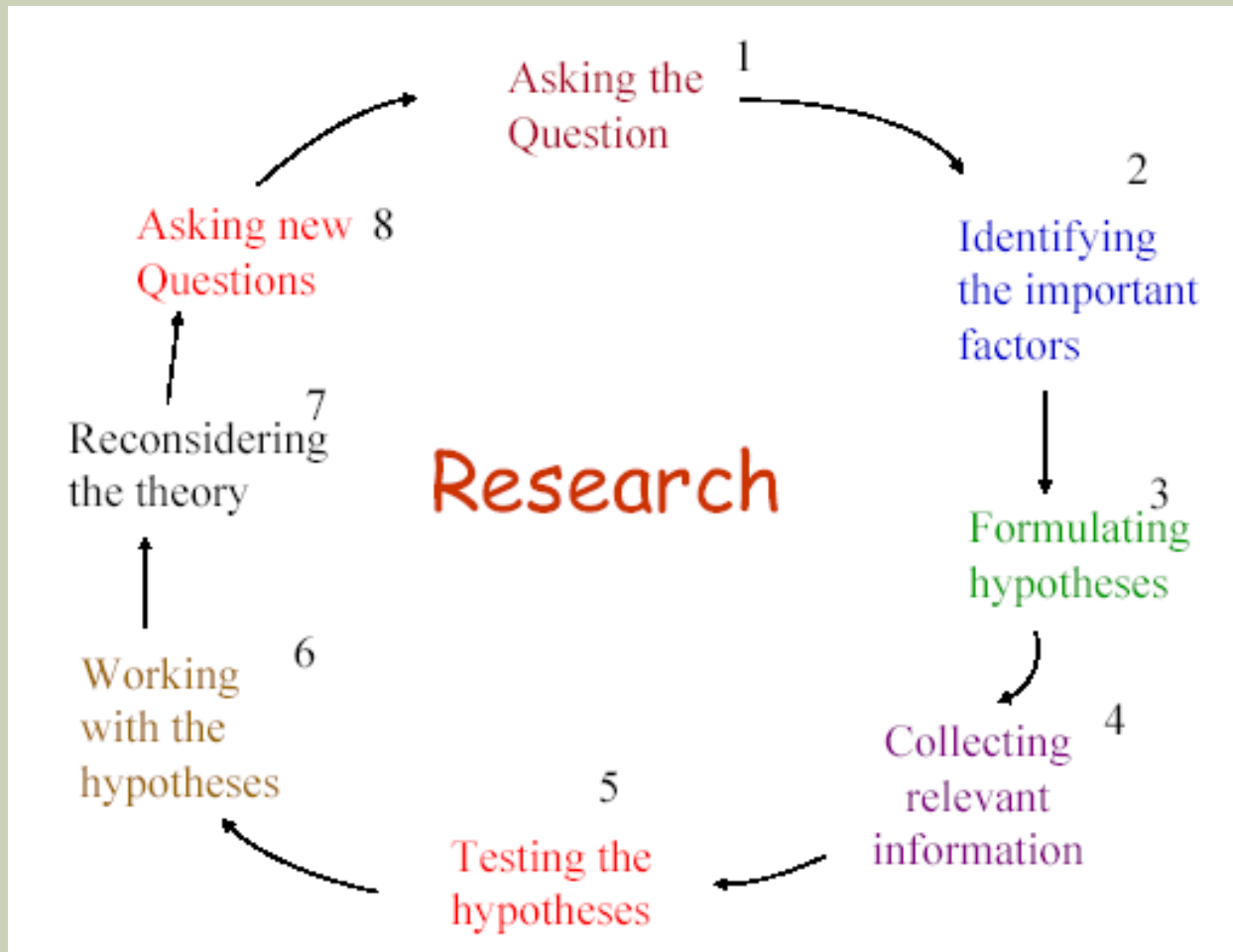
RESEARCH ACTIVITIES IN ENGINEERING

- Stability analysis on newly proposed algorithms.
- Involve in the application of some proposed algorithms in novel applications.
- Involve in the study of certain aspects of dynamics (behavior) of plants/systems.
- Involve in surveys of some engineering aspects.
- Involve in market study of certain engineering products.

