DATA REPRESENTATION OF CRIME ANALYSIS BY USING INFORMATION VISUALIZATION

RAHILLDA NADHIRAH NORIZZATY BINTI RAHIDDIN

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS TESIS*

JUDUL: DATA REPRESENTATION OF CRIME ANALYSIS BY USING INFORMATION VISUALIZATION

SESI PENGAJIAN: 2014/2015

SAYA RAHILLDA NADHIRAH NORIZZATY BINTI RAHIDDIN

mengaku membenarkan tesis (PSM) ini disimpan di Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dengan syarat-syarat kegunaan seperti berikut:

1. Tesis dan projek adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (/)

_____ SULIT	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)
_____ TERHAD	(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
_/_ TIDAK TERHAD	

(TANDATANGAN PENULIS)

Alamat tetap: 2215, Taman Kalong, Bukit Kuang, 24000 Kemaman, Terengganu Darul Iman.

Tarikh: 1 September 2015

(TANDATANGAN PENYELIA)

ROSMIZA WAHIDA BINTI ABDULLAH
Pensyarah
Fakulti Teknologi Maklumat Dan Komunikasi
Universiti Teknikal Malaysia Melaka (UTeM)

Nama Penyelia

Tarikh: 1/9/2015

Catatan: *Tesis bermaksud sebagai Laporan Akhir Projek Sarjana Muda (PSM)
**Jika tesis ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa

DATA REPRESENTATION OF CRIME ANALYSIS BY USING INFORMATION VISUALIZATION

RAHILLDA NADHIRAH NORIZZATY BINTI RAHIDDIN

The report is submitted in partial fulfilment of the requirements for the Bachelor of Computer Science (System Development) with Honour

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2015

DECLARATION

I hereby declare that this project report entitle

DATA REPRESENTATION OF CRIME ANALYSIS BY USING INFORMATION VISUALIZATION

Was my original work and not copy from any resources except a few parts that were mention in references section.

STUDENT: _____ DATE: 1 SEPTEMBER 2015

(RAHILLDA NADHIRAH NORIZZATY BINTI RAHIDDIN)

SUPERVISOR: _____ DATE: 1 SEPTEMBER 2015

(ROSMIZA WAHIDA BINTI ABDULLAH)

DEDICATION

To my beloved family, I love you all. To my supervisor, thank you so much for the assist and help. To my all my friends, thank you for your hardship and support.

ACKNOWLEDGEMENT

First of all, praise upon Allah for giving me strength and patient to complete the PSM throughout this semester. Special thanks to my beloved parents for their pray and blesses to me. I also would like to express my gratitude and honour to my dedicated supervisor, Madam Rosmiza Wahida Binti Abdullah that always guide and conducting me through the completion of this project.

ABSTRACT

Crime Visualization System (CVS) is a system that visualizing the crime data in Malacca map, statistic graph, pie chart and spacetree. On Malacca map, the numbers of crimes are visualized using color on map. The statistic graph shows the number of crime happened in each district and state where the location of the crimes. While pie chart shows the percentage of category in each location. For spacetree, it displays the division of crime happened in Malacca. CVS has three types of user levels which are administrator, IPK staffs and public users. Each user can view different functionalities. The methodology used in CVS development is Object-Oriented Analysis and Design (OOAD). The system is a web-based system.

ABSTRAK

Crime Visualization System (CVS) merupakan satu system untuk mengvisualkan data-data jenayah yang dilaporkkan dalam bentuk peta Melaka, graf statistik, carta pie dan *spacetree*. Di peta Melaka, jumlah jenayah yang dilaporkan dipamerkan menggunakan warna pada peta. Graf statistik pula menunjukkan jumlah jenayah yang terjadi pada setiap daerah dan menyatakan lokasi setiap jenayah yang dilaporkan. Sementara itu, carta pie menunjukkan peratus jumlah kategori di setiap lokasi. *Spacetree* pula menunjukkan pecahan setiap jenayah yang dilaporkan di Melaka. CVS mempunyai tiga tahap pengguna iaitu pentadbir, staf-staf IPK dan pengguna awam. Setiap pengguna menggunakan fungsi yang berbeza. Metodologi yang digunakan di dalam CVS adalah Analisis dan Rekabentuk Berorientasikan Objek. Sistem ini adalah berasaskan web.

