Cloud Based Encryption Platform for Google Drive using Post-Quantum Cryptography Algorithm

MUHAMMAD DINNIEY SAUFEE BIN RAZALI

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ON-LINE RECOGNITION OF DEVELOPING CONTROL CHART PATTERNS

MUHAMMAD DINNIEY SAUFEE BIN RAZALI

A thesis submitted in fulfilment of the

requirements for the award of the degree of

Bachelor of Computer Science (Computer Networks & Security)

Faculty of Computing

Universiti Teknologi Malaysia

JUNE 2025

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I declare that this thesis entitled *“Cloud Based Encryption Platform for Google Drive using Post Quantum Crytography”* is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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DEDICATION

This thesis is dedicated to my father, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my mother, who taught me that even the largest task can be accomplished if it is done one step at a time.

ACKNOWLEDGEMENT

In preparing this thesis, I was in contact with many people, researchers, academicians, and practitioners. They have contributed towards my understanding and thoughts. In particular, I wish to express my sincere appreciation to my main thesis supervisor, Dr. Rashidah Binti Kadir, for encouragement, guidance, critics and friendship.

My fellow student should also be recognised for their support. My sincere appreciation also extends to all my colleagues and others who have provided assistance at various occasions. Their views and tips are useful indeed. Unfortunately, it is not possible to list all of them in this limited space. I am grateful to all my family member.

ABSTRACT

In today's digital age, data security is paramount, especially with the widespread use of cloud storage platforms like Google Drive for both personal and business applications. Traditional encryption methods may soon become inadequate against the evolving landscape of cyber threats and the impending rise of quantum computing, which poses a significant challenge to current cryptographic algorithms. This project, SafeDrive, aims to develop a robust cloud-based encryption platform specifically tailored for Google Drive, by implementing post-quantum cryptographic algorithms such as NTRUEncrypt.The primary focus of SafeDrive is to enhance the security of data stored in the cloud by providing functionalities such as file encryption, decryption, and secure key sharing. The project involves extensive research into existing encryption techniques and post-quantum cryptography, significant coding efforts to develop the encryption algorithms and integrate them with Google Drive APIs, and rigorous security performance testing to ensure the robustness of the system. By addressing the urgent need for advanced encryption solutions, SafeDrive seeks to protect sensitive data against unauthorized access, data breaches, and the potential threats posed by quantum computing. This project not only contributes to the field of cybersecurity but also has practical implications for individuals and organizations relying on cloud storage services for data management and collaboration. By ensuring the confidentiality, integrity, and availability of data, SafeDrive aims to provide a secure, user-friendly solution that safeguards against current and future cyber threats, thereby fostering greater trust in cloud storage technologies.

ABSTRAK

Dalam era digital masa kini, keselamatan data adalah sangat penting, terutamanya dengan penggunaan meluas platform penyimpanan awan seperti Google Drive untuk kegunaan peribadi dan perniagaan. Kaedah penyulitan tradisional mungkin tidak lagi mencukupi terhadap ancaman siber yang semakin berkembang dan kemunculan pengkomputeran kuantum, yang menimbulkan cabaran besar kepada algoritma kriptografi semasa. Projek ini, SafeDrive, bertujuan untuk membangunkan platform penyulitan berasaskan awan yang kukuh khusus untuk Google Drive, dengan melaksanakan algoritma kriptografi pasca-kuantum seperti NTRUEncrypt. Fokus utama SafeDrive adalah untuk meningkatkan keselamatan data yang disimpan dalam awan dengan menyediakan fungsi-fungsi seperti penyulitan fail, penyahsulitan, dan perkongsian kunci yang selamat. Projek ini melibatkan penyelidikan yang meluas ke dalam teknik penyulitan sedia ada dan kriptografi pasca-kuantum, usaha pengekodan yang signifikan untuk membangunkan algoritma penyulitan dan mengintegrasikannya dengan API Google Drive, serta ujian prestasi keselamatan yang ketat untuk memastikan ketahanan sistem. Dengan menangani keperluan mendesak untuk penyelesaian penyulitan yang maju, SafeDrive berusaha untuk melindungi data sensitif daripada akses tidak sah, kebocoran data, dan ancaman yang berpotensi dari pengkomputeran kuantum. Projek ini bukan sahaja menyumbang kepada bidang keselamatan siber tetapi juga mempunyai implikasi praktikal untuk individu dan organisasi yang bergantung kepada perkhidmatan penyimpanan awan untuk pengurusan data dan kerjasama. Dengan memastikan kerahsiaan, integriti, dan ketersediaan data, SafeDrive bertujuan untuk menyediakan penyelesaian yang selamat dan mesra pengguna yang melindungi daripada ancaman siber semasa dan masa depan, dengan itu memperkukuhkan kepercayaan dalam teknologi penyimpanan awan.

