

**CONSENSUS CONTROL OF MULTI-AGENTS SYSTEM
WITH LIPSCITZ NONLINEARITY**

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**CONSENSUS CONTROL OF MULTI-AGENTS SYSTEM WITH
LIPSCITZ NONLINEARITY**

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**This report is submitted in partial fulfilment of the requirements
for the degree of
Bachelor of Electronic Engineering with Honours**

**Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka**

2020

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I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Bachelor of Electronic Engineering with Honours.

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DEDICATION

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ABSTRACT

Home automation has been around from many decades in terms of lighting and simple appliances control, and only recently has technology caught up for the idea of the interconnected world, allowing full control of home from anywhere becomes reality. There are certain people that sometimes forget to turn off their home appliances before leaving the house and this can lead to wastage of energy and money. Therefore, in this project a microcontroller-based application is proposed to help the users monitor and control their house appliances from afar without physically at home just by using telephone communication line. This project is built by using the Dual-Tone Multi Frequency (DTMF) signal from telephone line produce when pressing the keypad of the telephone. This signal is then decoded into binary numbers and will be processed by the processor. It will produces output to the interfaced home appliances and switch on or off the device. This can be realized just by making a simple phone call to the landlines telephone connected to the system. This project had been verified to control the home appliances that had been limited to 4 output relays.

ABSTRAK

Penerapan teknologi automasi rumah telah wujud dari beberapa dekad dalam segi pencahayaan dan peralatan kawalan yang ringkas, dan hanya baru-baru ini teknologi ingin merealisasikan idea untuk menghubungkan dunia, yang membolehkan kawalan sepenuhnya di atas perkakas rumah dari setiap tempat. Terdapat beberapa orang tertentu yang kadang-kadang terlupa untuk mematikan peralatan rumah mereka sebelum meninggalkan rumah dan ini boleh membawa kepada pembaziran tenaga dan wang. Oleh itu, dalam projek ini sebuah aplikasi berasaskan mikropengawal dikemukakan untuk membantu pengguna memantau dan mengawal peralatan rumah mereka dari jauh tanpa berada di rumah secara fizikal dengan hanya menggunakan talian komunikasi telefon. Projek ini dibina dengan menggunakan isyarat nada frekuensi berganda hasil dari talian telefon apabila pad kekunci ditekan. Isyarat ini kemudiannya dinyahkan kepada nombor binari dan akan diproses oleh pemproses. Ia akan menghasilkan keluaran ke peralatan rumah yang disambung yang akan mematikan atau menghidupkan peranti. Ini boleh di menjadi kenyataan dengan hanya membuat panggilan telefon kepada talian tetap yang disambung dengan sistem. Projek ini telah berjaya untuk mengawal peralatan rumah yang terdiri daripada 4 keluaran geganti.

ACKNOWLEDGEMENTS

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LIST OF ABBREVIATIONS

BENG Bachelor of Electronic Engineering with Honours.

BENR Bachelor of Computer Engineering with Honours.

FKEKK Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer.

FYP Final Year Project.

JKPSM Final Year Project Committee.

KBA Kedudukan Baik Anugerah.

LA Los Angeles.

MAS Multi-agents System.

NY New York.

PC Personal Computer.

UN United Nations.

UTEM Universiti Teknikal Malaysia Melaka.

LIST OF SYMBOLS

A	The area of the needle point.
N	The number of angels per needle point.
\mathcal{L}	The Laplacian matrix.
a	The number of angels per unit area.

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CHAPTER 1

INTRODUCTION

1.1 Who can use this template

This is an unofficial Final Year Project (FYP) template for the students of Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer (FKEKK), Universiti Teknikal Malaysia Melaka (UTEM) that belong to either Bachelor of Electronic Engineering with Honours (BENG) or Bachelor of Computer Engineering with Honours (BENR) programmes. It is based on the Microsoft Word© template developed by the faculty's Final Year Project Committee (JKPSM).

1.2 How to use this template

This template can be obtained from Overleaf.com. At first, the students needs to register an account at Overleaf.com and open a new project. Then select 'thesis' and find 'Universiti Teknikal Malaysia Melaka' tag. Next, click on the tag and on the picture of the cover page of the thesis and select open as template. Hence the students can straightaway use the template out of the box.

1.3 On other Platform

You can also use other platform, namely:

- MikTex
- StudioTex
- TexMaker
- TexStudio
- Lyx
- other platforms

The easiest way to do it is to follow the instruction in the previous section, which is to open an account at [Overleaf.com](https://overleaf.com) and try to copy one by one of the files and syntaxes in your Personal Computer (PC).

CHAPTER 2

LITERATURE REVIEW

2.1 The beginning of your thesis writing

2.1.1 Making Sure the Organization of your Thesis is according to what it should be.

2.1.1.1 Proofreading Your Thesis

2.1.2 Portrait Mode

The default setting for the thesis is in Portrait mode. So there no need for you to do anything to change it.

2.1.3 Landscape Mode

If you wish to change your page into landscape mode, you can apply the following syntax



Figure 2.1: This view is too wide for a portrait page.

CHAPTER 3

METHODOLOGY

3.1 How to include Figures and Tables

You can insert a single figure just like in Figure 3.1.