RESEARCH ACTIVITIES IN ENGINEERING

- Involve in the study on the effects of environmental factors on a particular design.
- Involve in improving the design of existing products.
- Involve in extending the algorithms developed by others to a wider variety of applications/systems.
- Involve in the testing of new techniques extensively on benchmark problems in which earlier research has not done.

RESEARCH CYCLE



HOW TO START?

Conducting
Research

FINAL YEAR PROJECT SCOPES

- 1) **Improvement of existing project*** which output/methodology has been proven or carry out the project in different situation
- 2) **New project** that has been proposed by supervisor or proposed by student with the agreement of supervisor and can be completed within two semesters

***Extended Capstone Lab project for FYP is NOT ALLOWED.**

DIFFERENCES BETWEEN POSTGRADUATE & UNDERGRADUATE RESEARCH

<u>Programs</u>	<u>Research</u>	<u>Developmental</u>
-----------------	-----------------	----------------------

- | | | |
|--------------|-----|-----|
| • PhD level: | 75% | 25% |
| • MSc level: | 50% | 50% |
| • BSc level: | 25% | 75% |

RESEARCH DESIGN

FYP1 in
general

Problem Identification



Reviewing Information



Data Collection



Analysis



Drawing Conclusions

FYP2 in
general

RESEARCH STEPS

Irrespective of the category of a research study, the steps followed in conducting it are the same. These steps are :

**Selecting and
Defining a
Problem**



**Describing
Methodology of
Research**



Collecting Data



**Analyzing Data
and
Interpreting
Results**

STEP 1: SELECTING AND DEFINING A PROBLEM

This marks the beginning of a research study and is the **most difficult** and **important** step. This involves :

1. Identifying and stating the problem in specific terms;
2. Identifying the variables in the problem situation and defining them adequately;
3. Generating tentative guesses (hypotheses) about the relation of the variables or the solution of the problem, or writing explicitly the questions (research questions) for which answers are sought;
4. Evaluating the problem for its research ability.

STEP 1: SELECTING AND DEFINING A PROBLEM

- All this is not done in a vacuum.
- To achieve this, you **review the literature** related to the problem to know what other researchers have done and discovered and to identify the possible methodology for conducting the research.

STEP 2: DESCRIBING METHODOLOGY OF RESEARCH

You need to state the purpose of the study and to define the problem clearly. This guides you in deciding the methodology of research which involves :

- a.** Identifying the method of research;
- b.** Specifying the subjects of study;
- c.** Selecting an adequate representative sample of subjects;
- d.** Selecting/constructing valid and reliable instruments for measuring the variables in the problem;
- e.** Selecting a research design and describing the procedure to be employed for conducting the research study.

STEP 3: COLLECTING DATA

- This step involves conducting the study as per the designed procedure (manipulating the experimental variables in the case of an experimental method), administering instruments for measuring variables and/or gathering information through observation.
- It also involves tabulating the data thus collected for the purpose of analysis.

STEP 4: ANALYZING AND INTERPRETING RESULTS

- The results of the study are generated at this stage.
- The data are summarized, in other words analyzed to provide information for testing the hypotheses.
- Appropriate statistical methods of analysis are used to test the hypotheses.
- You can perform the analysis manually, by using a hand calculator or a computer as per the demands of the problem, and the available facilities.

STEP 4: ANALYZING AND INTERPRETING RESULTS

- After completing the analysis results are tied together or summarized.
- The results are interpreted in the light of the hypotheses and/or the research problem.
- These are then discussed in relation to: the existing body of knowledge, consistencies and inconsistencies with the results of other research studies, and then the conclusions are drawn.
- This is followed by writing the research report.

WHAT TO WRITE?



Writing
Research
Report

WHAT SHOULD I WRITE IN A PROPOSAL?

