CHANGE DETECTION ON KLANG AREA USING LANDSAT 5-TM DATA

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NURAMALINA BINTI MAT SERAH

This report is submitted in partial fulfillment of the requirements for the
Bachelor of Computer Science (Software Development)

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DECLARATION

I hereby declare that this project report entitled

CHANGE DETECTION ON KLANG AREA USING LANDSAT 5-TM DATA

Is written by me and is my own effort and that no part has been plagiarized without

citations.

STUDENT : NURAMALINA BINTI MAT SERAH Date: _____

SUPERVISOR : DR. ASMALA BIN AHMAD Date: _____

DEDICATION

Dedicate to my beloved parents, Mr. Ahmad Bin Che Muhamud and Pn. Rosnani Binti Aliman for supporting me mentally and physically.

To my supervisor, Dr. Asmala Bin Ahmad for his guidance on completing this final year project.

Also, to my loveable friends who helping and supporting me to finish up my final year project.

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ABSTRACT

The main goal for this project is to detect changes in Klang land-cover by using Landsat-5 TM. This project involves change detection method and remote sensing to detect changes by comparing the satellite imagery of the area taken at different times. Investigation of the land-cover structure and object changes is based on satellite images with medium resolution that recorded surface reflectance at approximately 0.4 to 0.7 micrometers wavelengths. Expected outcome from this project is producing a well processed image of the land-cover. Those images are enhanced by using unsupervised k-mean clustering method. The first image are compare to the enhanced image to see whether there is any change on those images in term of land structure. The well processed image can provide the information to the end-user about the degree of land or object changes in a period of time by looking at the result from the image.

ABSTRAK

Matlamat utama projek ini adalah untuk mengesan perubahan di permukaan tanah di kawasan Klang dengan menggunakan data daripada Landsat-5 TM. Projek ini melibatkan kaedah *Change Detection* dan *remote sensing* bagi mengesan perubahan dengan membandingkan dua imej satelit pada kawasan yang sama tetapi berlainan masa. Penyiasatan struktur permuakaan tanah dan perubahan objek adalah berdasarkan imej satelit dengan menggunakan resolusi sederhana yang mencatatkan panjang gelombang pantulan pada permukaan sebanyak 0,4-0,7 mikrometer. Hasil akhir projek ini adalah dengan menghasilkan imej permuakan tanah yang telah diproses. Imej tersebut dipertingkatkan dengan menggunakan kaedah tanpa pengawasan iaitu *K-Mean*. Imej pertama adalah berbanding dengan imej yang dipertingkatkan untuk melihat sama ada terdapat perubahan pada imej tersebut dari segi struktur tanah dan juga objek. Imej yang telah diproses boleh memberi maklumat kepada pengguna akhir tentang keadaan tanah atau perubahan objek dalam satu tempoh masa dengan melihat hasil akhir daripada imej.

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INTRODUCTION

1.1   Project Background

This project presents the detection of changes in Klang land-cover by using Landsat-5 TM. Change detection can be defined as the process of identifying differences in the state of an object or phenomenon by observing it at different times. The process is usually applied to earth surface because earth surface is changing constantly in many ways. It is very important to know how land cover has changed over time, in order to assess changes in soil structure or urban development because it provides quantitative analysis of the spatial distribution of the population of interest. It is involves by comparing the satellite imagery of the area taken at different times.

Remote sensing provides a unique perspective from which to observe large regions and global monitoring is possible from nearly any site on earth. Which means remote sensing refers to the activities of recording, observing and perceiving objects or events at faraway places. This method is using a few images of the same region which is Klang Selangor, Malaysia in different periods to detect changes in land covers.

The aim of the study is to analyze the satellite images in order to obtain a better image and to detect changes on the desired region using remote sensing data based on artificial intelligent methods. This project is to investigate the land-cover structure and object changes based on of satellite images with medium resolution that recorded surface reflectance at approximately 0.4 to 0.7 micrometers wavelengths.

The change detection maps are enhanced by using unsupervised K-Mean clustering method. In K-Mean clustering the objects with similar spectrum values are clustered together without any former knowledge. It is the basic algorithm of unsupervised classification which provides the overview of objects directly and to make the analysis clearer. Then, the first change detection map are compare to the enhanced image to see whether there is any change or difference on those images in term of land structure.

The expected outcome from this project is producing a well processed image of the land-cover. The well processed image can provide the information to the end-user about the degree of land or object changes in a period of time by looking at the result from the image. This will greatly assist decision makers, especially in town planning sectors, in monitoring and planning rapidly developed urban areas such as Klang.

