

UNIVERSITI TEKNOLOGI MARA

**FORECASTING UTILITY
MANAGEMENT IN UiTMCTKKT
USING PREDICTIVE ANALYTICS**

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ABSTRACT

Predictive analytics and Business Intelligence (BI) represent critical components in modern operational management, especially within institutions of higher learning. The improper handling of utility system at UiTM Cawangan Terengganu Kampus Kuala Terengganu (UiTMCTKKT) campus brings forth several issues, including excessive and inconsistent utility cost, irregularity and big gap in monthly bill charges and difficulty in decision-making and budget planning. In this project we will use the Cross Industry Standard Process for Data Mining (CRISP-DM) framework to mitigate these issues combining predictive analytics with iconic factors such as Holt-Winters and Autoregressive Integrated Moving Average (ARIMA) models. These techniques enable predicting utility costs and consumption and detecting trends and anomalies. Previous data was used to create a comprehensive dashboard which provides actionable insights for data-driven decisions. Using ARIMA and Holts-Winter this project shows the most optimum model found to gain insights is ARIMA(1,0,0), ARIMA (1,0,1) and Holts-Winter Multiplicative ($\alpha = 0.5$, $\beta = 0.2$, $\gamma = 0.1$). The model is validated with MAE values where lower MAE produced more accurate prediction. The Mean Absolute Error (MAE) values for the forecasting models are as follows: ARIMA (1,0,0) in Experiment 3 recorded an MAE of $14,135.026 \pm 2,883.271$. ARIMA (1,0,1) was used in Experiments 1 and 2, yielding MAE values of $2,915.241 \pm 1,880.403$ and $2,461.684 \pm 1,550.353$, respectively. Lastly, the Holt-Winters model ($\alpha = 0.5$, $\beta = 0.2$, $\gamma = 0.1$) applied in Experiment 1 resulted in an MAE of $9,225.052 \pm 5,862.083$. The dashboard provides key stakeholders with a mechanism to predict high-demand periods and reduce resource allocation through enabling data visualisation. Usability and efficacy were also tested using five experts and positive comments were received on its utility and relevance with a few suggestions on the enhancement of the dashboard. This project is an example of the need to combine predictive analytics and BI to better manage utilities proactively. The results show its potential to predict utility cost for better planning for the utility management. Future iterations could also improve the system using real-time monitoring and machine-learning based predictive algorithms.

TABLE OF CONTENTS

CONTENT	PAGE
SUPERVISOR APPROVAL	ii
STUDENT DECLARATION	iii
ACKNOWLEDGEMENT	iv
ABSTRACT	v
TABLE OF CONTENTS	vi
LIST OF FIGURES	x
LIST OF TABLES	xv
LIST OF EQUATIONS	xvii
LIST OF ABBREVIATION	xviii

CHAPTER ONE: INTRODUCTION

1.1 Background Study	1
1.2 Currents Business Process	5
1.3 Problem Statement	7
1.4 Objectives	9
1.5 Project Scope	9
1.6 Significance	10
1.7 Project Framework	11
1.8 Gantt Chart	13
1.9 Expected Outcome	13
1.10 Conclusion	14

CHAPTER TWO: LITERATURE REVIEW

2.1 Business Intelligence	15
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2.1.1 Overview of Business Intelligence	15
2.1.2 Business Intelligence Components	17
2.1.3 Business Intelligence Applications	25
2.2 Data Mining	27
2.2.1 Definition of Data Mining	27
2.2.2 Data Mining Techniques	28
2.2.3 Data Mining Applications	31
2.3 Predictive Analytics	32
2.3.1 Concept of Predictive Analytics	33
2.3.2 Predictive Analytics Algorithms	35
2.3.3 Predictive Analytics Applications	37
2.4 Overview of Utility Management	39
2.4.1 Overview of Utility Management	39
2.4.2 Challenges and Issues in Utility Management	39
2.5 Time Series in Utility Management	40
2.5.1 Overview of Time Series Analysis	40
2.5.2 Application of Time Series Analysis in Utility Management	41
2.6 CRISP-DM Framework	42
2.7 Similar Existing Work	46
2.8 Implication of Literature Review	50
2.9 Conclusion	51

CHAPTER THREE: METHODOLOGY

3.1 CRISP-DM Framework	52
3.2 Project Planning	55
3.3 Business Understanding	56
3.4 Data Understanding	59
3.4.1 Collect Initial Data	60
3.4.2 Describe Data	62
3.4.3 Explore Data	64
3.4.4 Verify Data	66