SPATIAL TREE RISK DETERMINATION IN UNIVERSITI TEKNOLOGI MALAYSIA

OMER ELSAYEDFAKI ELSAYEDMOHAMEDNOUR FAKI

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ABSTRACT

Trees are one of the assets to be taken care of. Without proper care, trees that are at risk of collapse can result in loss of life and property. The purpose of this study was to identify tree species and trees that are at risk for falling on UTM campus using GIS analysis. The study also focused on campus areas that are at risk for falling trees. This study focuses on four factors that make a tree at risk for tree fall, including tree species, tree height, tree age, tree size, and tree conditions and its ability to fall. Geospatial databases have been developed using whole data to calculate the level of risk for each tree. The methods highlighted in this study are the use of trigonometric methods, height estimation and growth rate, and the use of measuring tape. The end result of this study is a map of the risk level. This map will show the high-risk trees and high-risk areas within the UTM campus. There are a lot of establishments that will get benefit from this research first of all UTM campus, because they will get an organized data about tree species with the locations for each type of trees and we will design a hazard map for trees inside the campus, Secondly the local council of Malaysia because if any disasters happen inside the campus the primary authority is the local council and they will know what type of tree species inside the campus and where is the hazard area and what kind of solutions can help to protect the environment. Another agency that will get benefit from our research is forestry department because a geospatial data base will be developed for tree species inside the campus so this data will help them.

ABSTRAK

Pokok merupakan salah satu aset yang perlu dijaga. Tanpa penjagaan yang rapi, pokok yang berisiko untuk tumbang boleh menyebabkan kehilangan nyawa dan harta benda. Tujuan kajian ini adalah untuk mengenal pasti spesies pokok dan pokok yang berisiko untuk tumbang di kampus UTM menggunakan analisis GIS. Kajian ini juga memfokuskan kawasan kampus yang berisiko untuk pokok tumbang. Kajian ini menumpukan empat faktor yang menyebabkan pokok berisiko untuk tumbang antaranya ialah spesies pokok,ketinggian pokok, umur pokok, saiz pokok, dan keadaan pokok dan keupayaannya untuk tumbang.

Pangkalan data geospatial telah dibangunkan menggunakan keseluruhan data untuk mengira tahap risiko untuk setiap pokok. Kaedah yang diketengahkan dalam kajian ini adalah menggunakan kaedah trigonometri, pengiraan ketinggian dan kadar pertumbuhan pokok, serta pengunaan pita pengukur. Hasil akhir kajian ini adalah peta tahap pokok yang berisiko. Peta ini akan menunjukkan pokok-pokok yang mempunyai risiko tinggi dan sangat tinggi dan kawasan yang mempunyai risiko yang tinggi dalam kampus UTM.

Terdapat banyak pertubuhan yang akan mendapat manfaat daripada penyelidikan ini terlebih dahulu dari semua kampus UTM, kerana mereka akan mendapatkan data teratur mengenai spesies pokok dengan lokasi untuk setiap jenis pokok dan kami akan merekabentuk peta bahaya untuk pokok di dalam kampus, Kedua, majlis tempatan Malaysia kerana jika terdapat sebarang bencana yang berlaku di dalam kampus, pihak berkuasa utama adalah majlis tempatan dan mereka akan tahu jenis spesies pokok di dalam kampus dan di mana kawasan bahaya dan jenis penyelesaian yang boleh membantu melindungi alam sekitar . Agensi lain yang akan mendapat manfaat daripada penyelidikan kami ialah jabatan perhutanan kerana pangkalan data geospatial akan dibangunkan untuk spesies pokok di dalam kampus supaya data ini dapat membantu mereka.