1.2 Problem Statement

The change detection use remote sensing is to replace the existing system such as manual monitoring and observing land cover. It is the practical way to obtain data from inaccessible regions. At small scales, regional phenomena which are invisible from the ground are clearly visible with this change detection map examples like fault and other geological structures. Example of existing system such as aerial monitoring by helicopter or visit the land site and measure

the land cover by using land surveyors tool which is need a complex mathematical calculations and high-tech equipment. There are some problems that have been capture and identified such as below:

a) Manual survey to monitoring land or object changes.
   - A vehicle such as helicopter is used on observing the land cover from the top view. Another way is by visiting the land site. To gather information about the land cover, those manual surveys need a high-tech equipment and complex mathematical calculation.

b) Wastage of time and cost.
   - It is wastage of time because this manual monitoring takes several days to gather information about the land cover.
   - It is also high costing because to run this manual process it needs high-tech equipment, many man power and vehicle such as helicopter.

c) Accuracy of the data gathered.
   - Accuracy of the data that is produced from manual way is not quite accurate.

1.3 Objective

The objectives of this project are:

a) To investigate the land cover structure and object changes based on well process of images in a better resolution.

b) To observe whether there is any changes on region of Klang Selangor, Malaysia.

c) To develop method to derive change detection information.

d) To develop change detection map.

1.4 Scope

a) Software:-

- • ENVI.
- • Matlab.

b) Study area:-

- • Klang Selangor, Malaysia.
- - Spatial (Latitude: 3.043061, Longitude: 101.440657, 573KM^2)
- - Spectral (Band 1,2,3,4,5,6 and 7)

c) End user:-

- • Science and research officer.
- • Urban planner.
- • Real estate investor.
- • Education.

1.5 Project Significance

The aim of this project is to produce a digital map that is able to monitor Klang land cover from time to time without involving the man power or high-tech equipment. At the same time it can save cost and time to get information about those land cover. The significance of this project is also to facilitate the scientist to conduct their own research on Klang land cover. Besides that, it can assist the urban planner to monitor Klang area from time to time. Indirectly, this project will also benefit primarily to real estate investor. Not only that, it is also used in education which is important for those who want to conducting some research on this land.

1.6 Expected Output

The expected output for this project is able to provide change detection map by using data from Landsat-5 TM satellite which is used to monitoring Klang land cover from different time. Moreover, the map is produce in well process of images in a better resolution.

1.7 Conclusion

This first chapter introduce about the background of the project which is to detect the changes of Klang land cover from different time by using change detection method. The process to produce the change detection map is involving the data from Landsat-5 TM satellite. To produce change detection map, remote sensing is one of the techniques to obtaining information without any physical contact.

This project is develop to replace the existing system because the manual monitoring is more expensive and takes time to gather information of land cover. Moreover, the change detection maps are more precise than the manual monitoring.

Several software are used to produce the change detection map such as ENVI and Matlab. The end user of this product is scientist and researcher officer, urban planner, real estate investor and also used in education such as student or lecturer. The project objective is to produce change detection map so that it can be used in investigating the land cover structure and object changes on Klang land cover. It is also to develop method to derive change detection information. These objectives will be described more on the other chapter.

CHAPTER II

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

A literature review is an evaluative report of information found in the literature related to area of study. The review should describe summaries, evaluate and clarify this literature. It should give a theoretical base for the research and help to determine the research. All works included in the review must be read, evaluated and analyzed. It is published separately in a scholarly journal, either a part of a report from research project or the bibliography essay. Both of these have the same purpose, which is to review the scholarly literature that is related to the main topic and it also help to design the methodology and help interpret the project.

Literature review is to gather information about change detection method in remote sensing such as how to use change detection method on detecting land cover changes. As the process is involving the data from satellite, investigate it whether the accuracy of the data generated from satellite are precise or not by studying the paper from previous research that is generated from other person. The previous paper that is related to change detection method, satellite or remote sensing can help to identify the limitation of satellite image and gain some

knowledge before carrying out project development. It is also help to find the suitable software to use for producing the change detection map.

2.2 Fact and Findings

Fact and findings is references or past researches that have been found in the internet, books, and documentation. To develop any new project, analyst needs to do collect facts and all relevant information or in termed as data. The success of any project is depended upon the accuracy of available data. Accurate information can be collected with help of certain methods and techniques. These specific methods for finding information of the system are termed as fact finding techniques. The analyst may use more than one technique for investigation and compare it each other.

2.2.1 Domain

To develop a project, it is important to know the project domain. The aim of this project is to produce information of data changes such as soil structure, coast, object or urban changes on Klang land cover. This change detection map shows the thing that has been change on that land cover form a different time.