TABLE OF CONTENTS

CHAPTER	SUBJECT	PAGE
	TITLE	
	DECLARATION	**ii**
	DEDICATION	**iii**
	ACKNOWLEDGEMENT	**iv**
	ABSTRACT	**v**
	ABSTRAK	**vi**
	TABLE OF CONTENTS	**vii**
	LIST OF TABLES	**x**
	LIST OF FIGURES	**xiii**
CHAPTER I	**INTRODUCTION**	
	1.1 Project Background	1
	1.2 Problem Statement	2
	1.3 Objectives	2
	1.4 Scope	3
	1.5 Project Significance	3
	1.6 Expected Output	3
	1.7 Conclusion	4
CHAPTER II	**LITERATURE REVIEW AND PROJECT METHODOLOGY**	
	2.1 Introduction	5
	2.2 Fact and findings	6
	2.2.1 Domain	6
	2.2.2 Existing System	13

	2.2.3 Technique	15
	2.3 Project Methodology	16
	2.4 Project Requirements	17
	2.4.1 Software Requirements	17
	2.4.2 Hardware Requirement	18
	2.4.3 Other Requirements	18
	2.5 Project Schedule and Milestones	18
	2.6 Conclusion	20
CHAPTER III	**ANALYSIS**	
	3.1 Introduction	21
	3.2 Problem analysis	22
	3.3 Requirement analysis	29
	3.3.1 Data Requirement	29
	3.3.2 Functional Requirement	34
	3.3.3 Non-functional Requirement	45
	3.3.4 Other Requirement	45
	3.4 Conclusion	46
CHAPTER IV	**DESIGN**	
	4.1 Introduction	47
	4.2 High-level Design	48
	4.2.1 System Architecture	48
	4.2.2 User Interface Design	49
	4.2.2.1 Navigation Design	50
	4.2.2.2 Input Design	52
	4.2.2.3 Output Design	56
	4.2.3 Database Design	60
	4.2.3.1 Conceptual and Logical Database Design	60
	4.3 Detailed Design	61
	4.3.1 Software Design	61
	4.3.2 Physical Database Design	62
	4.4 Conclusion	66
CHAPTER V	**IMPLEMENTATION**	

	5.1 Introduction	67
	5.2 Software Development Environment Setup	68
	5.3 Software Configuration Management	70
	5.3.1 Configuration environment setup	70
	5.3.2 Version Control Procedure	75
	5.4 Implementation Status	75
	5.5 Conclusion	77
CHAPTER VI	**TESTING**	
	6.1 Introduction	78
	6.2 Test Plan	79
	6.2.1 Test Organization	79
	6.2.2 Test Environment	79
	6.2.3 Test Schedule	80
	6.3 Test Strategy	81
	6.3.1 Classes of tests	82
	6.4 Test Design	83
	6.4.1 Test Description	83
	6.4.2 Test Data	91
	6.5 Test Result and Analysis	102
	6.6 Conclusion	122
CHAPTER VII	**CONCLUSION**	
	7.1 Observation on Weaknesses and Strengths	123
	7.2 Propositions for Improvement	124
	7.3 Project Contribution	124
	7.4 Conclusion	125
	REFERENCES	
	APPENDIX	

LIST OF TABLES

TABLE	TITLE	PAGE
3.1	Crime_category table	30
3.2	Crime_color table	30
3.3	Crime_event table	31
3.4	District table	32
3.5	Location table	32
3.6	Role table	33
3.7	Staff table	33
5.1	List of software requirement in CVS	68
5.2	Version control of CVS	75
5.3	Implementation status in each module in CVS	75
6.1	Test description of verify login	83
6.2	Test description of administrator / IPK staff logout button	84
6.3	Test description of add new IPK staff	84
6.4	Test description of administrator edit IPK staff information	85
6.5	Test description of administrator deletes IPK staff	86
6.6	Test description of administrator search IPK staff	86

6.7	Test description of edit maximum number of crime in colour code	87
6.8	Test description of add new crime event	88
6.9	Test description of edit crime event	89
6.10	Test description of administrator delete crime event	90
6.11	Test description of add new crime category	90
6.12	Test description of edit crime category	91
6.13	Test data of verify login	91
6.14	Test data of administrator / IPK staff logout button	92
6.15	Test data of add new IPK staff	93
6.16	Test data of administrator edit IPK staff information	94
6.17	Test data of administrator deletes IPK staff	95
6.18	Test data of administrator search IPK staff	96
6.19	Test data of edit maximum number of crime in colour code	96
6.20	Test data of add new crime event	97
6.21	Test data of edit crime event	98
6.22	Test data of administrator delete crime event	100
6.23	Test data of add new crime category	101
6.24	Test data of edit crime category	101
6.25	Test Results and Analysis of verify login	102
6.26	Test Results and Analysis of administrator /IPK staff logout	104