- Title
- Objectives
- Expected project outputs
- Knowledge/skills required to do this project
- Hardware/software requirements
- Develop the project schedule for FYP1 and FYP2
- Milestones
- Budget requirement



WHY DO I NEED TO WRITE A REPORT?

- It is obvious that every research needs good and proper documentation.
- To share research results with other researchers.
- To get views for improvement.
- To get recognition.
- To obtain some form of degree (part of fulfillment of a degree).



PROJECT REPORT

- Project report is usually written at the end of a research work.
- It could be an initial documentation for writing a technical paper for a journal or a conference.
- It is usually meant for internal verification/discussions or as a preliminary documentation for a bigger research.

THE BODY OF A PROJECT REPORT

The body of the report follows the preliminary information. The body of the research report contains four logical divisions:

1. Introduction
2. Methodology
3. Presentation and analysis of data
4. Conclusions and further work

1. INTRODUCTION

- Statement of the problem
- Review of related literature
- Statement of hypotheses of research questions
- Limitations
- Definition of terms

2. METHODOLOGY

- Procedures for collection and treatment of data
- Design/project implementation (hardware/software)

3. PRESENTATION AND ANALYSIS OF DATA

- Presentation of collected data (e.g. experimental data etc.)
- Analysis of data

4. CONCLUSIONS AND FURTHER WORK

- Summary (of each part)
- Conclusions
- Recommendations (future works)

GENERAL LIST OF CONTENTS

- i. Abstract
- ii. Chapter 1: Introduction
- iii. Chapter 2: Theory/literature review on the research
- iv. Chapter 3: Proposed methodology
- v. Chapter 4: Implementation (design)
- vi. Chapter 5: Results and discussions
- vii. Chapter 6: Conclusions and further work
- viii. References
- ix. Appendices

