DEVELOPMENT OF PLANT MATERIAL DATABASE AND TRACEABILITY MODEL SYSTEM FOR BOTANICAL GARDEN

BY

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ABSTRACT

Effective inventory management can be extremely difficult owing to various types of plants in Putrajaya Botanical Garden. These databases are required to provide high-level effective and accuracy. Usually, staff will make file in Microsoft Excel for new species. Consequently there are often difficulties in accessing information and data re-entry problems. By using 2D barcode, this study presents a novel system called Development of Plant Material Databases and Traceability Model System for Putrajaya Botanical Garden. These development based on databases system and 2D barcode system to troubleshooting in difficulties in finding information regarding plant morphology, difficulties of keeping track of new plant record and existing manual system. Development of Plant Material Databases and Traceability Model System is a new approach in the field of botanical garden design and landscape where it is necessary to handle large data to complete an inventory management. This combines information technology and landscape knowledge. The idea began with looking at the palm plantation, which is the main model of this thesis study. The study on the plant morphology is carried out at two site sites namely palm hill and lakeside in front of the lakeside. It can be said there is no database of the palm plant species based on the plant morphology in Putrajaya Botanical Garden. Research planning uses the Species study, Databases system and Barcoding system, and also System Development Life Cycle (SDLC). The implementation of the system is by the aid of many software which including PHP and JAVA (programming language), Visual Basic and JavaScript (Script Language), Mysql and SQL (database) and Joomla (web development) as to make sure the smooth running of the project. By using Development of Plant Material Databases and Traceability Model System, the inventory data well managed thus ease for managing and monitoring.

خلاصة البحث

هناك صعوبات جمة تواجه الإدارة الفعالة في حديقة بوتراجايا النباتية بسبب الأنواع العديدة والمختلفة للنباتات في الحديقة النباتية، وقواعد البيانات هذه مطلوبة لتوفير فعالية ودقة عالية المستوى. يقوم الموظفون عادة باعداد ملف في برنامج الحاسوب المعروف ب (مايكروسوفت إكسل) للأنواع الجديدة، وبالتالي غالباً ما تكون هنالك صعوبات في الوصول إلى المعلومات، بالإضافة إلى المشاكل التي تواجههم في إعادة إدخال البيانات. تقدم هذه الدراسة باستخدام الرمز الشريطي أو الباركود الثنائي الأبعاد نظاماً جديداً يسمى تطوير قواعد بيانات المواد النباتية ونموذج نظام التتبع لحديقة بوتراجايا النباتية أو أي حديقة نباتية أخرى. يعتمد هذا التطوير على أساس نظام قواعد البيانات ونظام الباركود الثنائي الأبعاد لتصحيح صعوبات العثور على المعلومات المتعلقة بمورفولوجيا النبات، والصعوبات المتعلقة بتتبع سجل نبات جديد والنظام اليدوي الحالي. يعتبر تطوير قواعد بيانات المواد النباتية ونموذج نظام التتبع نظاماً جديداً في مجال تصميم الحدائق النباتية والمناظر الطبيعية حيث أنه من الضروري التعامل مع بيانات كبيرة لاستكمال إدارة المخزون أو ما هو موجود آنياً، وهذا يجمع بين تكنولوجيا المعلومات والمعرفة المتعلقة بالمناظر الطبيعية. بدأت هذه الفكرة بعد ملاحظة مزارع النخيل، والتي أُخذت كنموذج رئيسي لهذه الدراسة. أجريت الدراسة على مورفولوجيا النبات في موقعين هما نخيل التلال وأمام البحيرة. بامكاننا القول بأنه لا توجد قاعدة بيانات لأنواع نباتات النخيل على أسس مورفولوجية نباتية في حديقة بوتراجايا النباتية. استخدم التخطيط البحثي، ودراسة الأنواع، ونظم قواعد البيانات، والنظام الباركودي، وأيضا دورة حياة تطوير النظام (SDLC). تم تنفيذ النظام من خلال مساعدة العديد من البرامج التي بما في ذلك PHP وجافا (لغة برمجة)، والفيجوال باسيك، وجافا سكريبت (لغة البرنامج النصي)، وميسكل، و SQL (قاعدة البيانات)، وجوملا (Joomla) (تطوير الشبكة) للتأكد من سلاسة عمليات المشروع. وباستخدام نموذج نظام تطوير قواعد بيانات المواد النباتية ونموذج نظام التتبع، فإن البيانات المخزونة سوف تدار بشكل جيد، وبالتالي تسهيل عملية إدارتها ورصدها.

APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a thesis for the degree of Master of Science (Halal Industry Science).

……..
Rashidi bin Othman
Supervisor

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Co-Supervisor

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a thesis for the degree of Master of Science (Halal Industry Science).

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Internal Examiner

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External Examiner

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Deputy Dean, International Institute for Halal Research and Training

This thesis was submitted to the International Institute for Halal Research and Training and is accepted as a fulfilment of the requirement for the degree of Master of Science (Halal Industry Science).

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Hamzah Mohd Salleh
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DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

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It is in my humble ambition that the findings of this research project could be extended to improve and benefits future projects.

Thank you.

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LIST OF ABBREVIATIONS

saw	Salallahu ‘alayhi wa sallam
QR	Quick response
2D	2 dimension
SDLC	System Development Life Cycle
PHP	Hypertext preprocessor
SQL	Structure Query Language
MySQL	Open source relational database management system
RAD	Rapid Application Development
ORNIS	Online Registration New Student Intake System
MCIR	Magnetic-ink Character Recognition
B2B	Bussiness to Consumer
C2C	Consumer to Consumer
IE	Internet Explorer

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

The use of 2D barcode is a transformation from manual identification to automated identification. The 2D barcode is an automated identification for areas industry, labels, and smart cards. Many industrial products are widely used barcode for automated data collection and inventory control (Chang, Lo, & Hsieh, 1997). However, the use of barcodes in the landscape industry has not been found primarily on plant species. The limitation of inventory data causes plant information to be difficult to find. This is happening at a research site at Putrajaya Botanical Garden. This study proposed Development of Plant Material Databases and Traceability Model System for Putrajaya Botanical Garden. The database is designed as a development application. This is a free of charge for guest user scan 2D barcode. Data can be retrieved and printed locally in PDF file. Database palm species is also contribute to the development of website process. This is because, the output of the website dependent on the quality of the database. The unique inventory number on each palm helps contribute unique class id for database information system. Palm characteristic that make them structurally. This is because, research on palm species is very little and it is difficult to obtain various references. Therefore, this is one of effort to improve the study of palm species, and palm species is a model system for this study. Two different users using this model system are staff and guest. Staffs are responsible for monitoring website, editing and updating information. While guest users can enjoy the beauty of the garden while studying the plant collection in Putrajaya Botanical Garden.

1.2 PROBLEM STATEMENT

Problems regarding plant diversity in Putrajaya Botanical Garden are as follow:

i. The major constraint is the insufficient information on the diversity of plant. The importance of plant morphology study is to identify plant ethnobotany, anatomy, and structure analysis. There are many types of plant species arranged by the type of family, in Putrajaya Botanical garden, as the area is very spacious. Based on the discussion with the staff, there is no detailed information on the plant species in Putrajaya Botanical Garden. The information is provided in manual files, containing only the name, family species, location, and the plant origin. The files are saved in Microsoft Excel file. Therefore, the existing database information is only limited to the plant nomenclature, category, inventory number, and plant origin. This information is also displayed using a signage placed on the board for the visitors to find and identify a specific plant. These problems opened up opportunities for the researcher to develop a complete database of plant collection based on plant morphology.

ii. Difficulties of keeping track on the new plant record

The Putrajaya Botanical Garden has no suitable software to be used to manage the plant collection. There is a difficulty to monitor the recorded data such as the detailed data of plant collection, plant morphology, as well as the ethnobotany. In addition, the data sometimes are inaccurate, when the record is being updated and deleted. Based on these problems, a convenient model system is required to improve the management efficiency in Putrajaya Botanical Garden.

iii. Existing manual system or other terms traditional method

The existing manual system involves the use of a traditional manual system such as keeping data in files and folders, making it inconvenient to track the data. It is hard to maintain the record when the management of Putrajaya Botanical Garden is still using the manual system. For example, the staffs have to update the whole file if he/she needs to add a new species in the system. Otherwise, the data will become inaccurate. Besides, by using a manual system, the staffs need more time to search and update the data, and the process is different when using the current system. Furthermore, the staffs will need more space to keep all folders and files. Indirectly, this will decrease the employee efficiency and affect the organization.