2.2.2 Existing System

Currently, many research that has been done by researcher in change detection remote sensing. They also use a data from different satellite. Change detection map are ideal solution for end user to see the changes of Klang and get the information about the changes form statistic. Below are the literature review that have been analyzed.

a) Cloud detection for cloud masking

The reflective bands for cloud selection was based on their spectral response to cloud, their data quality, their capability of distinguish the cloud and other features. The spectral response to cloud and separability efficiency are interrelated as they provide information on the contrast between clouds and other features (Asmala et al,2012).

b) Geometric correction

Geometric registration is required to remove or reduce the effects of non-systematic or random distortions present in remote sensing data. (John Rogana et al, 2003) Geometric corrections include correcting for geometric distortions due to Earth geometry variations, and conversion of the data to real world coordinates such as latitude and longitude on the Earth's surface.

c) Change detection

Change detection is the measure of the distinct data framework and thematic change information that can guide to more tangible insights into underlying process involving land cover and land use changes than the information obtained from continuous change (T. V. Ramachandra et al, 2004).
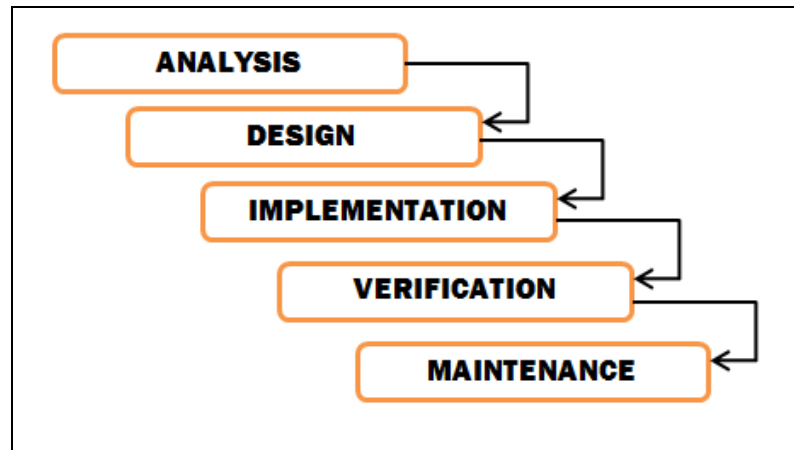
2.3 Project Methodology

Figure 1: Waterfall model

Methodology in system development refers as a framework that is used to structure, plan, and control the process of develop an information system. Methodology model that is choose in this project is waterfall model that has a sequential design process, where the step will take inputs from the previous step and gives output to next step. It is often used in development process when requirements are well understood. The waterfall model was first defined by Winston W. Royce in 1970 and has been widely used for software projects ever since. Waterfall model is show on figure 1 which is contain analysis phase, design phase, implementation phase, verification phase and maintenance phase.

The waterfall methodologies are chosen because in design phase, the design errors are captured before any software is written and this will save time during the implementation phase. Moreover, this model has an excellent technical documentation that is a part of the deliverables and it is easier for developer to speed up during the maintenance phase. It is also very structured and it is easier to measure the progress by refer to milestones. Cost of the project can be estimates accurately after undergo the analysis phase and the requirements

have been defined. The verification is easier as it can be done with reference from the processes before the verification phase. Below is a description of each phase in this waterfall methodology:-

a) **Analysis Phase**

The activities in analysis process are to find the problems of the previous techniques of mapping processes. Study the existing system to gain some knowledge that can derive to the project problem statement. After that, objectives are stated after performing the analysis and understanding the relevant information. Next, find the hardware and software requirement of remote sensing mapping processes and select the location of land cover to process through the satellite images. Project plan are also made in this phase.

b) **Design Phase**

Design the flow chart of mapping process by using changes detection method. Based on the requirements and the detailed analysis of a change detection map, the new map process must be designed. It is the most crucial phase in the development of change detection map process. The logical system design arrived at as a result of system analysis and is converted into physical system design.

c) **Implementation phase**

After having the supervisor acceptance of the new change detection map design, the implementation phase begins. Implementation is the stage of a project during which theory is turned into practice. The major steps involved in this phase are getting the information about change detection map and documentation. In this phase, satellite image from different time will be process by using change detection method. Information such as statistics and changes of object or phenomenon will be shows on change detection map.

d) Verification phase

After the implementation phases are complete, the system is verify and if there are any faults in earlier phases it will be remove in this phase. The methods of change detection provide the information about the degree of land or object changes in a period of time by looking at the result which is the change detection map. Those change detection map will be verify by supervisor whether it is suitable to proceed to the next step or not.

e) Maintenance phase

Update the information of land mapping based on the changes of land from time to time if needed.

2.4 Project Requirement

a) Software requirement

Table 1 shows the software requirement for the project.

Operating System	Windows 7 Ultimate
Software Support	ENVI 4.5
	Matlab R2010a
	Microsoft Office Word 2010
	Microsoft Office Excel 2010
	Microsoft Office Power Point 2010

Table 1: Software requirement