You may put “[Project management and costing](#)” as a subchapter in Ch. 3

OR

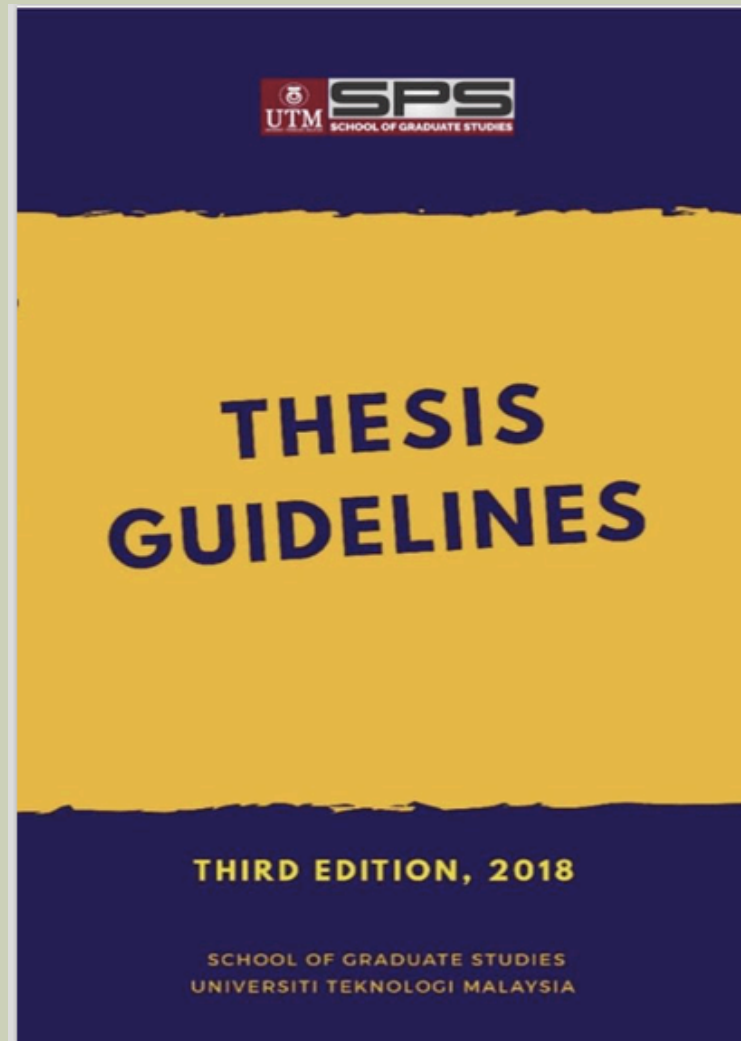
GENERAL LIST OF CONTENTS

- i. Abstract
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- iv. Chapter 3: Proposed methodology
- v. **Chapter 4: Project management and costing**
- vi. Chapter 5: Implementation (design)
- vii. Chapter 6: Results and discussions
- viii. Chapter 7: Conclusions and further work
- ix. References
- x. Appendices

REPORT FORMAT

UTM Thesis Manual Version 2018

Link to download is
provided at the FYP
website.



UTM THESIS MANUAL

Information that you can get from this manual:

- ✓ Organisation of a thesis
 - Preliminary pages
 - Text
 - References
- ✓ Size and format
- ✓ Reference style
- ✓ Electronic/digital thesis preparation

WHAT IS PLAGIARISM?

Writing
Research
Report

DEFINITION

"the wrongful appropriation or purloining, and publication as one's own, of the ideas, or the expression of the ideas [...] of another"

**The Oxford English Dictionary. 2nd ed. (1989)
Oxford University Press**

AS A STUDENT...

Plagiarism is cheating in your academic assignments by using other people's work **without telling us that you are doing it**, so that it looks as if you are the one who created the work. If you learn anything from a resource you read, you **must show** where you found it out from, even if you are not using exactly the same words as they wrote.

ACKNOWLEDGE THE SOURCES

You **must** always give credit to people who create, among others:

- Books.
- Journal articles.
- Technical report/thesis.
- Newspaper articles.
- **Websites.**

ACKNOWLEDGE THE SOURCES

If you are using a website (or some other source) where **no person is named** as having written it, you **must still acknowledge** that you found the information on a website. Always make it clear to the person marking your assignment whether you are referring to your own work or that of someone else.

ACKNOWLEDGE THE SOURCES

You must be careful to give people credit for anything that they produce, for example:

- Facts they discovered.
- Ideas they discussed.
- Photographs they took.
- Computer code they wrote.
- Designs or diagrams they drew.
- Models they built

THE BENEFITS...

When you acknowledge the sources of your information, you will not just stay out of trouble. You will also gain marks by:

- ✓ Showing that you have put in the time and effort to find and read relevant resources.
- ✓ Providing evidence to support your arguments.
- ✓ Enabling your supervisor/examiners to check the accuracy and dependability of your sources.

WHAT IS NOT PLAGIARISM?

You can use other people's work for your project as long as you make it clear that you did not create it.

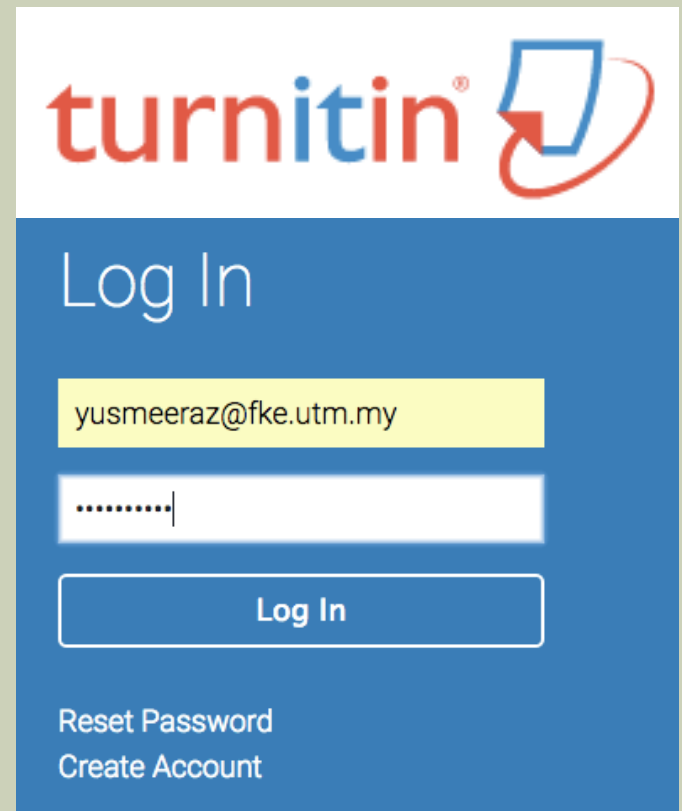
WHY IS PLAGIARISM WRONG?