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LIST OF ABBREVIATIONS

|  |  |  |
| --- | --- | --- |
| ANN | - | Artificial Neural Network |
| GA | - | Genetic Algorithm |
| PSO | - | Particle Swarm Optimization |
| MTS | - | Mahalanobis Taguchi System |
| MD | - | Mahalanobis Distance |
| TM | - | Taguchi Method |
| UTM | - | Universiti Teknologi Malaysia |
| XML | - | Extensible Markup Language |
| ANN | - | Artificial Neural Network |
| GA | - | Genetic Algorithm |
| PSO | - | Particle Swarm Optimization |
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LIST OF SYMBOLS

|  |  |  |
| --- | --- | --- |
| δ | - | Minimal error |
|  | - | Diameter |
|  | - | Force |
|  | - | Velocity |
|  | - | Pressure |
|  | - | Moment of Inersia |
|  | - | Radius |
|  | - | Reynold Number |
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# INTRODUCTION

## Introduction

In today's digital age, the importance of data security cannot be overstated. With the widespread adoption of cloud storage platforms like Google Drive in which is accessible to the public and also business use, there is an urgent need to have a robust and reliable encryption method to safeguard data shared using cloud computers. Traditional encryption method used by Google Drive today may not be enough to handle the increasingly advanced cyber attacking method which may harm to the data stored in the cloud. Recognizing this challenge, the focus of this research is to develop a cloud-based encryption platform specifically tailored for Google Drive, leveraging post-quantum cryptography algorithms. Post-quantum cryptography is designed to resist attacks from quantum computers, which have the potential to compromise conventional encryption methods used currently such as AES method and RSA method. By exploring this topic, the aim of this research is to address the pressing need for advanced encryption solutions that can safeguard sensitive data stored in the cloud. This research not only contributes to the field of cybersecurity but also has practical implications for individuals and organizations relying on cloud storage services for data management and collaboration.

## Problem Background

In the digital era, cloud computing has become essential for storing and accessing data remotely, offering convenience and accessibility. However, cybersecurity threats are a significant concern, especially for cloud-based storage services like Google Drive, which are prime targets due to the large volume of sensitive data they host. Metomic's 2023 Google Scanner Report revealed that 40.2% of approximately 6.5 million scanned Google Drive files contained sensitive data at risk of breaches or cyber-attacks.

For UTM students, who rely on Google Drive for academic work and personal documents, secure and reliable cloud storage is crucial. The vulnerability of cloud storage services to cyber threats is exacerbated by insufficient encryption methods, which struggle against sophisticated attacks and the emerging threat of quantum computing. Current methods like AES encryption may not be robust enough for future challenges.The National Institute of Standards and Technology (NIST) in the USA is developing post-quantum encryption standards, anticipating that quantum supremacy will compromise existing algorithms within a decade (Clyde & Gillis, 2023). This inadequacy leaves UTM students' data at risk of unauthorized access and breaches.As quantum computing advances, switching to more secure methods will become costlier if not addressed promptly.

In Malaysia, the rise in cyber threats highlights the need for advanced encryption in cloud storage,particularly in education. CyberSecurity Malaysia reported a significant increase in incidents involving unauthorized access to cloud services (CyberSecurity Malaysia, 2023). This highlight the pressing need of maintaining data integrity, confidentiality, and availability through secure cybersecurity measures.want to add a row or a column, and then click the plus sign.

## Project Aim

The aim of this project is to create a cloud encryption system for Google Drive which can be used to encrypt real-time data stored in cloud and also to showcase the usage of post quantum algorithm in a Google Drive encryption system..

