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JUDUL : LAND SURFACE TEMPERATURE DETERMINATION FOR SELANGOR AREA

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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LAND SURFACE TEMPERATURE DETERMINATION FOR SELANGOR AREA

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This report is submitted in partial fulfillment of the requirements for the
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UNIVERSITI TEKNIKAL MALAYSIA MELAKA
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DECLARATION

I hereby declare that this project report entitled

LAND SURFACE TEMPERATURE DETERMINATION FOR SELANGOR AREA

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

STUDENT : _____Date: _____

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DEDICATION

I dedicate my final year project report to my family and many friends. A special to my loving parents, whose words of encouragement and push for tenacity ring in my ears. I also dedicate this report to my close friends and family who have supported me throughout the project development. I will always appreciate all they have done. I dedicate this work and give special thanks to my best friends Fatehah and Amalina for being support me throughout the entire project development. Both of you have been my best cheerleaders.

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ABSTRACT

The study was implemented by using Landsat TM. This scene covers the areas of Klang, Selangor. The main objective of this study is to evaluate the use of remote sensed information. Remote sensing is a technology to obtain information about the object or phenomenon without having to be physically connected to the object. Remote sensed information is use to gain land surface temperature (LST) using supervised method of Landsat images. The derivation of LST map using remote sensing technique in this study is useful in providing information for analyzing geophysical information over Selangor area, especially dealing with the urban heat island phenomenon. Supervised image classification was used, in which it requires training sites on the image that represent of each desired land temperature category. The delineation of training areas that represent the land temperature is most effective when an image analyst has knowledge of the geography of a region and experience with the spectral properties of the suitable classes. Envi software is used to identified spectral values or signatures associated with the training sites. After the signatures for each land temperature category have been identified, the software then uses all the signatures to classify the remaining pixels. The methodology consist 4 phases; analysis, design, implementation and testing.

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ABSTRAK

Kajian ini dilaksanakan menggunakan Landsat TM. Kejadian ini meliputi kawasan Klang, Selangor. Objektif utama kajian ini adalah untuk menilai penggunaan maklumat 'Remote Sensing'. 'Remote Sensing' adalah perolehan maklumat tentang objek atau fenomena tanpa membuat hubungan fizikal dengan objek. Maklumat 'remote sensing' adalah digunakan untuk mendapatkan suhu permukaan tanah (LST) menggunakan kaedah 'supervised' dan imej satelit. Penghasilan peta LST menggunakan teknik 'remote sensing' dalam kajian ini amat berguna dalam menyediakan maklumat untuk menganalisis parameter geofizik di kawasan Selangor, terutamanya berurusan dengan fenomena haba pulau bandar. 'Supervised image classification' adalah satu kaedah di mana penganalisis mentakrifkan kawasan kecil, yang dikenali sebagai tapak latihan, pada imej yang mewakili setiap kategori suhu tanah yang dikehendaki. Penggarisan wakil kawasan latihan suhu tanah adalah paling berkesan apabila seorang penganalisis imej mempunyai pengetahuan geografi rantau dan pengalaman dengan ciri-ciri spektrum kelas perlindungan. Penganalisis imej kemudian menggunakan perisian untuk mengenali nilai spektrum atau petanda yang berkaitan dengan tapak latihan. Selepas petanda bagi setiap kategori suhu tanah telah ditentukan, perisian kemudian menggunakan petanda untuk mengklasifikasikan baki piksel. Kaedah ini terdiri 4 fasa iaitu analisis, reka bentuk, pelaksanaan dan ujian.

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LIST OF ABBREVIATIONS

LST	- Land-surface temperature
TM	- Thematic Mapper
OS	- Operating Windows
UHI	- Urban Heat Island
IFOV	- Instantaneous Field Of View
ML	- Maximum Likelihood
ENVI	- ENvironment for Visualizing Images
MATLAB	- Matrix Laboratory
ROI	- Regions of Interest
ARSM	- Malaysian Remote Sensing Agency
MACRES	- Malaysian Centre for Remote Sensing
MOSTI	- Ministry of Science, Technology and Innovation
TDRS	- Tracking Data and Relay Satellites
GCP	- Ground Control Point
IR	- Infra-Red
PSM2	- Projek Sarjana Muda 2
NN	- Neural Network

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CHAPTER 1

INTRODUCTION

1.1 Project Background

Image processing is a technology that provides numerous benefits for the betterment of life. Remote sensing is one of technology used in image processing. The use of digital image processing for land temperature survey and mapping was initiated with the establishment of the National Remote Sensing Agency and Regional Remote Sensing Service Centres. Land-surface temperature (LST) is the thermal emission from the earth surface, including the top of the canopy for vegetated surfaces as well as other surfaces (such as residential landscape). LST plays an important role in the field of atmospheric sciences as it describes surface-atmosphere interaction between the atmosphere and the ground. Land surface temperature is an important parameter in determining the heat and moisture flow between the surface and the atmosphere. LST is also important in hydrologic, vegetation and decomposition processes. LST helps to control water exchange and surface heat with atmosphere.