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LIST OF ABBREVIATIONS

UTM	-	University Technology Malaysia
GIS	-	Geographic Information System
JB	-	Johor Bahru
GCP	-	Ground Control Points
GPS	-	Global Position System
USDA	-	United States Department of Agriculture

CHAPTER 1

INTRODUCTION

1.1 Background of the study

Trees are vital and very important in our life because they have a lot of benefits to us, they produce oxygen, and remove carbon dioxide from our environment in addition to that we get fruits and wide shade from it. Research shows that within couple of minutes of being surrounded by trees and green space, your blood pressure come down, your heart rate slows, and your stress levels drops. Trees absorb carbon dioxide as they grow and the carbon that they store in their wood helps slow the rate of global warming (Ellison, 2005). It's critical that woodlands, rainforests and trees in urban settings, for example like parks, are preserved and sustainably managed across the world. Trees are the longest living species on earth, not only essential for our life, they give us a link between the past, present and future.

On the other hand, trees have also disadvantaged to the world, all trees present a given amount of risk to the environment. Risk is a state of uncertainty where some of the possibilities involve a loss, catastrophe or other undesirable outcome. A tree risk refers to any potential tree failure according to a structural defect that may result in property damage or personal injury. A primary goal of tree risk assessment is to provide information about the level of risk posed by a tree over a specific time period. The two primary approaches to risk assessment are quantitative and qualitative. Each has advantages and limitations, and each may be appropriate with different objectives, requirements, resources, and uncertainties(Gullick, Blackburn, Whyatt, Vopenka, & Abbatt, 2017). A high number of tree species, low density of adults of each species, and long distances between conspecific adults are characteristic of many low-land tropical forest habitats. I propose that these three traits, in large part, are the result of the action of predators on seeds and seedlings(Staples & Craig R. Elevitch, 2006). There are many tree species around the world like a group of trees in the same genus made up of similar individuals, in this thesis we will focus on tree species in UTM campus and what kind of risk that can reflect to the campus, because in spite of trees have a lot of benefits to the environment also it has a negative side and that depends on the tree species also.

There are many types of trees inside the campus, the selection of trees in the vicinity of the site devoted to trees that are useful in daily life of Malaysians, such as for food, architecture, building materials and home appliances.

1.2 Problem Statement

In this research we are going to identify that what kind of risk that trees can reflect to UTM campus to do that we should firstly identify tree species inside the campus because the risk might be different from species to another, for example some trees can cause allergies to some people, some trees are able to fell down faster than other trees, it means their lifetime is shorter comparing to other type of trees, some trees can be suitable home for dangerous animals or hazard insects like snakes, all of these and more that what trees might deliver to us.

All trees pose a level of risk, Risk is the combination of the likelihood of a tree failure event and the severity of the possible consequences of that event. Each tree has the potential to fail; however, only a small number of failures actually cause injury or damage. It is impossible to maintain trees free of risk. Some level of risk must be accepted by the owner. Hazard is a likely source of harm and is identified as the tree part or parts which will affect the target zone. For example, an entire tree or a single branch could be determined as a hazard. Hazards are identified during tree assessments, and tree owners are required to take steps to minimize the risk of damage from failure, and we have a real example for a fallen tree inside the campus, fortunately it didn’t cause any damage as we can see in Figure 1.1.

Figure 1.1 A fallen tree beside the clinic fell from the roots

Here in Figure 1.2 we show the same tree from another view that show there is a small restaurant but happily this tree didn’t cause any harm.

Figure 1.2 The same tree from another view show the surrounding area

In addition to tree falling another risk that threats our campus is Wildfires specially in summer season when the temperature usually increases up to 33C at daytime. Wildfires can occur anywhere; it always starts by one of two ways – naturally caused or human caused. Natural fires are generally started by lightning, with a very small percentage started by spontaneous combustion of dry fuel such as sawdust and leaves. On the other hand, human caused fires can be due to any number of reasons. Some classifications include smoking, recreation, equipment and miscellaneous. Human-caused fires constitute the greater percentage of forest fires in our forests, but natural fires constitute the great majority of the total area burned.

1.3 Aim and objectives

- Aim

The purpose of this research is to identify tree species and risk in UTM JB campus using some techniques like geographic information system.