- Not fair to students who do their own work
- Not fair to the people who actually created the source that a plagiariser uses; they deserve to get the credit for their hard work
- Not fair to employers (they deserve to know that a UTM graduate has really learnt everything they need to know at tertiary education level (bachelor), not just copied from other people.

UTM POLICIES ON PLAGIARISM

Must use **Turn-it-in** as an anti-plagiarism software to generate the **similarity report**.

The overall similarity index is a measure of the percentage of the paper that the system was able to find matching text for, regardless of whether or not the text was properly cited.



The image shows a screenshot of the Turnitin login page. At the top, the Turnitin logo is displayed in red and blue. Below the logo, the text "Log In" is written in white on a blue background. There are two input fields: the first contains the email address "yusmeeraz@fke.utm.my" and the second contains a masked password ".....". Below the input fields is a "Log In" button. At the bottom, there are links for "Reset Password" and "Create Account".

UTM POLICIES ON PLAGIARISM

The determination and adjudication of proper citation and plagiarism are left solely up to the (academic judgement of) supervisors.

HOW TO AVOID PLAGIARISM?

Writing
Research
Report

TIPS...

Some steps you may take:

- ✓ Take good notes (use logbook), so you trace the source of the facts and ideas you wish to use in your work/report
- ✓ Acknowledge your sources by referencing
- ✓ Manage your time — don't write last minute!

WHAT IS A REFERENCE?

A reference is the way that you acknowledge your use of other people's work. There are two parts:

- The **citation** is a pointer in the text of your work, saying that you are using someone else's ideas.
- The **reference** gives the full details of where the information came from. You put it in a reference list at the end of your work

EXAMPLE OF CITATION AND REFERENCE IN NUMERIC FORMAT

unit and transducer element in the same device. In particular, realization of an integrated deoxyribonucleic acid (DNA) biosensor is the main interest of scientists due to the completion of human genome project and advances in genetic sequencing of pathogenic species [1]. Label-based DNA detection method such as optical DNA microarray is now a mature technology with applications in health care and biological

This is the
citation

This is the
reference

REFERENCES

1. Teles, F. R. R. and Fonseca, L. P. Trends in DNA Biosensors. *Talanta*. 2008. 77(2):606–623.
2. Watson, J. D. *The Double Helix*. New York : Athenaeum Press, 1968.
3. Watson, J. D. and Crick, F. H. C. Molecular Structure of Nucleic Acids - A Structure for Deoxyribose Nucleic Acid. *Nature*. 1953. 171(4356):737–738.

TIPS...

- ✓ Make sure you cite and reference every source you use while you are doing the writing.
- ✓ Do not leave it until the end: you could end up missing some places where you need to cite, or running out of time to do it properly.

QUATATION

- Quoting is when you use the **exact words** of someone else's work
- Please note that direct quotation of words is **strongly discouraged** in science and engineering.
- Items such as charts, diagrams, photographs and code which are directly copied from someone else's work also count as direct quotes.

PARAPHRASING

- Paraphrasing takes place when you read someone else's work, think about it, and **rewrite** or summarise it in your own words, keeping the facts and ideas of the original source.
- It is considered **good** academic practice to paraphrase, because it shows you have understood the original work
- You still **must** acknowledge the source of anything you paraphrase or summarise, because you did not come up with the facts by yourself.


WHAT IS TURNITIN?

A software tool that:

- helps your supervisor by indicating parts in your report that use very similar words to other documents in their database.
- generates a report based on the percentage of similarities between your work and other works in the database. This is called the **Originality Report**.