	button	
6.27	**Test Results and Analysis of add new IPK staff**	**105**
6.28	**Test Results and Analysis of administrator edit IPK staff information**	**107**
6.29	**Test Results and Analysis of administrator deletes IPK staff**	**110**
6.30	**Test Results and Analysis of administrator search IPK staff**	**111**
6.31	**Test Results and Analysis of edit maximum number of crime in colour code**	**112**
6.32	**Test Results and Analysis of add new crime event**	**113**
6.33	**Test Results and Analysis of edit crime event**	**116**
6.34	**Test Results and Analysis of administrator delete crime event**	**119**
6.35	**Test Results and Analysis of add new crime category**	**120**
6.36	**Test Results and Analysis of edit crime category**	**121**

LIST OF FIGURES

FIGURE	TITLE	PAGE
2.1	Regular mesh	8
2.2	Perimeter mesh	9
2.3	Polynomial domain	10
2.4	Triangulated domain	10
2.5	Surface	11
2.6	ConcurTaskTree (CTT)	12
2.7	Treemaps	12
2.8	Hyperbolic browser	13
2.9	Malaysia Crime map	14
2.10	List of crime news	14
2.11	Update crime report page	15
2.12	OOAD activities cycle	17
2.13	CVS Gantt chart	19
3.1	The map with crime icons	22
3.2	The reported crime events list	23
3.3	The details of crime event and update crime report	23
3.4	Update Crime Report form	24
3.5	Required to insert valid password	24
3.6	After insert invalid or empty password	25
3.7	Sequence diagram of display crime map and update crime event	25

	functions	
3.8	Add new crime event form	26
3.9	Sequence diagram of add new crime event module	27
3.10	The redundancies of crime icons on map	28
3.11	Unauthorized user that report the crime using fake name	28
3.12	The wrong reported crime location display on map	29
3.13	Use case diagram of CVS	44
4.1	Layered Architecture for Crime Visualization System	48
4.2	The navigation flow of CVS	50
4.3	The CVS administrator home page, with main navigation tabs highlighted	51
4.4	The new staff forms to insert information of new IPK staff	52
4.5	The validation window appeared when users insert empty information in form	52
4.6	The search section to display the list of staff based on police number	53
4.7	The edit staff form	53
4.8	The edit range form	54
4.9	The add new crime event form	54
4.10	The validation window	55
4.11	Edit crime event form	55
4.12	The add crime category form	55
4.13	The edit crime category form	56
4.14	The map show the number of crime happened in Malacca	56

4.15	The bar chart show the number of crime happened each district in Malacca	57
4.16	The pie chart show the percentage of number of crime happened each district in Malacca	57
4.17	The list of crime event in Malacca	58
4.18	The description of crime event in Malacca	58
4.19	The multiple bar chart of number of crime in each district in Malacca	58
4.20	The line graph show the pattern of crime category in each month in Malacca	59
4.21	The CVS spacetree	59
4.22	Entity relationship diagram (ERD) of CVS	60
4.23	Class Diagram of CVS	62
5.1	Deployment Diagram of CVS	69
5.2	Setup wizard of AppServ 2.5.10	70
5.3	Select components window	71
5.4	Apache HTTP Server information window	71
5.5	MySQL Server configuration window	72
5.6	Homepage of AppServ after successfully installed	72
5.7	phpMyAdmin homepage	73
5.8	Adobe Dreamweaver CS5 installer homepage	74
5.9	Adobe Dreamweaver after successfully installed	74

CHAPTER I

INTRODUCTION

1.1 Project Background

Crime activity reports available from victims, governmental organizations, news press, and social networks play a significant role in public safety, including crime prevention, suppression and investigation, uniformed patrol and response. The public also worried about their belongings and housing area.

With this project, we help the authorities to increase public awareness about the crimes that happened in their housing area and state. So they can be more careful. The project will help them viewing the crime analysis by information visualization technique, view the state map, view the statistic and summarize the crime that happened. The information and statistic show the actual information from IPK Malacca staffs.

1.2 Problem statement(s)

The problem statements in the project are

- Disability to visualize the big picture of crime.
- Lack of information reliability.
- Late updating of crime information and police officer difficult to patrol the dark areas.

1.3 Objectives

The objectives in the project that need to be achieved are

- To represent crime information in more interesting and easier to understand.
    - The authority can get better understanding to seeing the big picture and overcoming the challenge of detecting and preventing crime.

- To provide more accurate and trusted information.
    - The purpose of this project is to help to prevent mistake or inaccurate information from IPK staff and help the authority get the right information.