- Objectives

1. To identify about tree species and risk in UTM JB.
2. To design geospatial database for tree species inside UTM JB.
3. To develop a risk map for tree species inside UTM JB

1.4 Research questions

In order to fulfil these three objectives, six research questions are developing in answering the objectives. Each objective has two research question as shown in table 1.1 below.

Table 1.1 Research question of the study

Objectives	Research Questions
1. To identify tree species and risk in UTM JB	What is the most effective method to identify tree species in UTM JB?
	How we can identify tree species?
2. To design geospatial database for tree species inside UTM JB	What is the physical model that we will use to design the database?
	How to design geodatabase?
3. To develop a risk map for tree species inside UTM JB	What type of data is needed to develop a risk map?
	How to develop map from the integrated database?

1.5 Significance

There are a lot of establishments that will get benefit from this research first of all UTM campus, because they will get an organized data about tree species with the locations for each type of trees and we will design a hazard map for trees inside the campus, and may be they will give more concern to trees to reduce the level of the risk, also addition benefit to the campus it will help them to know the locations for the most riskiest trees inside the campus that have the ability to fell down faster than another species ,then they will take care about this area.

Secondly the local council of Malaysia because if any disasters happen inside the campus the primary authority is the local council and they will know what type of tree species inside the campus and where is the hazard area and what kind of solutions can help to protect the environment. Another agency that will get benefit from our research is forestry department because we are going to develop a geospatial data base for tree species inside the campus so this data will help them.

1.6 General methodology

The general methodology represented on this section explains about the stages taken to actualize the entire research work.