1.3 RESEARCH OBJECTIVES

The aim of this research is to develop an integrated software and barcoding systems, fully computerised for plant material database in botanical garden. The objectives of this research are:

i. To identify the components of plant material in botanical garden.
ii. To produce a new system and organised the data properly based on the problems identified.
iii. To develop a new, high performance and cheap media formulation to trace species based on the morphology study for botanical garden.

1.4 RESEARCH AIM

The aim of this research is to develop an integrated software and barcoding systems, fully computerised for plant material database in Botanical Garden. This is a simple but far too often neglected wisdom. Very often, failure of establishment in the field can be directly related to insufficient care in the nursery stage. Similar to the call for quality germplasm such as in the Putrajaya Botanical Garden, quality seedling production is a necessary prerequisite for quality tree production. This change in demand has created opportunities as well as problems for the established Botanical Garden as well as local authorities in the maintenance and management of trees. The question of quality, the predictability of requirement, higher cost of production and understanding the biology of these plants becomes obvious. Therefore, there is a need to change the strategies in the management of landscape plants to satisfy the needs of the more technologically advanced market. One of the most promising new urban tree management techniques is the development of landscape management system using barcode using 2D Barcode system.

1.5 SIGNIFICANCE OF THE STUDY

i. Cost Effective

Limited financial resources are required for a cost-effective management. This is because an effective cost management can implement a strategized process with several principles. In this study, the three principles to ensure cost-effective management are:

a. Identify aims and objectives

The process of managing cost efficiently is a strategic and an operational process. It starts with clear aim and objective that are focused on finding and correcting the underlying causes of ineffective cost management.

b. Provide the tools and knowledge needed for success

The specific costs are determined. It means that the specific tools are needed to implement the project. In addition, an insight into a specific process and day-to-day activities are needed to identify the opportunities for an effective cost management.

c. Planning

The best strategy is always planning, as the cost-effective management is about being proactive instead of reactive.

ii. Easy to be used

The second objective of this study is to produce a new system and organised the data properly. To achieve the target objective, the first step is to be a user-friendly model design. Five principles to ensure the implementation of user-friendly model design are:

a. Simplify

An effective design should consist of less than three theme colours. In this study, only two colours are used for the themes, which are green and white, while graphics are only created if it can help a user to perform a specific function.

b. Navigability

Include a search box near the top site so that the users can search by keyword. Other than that, breadcrumbs on every page are created except for the homepage.

c. Consistency

The overall look should be consistent across all pages. Backgrounds, colour schemes, types, and even tone writing in all areas have to be consistent and positively reflect the usability.

d. Accessibility

In order to provide a great user experience, the site needs to be compatible with different devices (operating systems, browsers) used by the users. Investing in a website structure that is highly flexible, with responsive design, and the content automatically resized and reshuffled to fit the dimensions of whichever device the users used are among the benefits to the website.

e. Conventionality

There are certain web design conventions applied in this study, such as a logo at the top of a page and links exchange when the user hover over them

1.6 RESEARCH FRAMEWORK

The information were documented in PDF file for admin user and guest user. This designed for ease the authorized admin access and update and improved the information. The good database can impact the expectation website system. There are techniques for combine knowledge to resolve the problem. The integrated tools are being develop to speed the process data entry. Nowadays, the interactive education

and information from many sources such as video, other media system and etc. permits to user to learn and ability new thing. The saving tool such as this model system, its can reduce of expand time used for searching information, and such as the manual way retrieved information through book. Overall, the model system for palm material will benefit not only the people in the botanical garden, but it will bring benefit the whole who are needed in the plant study.