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This study used data recorded from a remote sensing satellite. Landsat platform use TM (Thematic Mapper) sensor. It is a multispectral scanning Earth surface. Images captured from such sensor usually has sharper spectral separation and greater image resolution. Other than that, it also has greater geometric accuracy. The TM data are scanned simultaneously by the TM sensor that is equipped with different spectral bands. Before the advent of this technology, land mapping information is done by using a plane that would cost. By using this technology mapping method can be done in a better way and save costs. Nature of technology requires data from satellite images to identify and use the land surface through the spectral response.

1.2 Problem Statements

The study of LST mapping using remote sensing technology offers a new alternative over the convensional methods practiced elsewhere. This technology has not been widely used in Malaysia as compared to western countries.

One of the main problems encountered in the conventional methods is that the LST data may contain variety of disturbance such as a noise. The disturbance of images will affect the accuracy of the temperature of the images. The traditional way to mapping process are use a plane and Sling Psychrometer at certain point on the ground. The ambient temperature variation only cover within a limited space. It needs a longer time to get the final result because the data need to be combined manually before getting the result. Involvement of plane required a big amount of cost. The

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technique used does not give a good result because they could not prevent the images from environmental interference such as noise. Moreover, ground truth information of earth surfaces is hard to obtain due to the factors such as time, logistic and cost. The aim of the study is to derive derive LST information using remote sensing technology.

1.3 Objectives

In order to achieve aim of the study, the specific objectives are:

1) To design a method to derive LST information.
2) To develop LST information.
3) To assess the accuracy of the LST map.

1.4 Scopes

The Scopes of the study is divided into three part: software scope, area of study scope and user scope.

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1.4.1 Software Scope

All of the software in Table 1.0 is required in LST mapping process from start to end of the process of mapping.

Software	Requirement
Operating Windows (0S)	Microsoft Windows 7 Ultimate
Software Processed	Envi 4.5(Used to process and analyze geospatial imagery.)
Software Support	Matlab 2009a
Database Support	Microsoft Excel 2010 (Use to represent the data.)

Table 1.0: List of software required

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1.4.2 Area of Study Scope

Klang was chosen as the focus area of the study. Klang, Selangor is located at latitude: 3.043061 and Longitude: 101.440657, 573KM2). Klang is the royal town and former capital of Selangor. The Klang River was separates Klang town into north and south sections. Klang is also the main port of Malaysia. On the east side, Klang borders with Shah Alam, on the north side borders with Kuala Selangor, on the west side borders with the Straits of Melaka and borders with Banting (Kuala Langat) to the south. Klang is booming and becoming the focus city rapid development and high growth of urbanisation and industrialisation.

If unplanned development is practiced in Klang, various problems tend to exist. These urban transformations have altered the physical and natural environment. The urban surfaces absorb heat and will increase the temperature. This leads to Urban Heat Island (UHI) phenomenon. Therefore, a systematic urban planning is needed in order to avoid this phenomenon to occur. By using an appropriate Land Surface Temperature Determination the urban areas can be planned and developed systematically. Figure 1.0 show the location of Klang as the focus area of study.

Spectral used in this area is band 1 until band 7. Landsat 5 TM was use as a platform in data processed and recorded. Landsat 5 is the fifth satellite of the Landsat program. It has a maximum transmission bandwidth of 85 Mbit/s. It was used at an altitude of 438.3 mi (705.3 km). It takes some 16 days to scan the entire Earth. The Thematic Mapper (TM) is an advanced satellite compare to others. With the multispectral scanning capabilities, Earth resources sensor are capable to achieve higher image

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resolution, sharper spectral separation, improved geometric fidelity and greater radiometric accuracy and resolution.

TM data are processed in seven spectral bands simultaneously (Table 1.1). Band 6 senses thermal (heat) infrared radiation. Landsat can get night scenes in band 6. A TM scene has an Instantaneous Field Of View (IFOV) that capable to view image of 30m x 30m in bands 1-5 and 7 while band 6 has an IFOV of 120m x 120m on the ground.

Landsat 5 (TM sensor)	Wavelength(micrometers)	Resolution (meters)
Band 1	0.45 - 0.52	30
Band 2	0.52 - 0.60	30
Band 3	0.63 - 0.69	30
Band 4	0.76 - 0.90	30
Band 5	1.55 - 1.75	30
Band 6	10.40 - 12.50	120
Band 7	2.08 - 2.35	30

Table 1.1 : Spectral range of bands and spatial resolution for the Landsat 5 TM sensor

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Figure 1.0 : Focus Area of Study

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