## Project Objectives

The objectives of the project are:

1. To study the current cloud-based encryption platform that is used for files and existing post-quantum cryptography algorithms.
2. To design and develop a real-time data cloud-based encryption platform for Google Drive with the addition of integrating post-quantum cryptography algorithms.
3. To validate the result by conducting security performance testing

## Project Scope

The scopes of the project are:

1. The stakeholder in this project will be Google Drive as the technology this project focus on is Google Drive
2. SafeDrive will focus only on real-time data sharing, encryption, decryption, and secure file sharing within Google Drive.
3. SafeDrive will be implementing post-quantum cryptography algorithm like NTRUEncrypt
4. SafeDrive will involve research into encryption techniques and cloud storage security systems. It will require significant coding effort to develop the encryption algorithms, user interface, and integration with Google Drive APIs. Testing will be important to ensure the security and functionality of the tool.
5. The targeted user for this project will be UTM student who want to secure their real-time files in Google Drive

## Project Importance

This project is important to highlight the current weaknesses of the cloud encryption method used by Google Drive against quantum computing. By implementing the post-quantum algorithm into the system. The aim is to develop a

more robust and secure real time encryption system tailored specifically for UTM students. This enhanced security will safeguard sensitive data stored in the cloud, ensuring that their academic and personal information remains protected against both current and future cyber threats. The project not only highlights the necessity of advanced encryption methods but also contributes to the overall security infrastructure, providing UTM students with a reliable and secure cloud storage solution.

## Report Organization

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# LITERATURE REVIEW

## Introduction

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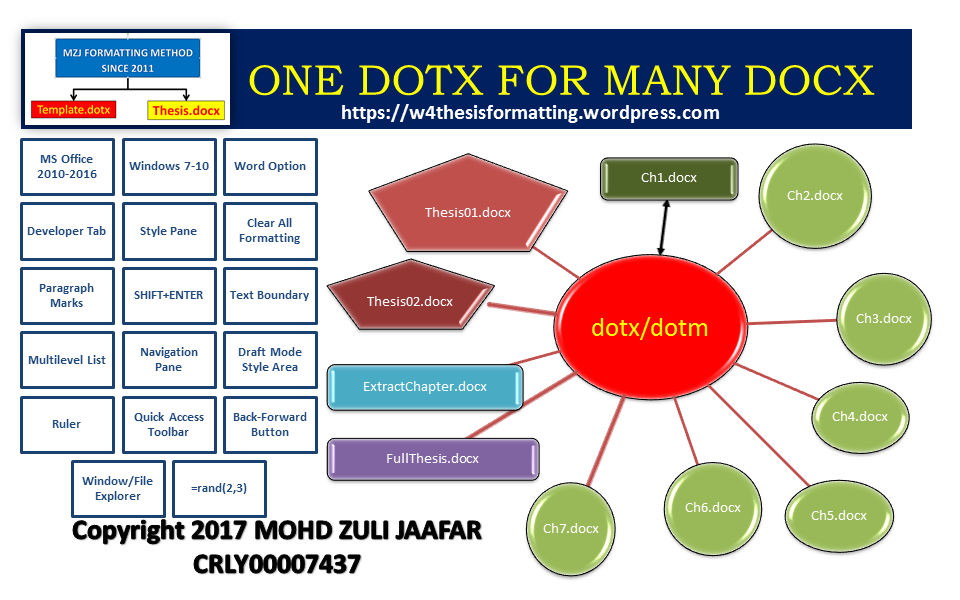


Figure 2.1 Continuous variability reduction using SPC chart (Revelle and Harrington, 1992)

Table . Example Repeated Header Table

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Table . Regression analysis for the results of preliminary feature screening

Table . Estimated effects and regression coefficients for the recogniser's performance (reduced model)

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## Case Study (If any)

Study of domain from general to specific, related studies, a description of the identified problem.

### Company Organization Structure

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### Manual Operation

After deliberating on doctoral education in Australia in the 1990s, one observer I Australia writes:

The lack of any significant formal course work within our Ph.D. and master degrees by research has continued for three decades. The focus of our Ph.D. research type degrees continues to be the research project, and this is almost the only medium by which education is accomplished.