HOW TURNITIN REPORT CAN HELP?

- The level of **similarity** will be indicated by a **traffic light** colour (amber/red for a high percentage of detected copied text, green/blue for a low percentage). Click on the colour of the similarity column to see the **Originality Report**.


<input type="checkbox"/>	AUTHOR	TITLE	SIMILARITY
<input type="checkbox"/>	Brad Pitt	FYP1 Report	12% 
<input type="checkbox"/>	Chris Hemsworth	Final Report FYP 1	33% 
<input type="checkbox"/>	Matt Damon	fyp1	34% 
<input type="checkbox"/>	Ben Affleck	Lit-rev chapter	39% 
<input type="checkbox"/>	George Clooney	Full Report	47% 
<input type="checkbox"/>	Tom Hindelston	tests	64% 

ORIGINALITY REPORT

- You can see a list of **matching sources** on the right column of the report.
- It helps by showing parts of your report that use very similar words to other documents in their database.

Originality GradeMark PeerMark

tests
BY TOM HINDELSTON

turnitin  64%
SIMILAR

--
OUT OF 0

INTRODUCTION

1.1 Project background

Automated guided vehicles (AGVs) are commonly used in facilities such as manufacturing plants, warehouses, distribution centers and transshipment terminals. AGV can be referred as mobile robots owing to their reprogrammability. The purpose of AGV is to help reduce costs of manufacturing and increase efficiency in a manufacturing system. It also involved the movement of tools, raw material and work in process between station or into the storage. These movements must be safely, accurately, efficiently and without any damage to the materials. It is an important system and in element to integrate manufacturing facilities

Match Overview

1	umpir.ump.edu.my Internet source	20%
2	library.utm.edu.my Internet source	17%
3	Submitted to Universit... Student paper	6%
4	Submitted to Universiti... Student paper	5%
5	Benhabib, . "Material H... Publication	3%

ORIGINALITY REPORT

- Although the Similarity Index does not indicate plagiarism, it may not be good academic writing practice.
- You should use the information from the Originality Report to improve your **writing skills**.
- You can **revise** your report by rewriting the sentence(s) using your own words (if already cited).
- If you find the matched sentence(s) are not cited and in doubt whether you need to cite or not, err on the cautious side and include a **citation**. The format for citations should follow the UTM Thesis manual.

MANAGE YOUR TIME

- The sort of reading and writing that you have to do at University level is different from what you have done before: you need to develop the skills for choosing trustworthy sources, scanning a source for information, reading critically and drawing on many pieces of information to write a logical assignment.

You will probably need more time than you think !

- As English is not your first language, it will take you longer to do your reading and writing.
- Do not leave it until near the deadline to ask your supervisor for comments on your work, or you might have no time for changes if they are needed.

CONCLUSIONS

Research
Methodology
for
Final Year
Project

WHAT YOU MUST DO IN FYP?

1. Design a project to conduct research on a chosen topic in Electrical Engineering **FYP1**
2. Define the objectives for the research
3. Construct literature review and theoretical study required for the research
4. Determine the most suitable methodology for data collection and experimental study
5. Analyze the data and findings of the research obtained through the theoretical and experimental study
6. Evaluate the findings of the research and the achievement of the research objectives
7. Prepare scientific report in the form of a thesis to communicate the findings of the research
8. Explain the findings of the research in the form of an oral presentation **FYP2**

FYP1: WHERE DO I BEGIN?

- 1.** Ask for topics and scope of projects from your project supervisor prior to the start of your FYP.
- 2.** Determine topic and scope of project with the supervisor.
- 3.** Get papers and books on the topics you have identified.
- 4.** Study the papers/books.

CONT..

5. Think on what you should be getting at the end of this research (hypotheses).
6. Develop/write a project proposal. Discuss with supervisor.
7. Wait – (Enhance programming skills, do further reading, enhance mathematical knowledge, etc.)

LET'S START THE JOURNEY

Wish you all the best!