(a) Signage plant board (b) Web (c) Pdf

Figure 1.1 2D Barcode used in plant material at Putrajaya Botanical Garden

1.7 THESIS ORGANIZATION

The outline of the chapters in this thesis is as follows:

i. Chapter One comprises of background, problem statement and significant of this study.

ii. Chapter Two reveals the literature review that is related to the study on landscape and barcoding systems.

iii. Chapter Three discusses the details of research methodologies used in this study.

iv. Chapter Four presents the results and discussion on the research conducted.

v. Chapter Five gives the conclusions of the research with recommendations for further related studies.

CHAPTER TWO

LITERATURE REVIEW

2.1 ISLAMIC PERSPECTIVE

As prescribed in the Qur'an and hadith, Muslims are bound by the Islamic rules and must comply to them (Al-A'ali, 2008). The Qur'an and hadith are the main sources of the broad principles and guidelines in the Islamic life (Beekun & Badawi, 2005). Al-A'ali (2008) describes the name of Islam in Arabic which means a submission and peace, for it is in submitting to God's will, will the human beings gain peace in their lives in this world and in the hereafter. Based on the Qur'an, the human race is considered the Khalifah (trustee) of God on earth, and life on earth is a 'test' for the humankind (Qur'an, 67:2). This verse means that, to be the trustee of God on earth, our actions must be in accordance with the conditions of belief and will emulate the Prophet (saw) as the quintessential role model (Beekun & Badawi, 2005). God uses the word '*khuluq*' in describing the Prophet's (saw) behaviour (Qur'an, 68:4). The meaning of this word is derived from the word '*akhlaq*', and a comparable word for ethics in Islam (Siddiqui, 1997). Islam is considered as a comprehensive religion and its ethical system is given the utmost priority (Al-A'ali, 2008). According to Al-A'ali (2008), establishing an ethical system in the field of Information Technology (IT) is important especially at the present time due to the ever increasing ethical problems. He also describes that, "Working with computers without gaining an understanding an appreciation of ethics is like sailing without a compass." High technology computers play a major role in determining how computers affect our social life and interactions. Therefore, the appropriate computer knowledge is essential (Namlu & Odabasi, (2007). The main issues, which can be attributed to ethics related to IT are hacking,

privacy, software piracy, and IT personnel work ethics (Al-A'ali, 2008). Whenever a Muslim is properly acting out his or her role as God's trustee, a Muslim is performing an act of worship (Qur'an, 21:107, 9:34, 48:28, 61:9, and 34:28). Most people are subjected to various problems and risks such as theft, deception, and inaccuracy of data (Al-A'ali, 2008).

In short, the Qur'an is a guidebook, which contains general principles that can be used regardless of time and place. All principles and guidance are related to all areas of life, including the domain of IT (by analogy) (Al-A'ali, 2008). Islam emphasises the importance of seeking divine and earthly knowledge (Al-A'ali, 2008). As stated in the Qur'an: "Read the name of your Lord Who created" (96:1). Prophet Muhammad (saw) said "Seeking knowledge from the cradle to the grave". Thus, Islam stresses not only on productivity but also excellent at work. The Qur'an also emphasises that reward should be commensurate with effort (3:136, 99:7, 48:19). This study aims to analyse the effectiveness of computer ethics towards the management system from the Islamic perspective. The principles and measurement were based on primary sources.

2.2 LANDSCAPE INDUSTRY

Landscape is the enhanced of outdoor terrain in either residential or non-residential area. It engaged with the exterior work, gardening, planting trees, flowers, shrubs, grasses, water, fountains, construction of curbs, walkways, pavement, and drainage (Davesgarden, 2002). The process of arranging soil, water, plant, and structures to develop a space in a particular zone or appearance is also, what embodies landscape (Davesgarden, 2002). Ndubisi & Chukwonso (2005) described landscape as the land modified for permanent human occupation and shape. In the past, landscape