(Stranks, 1984:171)

## Current System Analysis

Study of theory/algorithm/method that can contribute towards solving the problem, Justification of chosen theory/algorithm/method, Every sub-topic within the domain must have a review.

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## Comparison between existing systems

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## Literature Review of Technology Used

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## Chapter Summary

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# SYSTEM DEVELOPMENT METHODOLOGY

## Introduction

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## Methodology Choice and Justification

On the Insert tab, the galleries include items that are designed to coordinate with the overall look of your document. You can use these galleries to insert tables, headers, footers, lists, cover pages, and other document building blocks. When you create pictures, charts, or diagrams, they also coordinate with your current document look. You can easily change the formatting of selected text in the document text by choosing a look for the selected text from the Quick Styles gallery on the Home tab.

## Phases of the Chosen Methodology

On the Insert tab, the galleries include items that are designed to coordinate with the overall look of your document. You can use these galleries to insert tables, headers, footers, lists, cover pages, and other document building blocks. When you create pictures, charts, or diagrams, they also coordinate with your current document look. You can easily change the formatting of selected text in the document text by choosing a look for the selected text from the Quick Styles gallery on the Home tab.

## Technology Used Description

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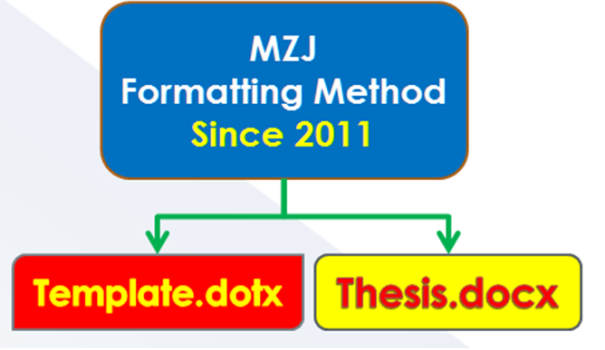


Figure 3.1 Example of Formatting Method

## System Requirement Analysis

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## Chapter Summary

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# REQUIREMENT ANALYSIS AND DESIGN

## Introduction

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## Requirement Analysis

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## Project Design

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## Database Design

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## Interface Design

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## Chapter Summary

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Table 4. Regression analysis for the results of preliminary feature screening

# IMPLEMENTATION AND TESTING

## Introduction

Video provides a powerful way to help you prove your point. When you click Online Video, you can paste in the embed code for the video you want to add. You can also type a keyword to search online for the video that best fits your document. To make your document look professionally produced, Word provides header, footer, cover page, and text box designs that complement each other. For example, you can add a matching cover page, header, and sidebar.

## Coding of System Main Functions

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## Interfaces of System Main Functions

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## Testing

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### Black box Testing

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#### System Flow

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#### Input Output Verification

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#### Error Messages

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### White box Testing

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### User Testing

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## Chapter Summary

Video provides a powerful way to help you prove your point. When you click Online Video, you can paste in the embed code for the video you want to add. You can also type a keyword to search online for the video that best fits your document. To make your document look professionally produced, Word provides header, footer, cover page, and text box designs that complement each other. For example, you can add a matching cover page, header, and sidebar.

# CONCLUSION

## Introduction

Video provides a powerful way to help you prove your point. When you click Online Video, you can paste in the embed code for the video you want to add. You can also type a keyword to search online for the video that best fits your document. To make your document look professionally produced, Word provides header, footer, cover page, and text box designs that complement each other. For example, you can add a matching cover page, header, and sidebar.

## Achievement of Project Objectives

Video provides a powerful way to help you prove your point. When you click Online Video, you can paste in the embed code for the video you want to add. You can also type a keyword to search online for the video that best fits your document. To make your document look professionally produced, Word provides header, footer, cover page, and text box designs that complement each other. For example, you can add a matching cover page, header, and sidebar.

## Suggestions for Future Improvement

Video provides a powerful way to help you prove your point. When you click Online Video, you can paste in the embed code for the video you want to add. You can also type a keyword to search online for the video that best fits your document. To make your document look professionally produced, Word provides header, footer, cover page, and text box designs that complement each other. For example, you can add a matching cover page, header, and sidebar.