- To assist authority to monitor crime cases effectively and decision making.
    - With the system, public can take a step on how to prevent the crime that will happen around them. Police department can increase the number of policemen in dark area and authority can make on duty call to guard their housing area.

1.4 Scope

There are three level users involve which are system administrator, IPK Malacca staffs and public users. For system administrator and IPK Malacca staffs, they need to login before enter the system. System administrator can manage IPK Malacca staffs, view crime statistic, view crime map, manage IPK staff, manage crime events and manage crime range. For IPK Malacca staffs can view crime statistic, view crime map, manage crime events and manage crime category. But for public users, they only can view crime statistic and view crime map.

1.5 Project significance

The benefits that gain in the project are crime information are representing in more interesting and easier to understand. The IPK staff and authority can get better understanding about the information. The project also helps to decrease the mistake or inaccurate information from IPK staff and help the authority get the right information to monitor crime cases effectively.

1.6 Expected Output

The outcome of the project is a web-based system to visualize the crime analysis data by information visualization technique.

1.7 Conclusion

As the conclusion, the output from this project can overcome all the problems that have been state in the problem statement and can achieve the all objectives. Hopefully this project also can be completed in the time duration given. For the second chapter, the things that will be discusses are about the related previous research, proposed solution and the project schedule and milestone.

CHAPTER II

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

In this chapter 2, it will focus on literature review and project methodology. The literature review is focused on the research of the existing system and the new system that will be developed. The purpose of a literature review is to convey the reader about the knowledge and also can established the ideas have been on a topic and what are the strengths and weaknesses.

This section is started by existing system. It will discuss and review about approach and related research, reference about this system. In project methodology section, selected approach or methodology will be described the activities that may do in every stage. All the requirements in this system will be explained in high level project requirements and followed with project schedule and milestones.

2.2 Fact and findings

2.2.1 Domain

Crime is divided into two comprehensive concepts which are legal and non-legal sense. Legal crime is breaking criminal law and aimed at protecting lives, property and right of citizens of belonging to that jurisdiction. Crime is an offence against a person, their properties or State regulation. A set of acts that violate socially accepted rules of human ethical or moral behaviour known as non-legal crime.[1]

A single detective officer may has different tasks such as assist investigating officers by analyzing crime patterns and identifying links between individual or group of offenders with series of crimes.[2]

In computer science research, the term visualization describes the field of study that uses interactive graphical tools to explore and present digitally represented data that might be simulated, measured, or archived [3]. Information visualization seems to be most effective for specialists doing data analysis. It is also used for creating computer graphs or animations to present information, data, scientific results, or concepts to facilitate communications or decision making processes. It can be used to render abstract information in a visual form that allows for interactive exploration and brings new insights in complex data [4].

Several of techniques in information visualization can be applied to represent the data. The techniques to visualize the data are depending on type of information. Many law enforcement and intelligence experts are interested in these visualization techniques for their practical use. There are list of techniques for visualize crime data [5]:

- Spatiotemporal crime visualization and analysis
- Geospatial crime hotspot visualization and analysis
- GIS visualization techniques for crime mapping
- Interactive investigation visualization/visual analytics tools for spatiotemporal crime analysis

- Collaborative and distributed visualization for multiple crime analysts
- Detecting crime patterns and predictions using visual analytics on big crime data
- Interactive information dashboards for crime analysts
- 3D visualization/animation/simulation for crime data exploration and analysis
- Virtual reality and augmented reality techniques for crime data visualization

In addition, there is example of proceeding that proposes a STT (spatio-temporal-textual) search engine for extracting, indexing, querying and visualizing crime information. They had developed a crime search engine for Washington DC metropolitan area that includes geo-temporal-tagger, STT indexer, heuristic query and ranker and dynamical ST visualization. It assists crime detection for investigators, identification of crime trends and patterns for decision makers and researchers, and security of city life for residents and journalists [6].

Card et al. [7] defines the two forms of visualization as

- Scientific Visualization: the use of interactive visual representations of scientific data, typically physically based, to amplify cognition.
- Information Visualization: the use of interactive visual representations of abstract non-physically based data to amplify cognition.

Examples of scientific visualization are

- **Regular mesh**

This is probably the most commonly seen representation of the model domain because it is conceptually simple and clear, it corresponds naturally to array types provided by programming languages, and there is a large body of traditional mathematics organized around uniform samplings. All "grid lines" are parallel to coordinate axes, and the spacing between cells is uniform within each direction. There is an implicit "topology" of the underlying