Figure 3.1: Logo UTeM dengan Jawi.

You can also insert several figures such as in Figure 3.2.



Figure 3.2: Differences Between Logos of UTeM.

3.2 Inserting a Table in your text

You can insert any table in your text as shown in Table 3.1.

Table 3.1: Temperature for the 12th week of 2020.

Day	Temp °C
Monday	11
Tuesday	15
Wednesday	10
Thursday	10
Friday	9

3.3 Inserting Subtables for comparison purposes.

You can also include several tables beside each other to enhance your explanation about any particular topic as shown in Table 3.2.

Table 3.2: Comparison Tables; side by side to each other.

(a) Day Temperature		(b)	
Day	Temp °C	a	b
Monday	11	c	d
Tuesday	15	e	f
Wednesday	10	g	h
Thursday	10	j	k
Friday	9		

(c) Cuba		(d)	
a	b	Day	Temp °C
c	d	Monday	11
e	f	Tuesday	15
g	h	Wednesday	10
j	k	Thursday	10
		Friday	9

CHAPTER 4

RESULTS AND ANALYSIS

4.1 Mathematical Equations

4.1.1 In line Mathematical Equations

If you want to put any mathematical equation in line with the text, we need to put the dollar sign as shown in the text below:

The formula `$f=mc^2$` has been applied to the mechanical application mentioned.

We will get something like below:

The formula $f = mc^2$ has been applied to the mechanical application mentioned.

4.1.2 Defining a Single Equation

The mathematical equations in \LaTeX is a lot prettier than in Microsoft Words. I know, it is subjective but this is true to some extent. In order to define an equation with a reference number, the following syntax can be used:


```
\begin{equation}
  f=mc^2
\end{equation}
```

You will get equation (4.1)

$$f = mc^2 \tag{4.1}$$

4.1.3 Showing Several lines of Mathematical Works

If you intend to show your mathematical work, I would strongly suggest you use the syntax below:

```
\begin{equation*}
  \begin{split}
    f&=mc^2\\
    &=(2)((3\times 10^8)^2)\\
    &=8
  \end{split}
\end{equation*}
```

You will get something like below, which is quite proper for mathematical work.

$$\begin{aligned} f &= mc^2 \\ &= (2)((3 \times 10^8)^2) \\ &= 8 \end{aligned}$$

For other mathematical syntax, you can always Google for them or refer to the famous book "Not too Short Introduction to Latex" which is available for free in the internet. I would love to show you another example with fraction:

```
\begin{equation}
```

```
f=\frac{1}{2\pi RC}
\end{equation}
```

and you will get something like this

$$f = \frac{1}{2\pi RC} \quad (4.2)$$

CHAPTER 5

DISCUSSIONS

5.1 Labelling and Cross-referencing

A lot of times in the thesis, we are required to refer to the point that have been made in the previous chapter or section to make our explanation better, known as cross-referencing. This involves equations, figures, quotes, titles, chapters or maybe sections. In most cases, the reference that we make often goes back to earlier chapters or sections that requires the reader to skip through a lot of pages to find it. Hence, it is vital for the writer to be able to guide the reader and show where the reference is located. This is what is so special about latex, where it can easily cross-reference to the point that the writers want by using the three important syntax: label, ref and pageref.

CHAPTER 6

CONCLUSION

6.1 Making Citation and Bibliography

It is very easy to cite in this thesis template. You simply need to use the syntax below:

```
\cite{}
```

One example can be shown as below:

```
Let's say that you are citing the work of \cite{filho2017}
where the paper is about lightning in the
North America, you would also want to cite
the work from \cite{zou2017} that is related
to it. These two references will be
automatically listed before Appendices pages.
```

The outcome is shown below:

Outcome:

Let's say that you are citing the work of [1] where the paper is about lightning in the North America, you would also want to cite the work from [2] that is related to it. These two references will be automatically listed before Appendices pages.

6.2 How to make the list of abbreviations and symbols

You can make a List of Abbreviations and List of Symbols by following this instructions:

1. Use the 'glossary' package.
2. Define the glossaries at the preamble.

New York (NY), Los Angeles (LA), UTEM, FKEKK, Multi-agents System (MAS) and United Nations (UN) are abbreviations whereas a , N and A are part of the symbols. Kedudukan Baik Anugerah (KBA) and \mathcal{L} matrices are widely used in consensus control for multi-agents system.

6.3 Other Sections of the Thesis - Appendices

The only section that requires a little bit of work is the Appendices. This is due to the face that

REFERENCES

- [1] A. do Nascimento Queiroz Filho and E. A. Tannuri, “Cooperative consensus control applied to multi-vessel dp operations,” *Ocean Engineering*, vol. 142, no. Supplement C, pp. 388 – 410, 2017.
- [2] L. Zou, Z. Wang, H. Gao, and F. E. Alsaadi, “Finite-horizon $\langle \infty$ consensus control of time-varying multiagent systems with stochastic communication protocol,” *IEEE Transactions on Cybernetics*, vol. 47, no. 8, pp. 1830–1840, Aug 2017.

APPENDICES

APPENDIX A1

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APPENDIX A2

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APPENDIX A3

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