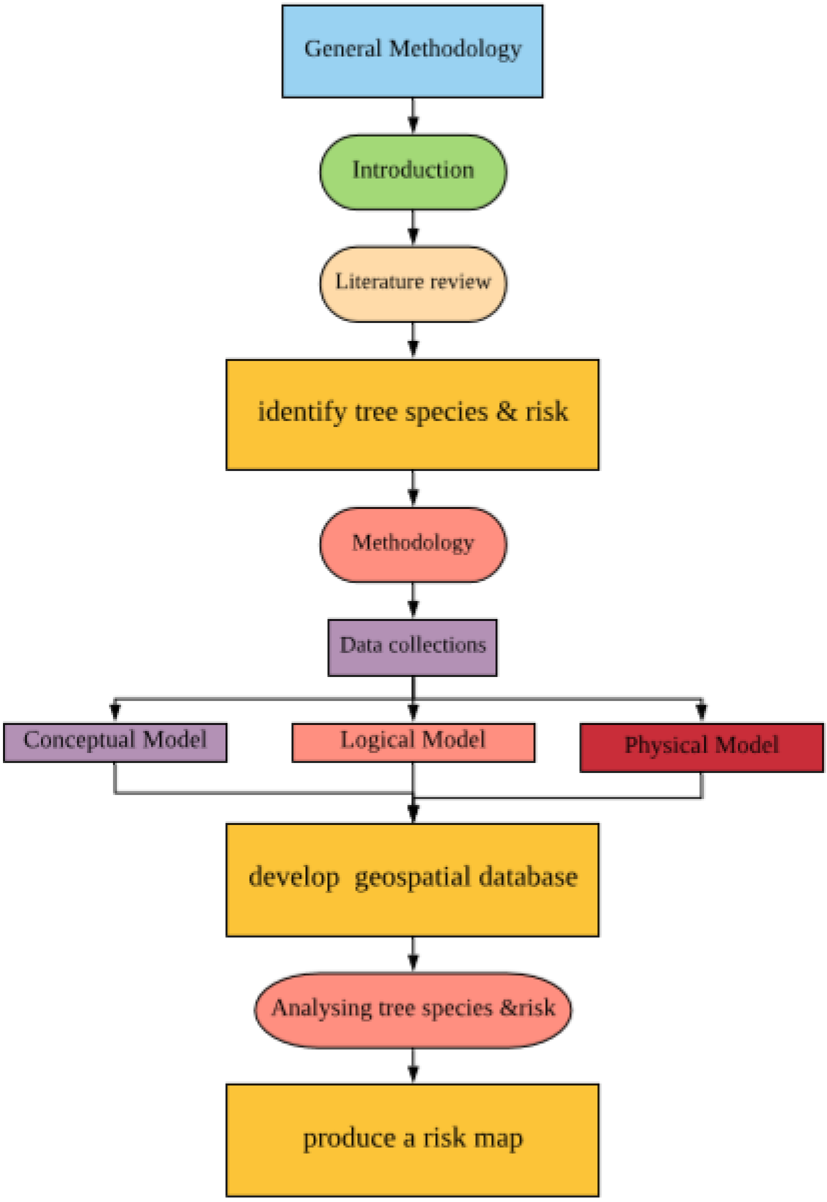

Figure 1.3 Overview of the general research methodology

- **Literature review**

This stage will concentrate on reviewing essential topics and concepts such as:

- **Definition of terms**

e.g. Tree risk, tree hazard, tree species.

- **Historical backgrounds**

History of tree species in UTM JB campus, history of tree risk inside the campus.

- **Concepts of research**

In relation to tree species and risk will form the general framework, ideas involving with the risk of trees falling, fire forests, dangerous animals like snakes.

- **Direct method**

Uses in the methodology emanated from the researcher will be discuss, other methods that are connected to the topic and area of research will also be discuss. For example, past studies that research on tree species, tree risk assessment.

- **Indirect method**

Involve other methods that will assist in drawing references from other studies and play significant role in the current research.

- **Issues**

Related to present and past research on identification of tree species and risk

- **Conclusions**

conclusions and recommendation of the entire research which come in the last stage of the research.

- **Methods**

Methodological aspect will be discussing here, and individual stages will be elaborated which includes:

- **Data collection**

will entail how the data will be collected both primary and secondary, examples include collection of some trees location inside the campus to identify the species which are all in the field while secondary data will entail from the university from book archives and any other documented data.

- **Conceptual Model**

This model is a tool to establish a communication between the designer and users.

- **Logical Model**

It is an intermediary model between the conceptual and the physical model, also it allows the optimization of the data structure considering the processes.

- **Physical Model**

It is the programming code of the application, and It represents the computerized content of the logical data model.

- **Develop geospatial database**

After we established the conceptual model then the logical model finally the physical model, then we will develop geospatial database for tree species.

- **Analysing tree species and risk**

After we developed geospatial database for many samples of trees then we will analyse the data by using some factors like the height of the tree and the width.

- **Produce a map**

After we analyzed the data then we are going to produce a map about the risky tree and the species of tree in specific area.

1.7 Thesis outlines

This study is contained of 5 chapters namely introduction, literature review, methodology, result and analysis, conclusions and recommendation. Chapter 1 comprises of Background to the problem, problem statement, research questions, and aims of the study, objectives of the study, general methodology and significance of the study. Chapter 2 discuss the various literature and immensely assist in understanding the objectives of the study. Chapter 3 described the methodology adopted in order to answer the specific objectives. Details of all the procedure have been explained. Chapter 4 explained the analysis of the research, it includes tables, maps and figures which show different types of tree risk inside the campus. Chapter 5 concluded the entire research, it rounds up with the summary of the research, what has been achieved and recommendations for future research.

1.8 Chapter Conclusion

To sum up with this first chapter we have started with the background to the problem identify tree species and risk in UTM campus so we have explained about some tree species and what kind of risk that can deliver to us, then problem statement shows some types of tree risk and we have shown some real pictures for falling trees inside the campus, after that we moved to aim and objectives then the research questions, in addition to that the significance of the study, after that the general methodology which show the overall method for the research, then the thesis outline which describe each chapter of the research and what it contains.

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