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Appendix A Mathematical Proofs

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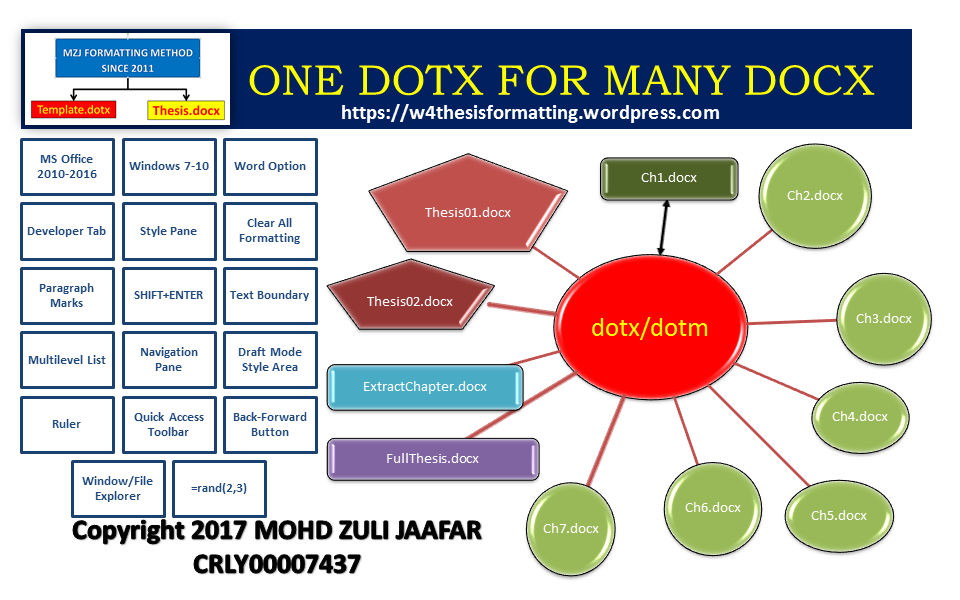


Figure A.1 xxxxxxxxxxxxxxxx

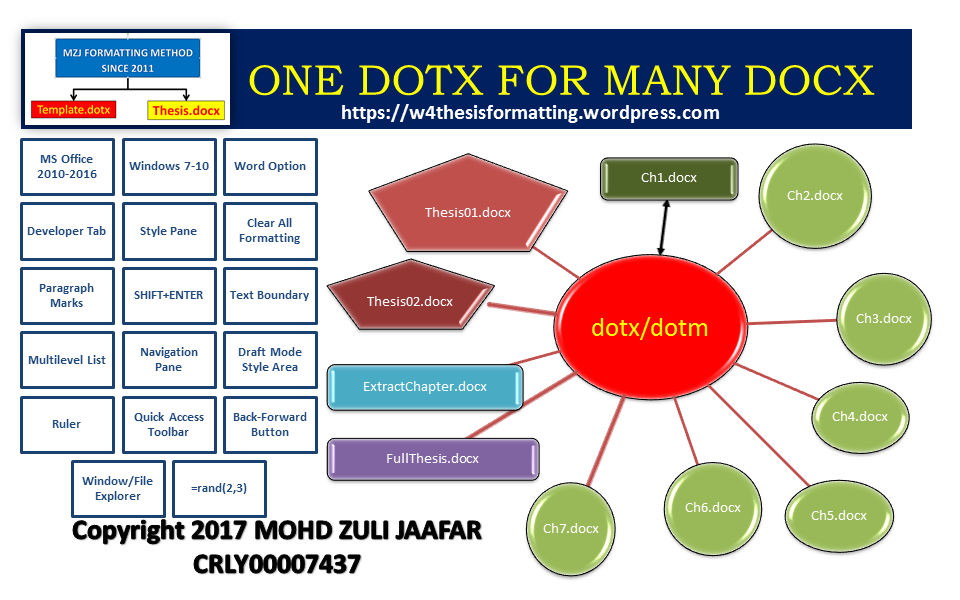


Figure A.2 xxxxxxxxxxxxxx

Table A. Example Repeated Header Table

| Title | Title | Title | Title |
| --- | --- | --- | --- |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

Appendix B Psuedo Code

Appendix C Time-series Results Long