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DEVELOPMENT OF PADI2U MOBILE APPLICATION FOR PADDY MANAGEMENT

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DEVELOPMENT OF PADI2U MOBILE APPLICATION FOR PADDY MANAGEMENT

By

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

DEVELOPMENT OF PADI2U MOBILE APPLICATION FOR PADDY MANAGEMENT

By

NOR ATHIRAH BINTI ROSLIN

February 2021

Chair : Nik Norasma Che'Ya, PhD
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Precision agriculture is a farming management, including site-specific crop management to increase production by reducing the input cost and saving the environment. A previous study developed web-based paddy management, Web Paddy Geographic Information System (Web-GIS) (Web Precision Farmer©). This study overcomes the limitation of the previous study, such as accessibility and affordability, user to use the system from the computer. Most of the information of the paddy management available in paper-based system. The current mobile application focused on one component in paddy management only. This research aims to design and develop mobile application for paddy management (PADI2U), populate the database into a mobile application, and test User Acceptance Test (UAT) of the mobile application. PADI2U mobile application is an Android-based mobile application developed using online software Master App Builder (MAB). The advantage of PADI2U is that it contains NDVI analysis from aerial imagery captured by UAV to monitor the paddy health status. UAT was conducted to get feedback and acceptance level from users of PADI2U mobile application performance. From UAT result show a high percentage of acceptance of the PADI2U mobile application. The contribution of this research to the farming community is the development of mobile application technology to manage their paddy field.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

PEMBANGUNAN APLIKASI TELEFON PINTAR PADI2U UNTUK PENGURUSAN PADI

Oleh

NOR ATHIRAH BINTI ROSLIN

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Pertanian tepat adalah pengurusan pertanian, termasuk pengurusan tanaman khusus lokasi untuk meningkatkan pengeluaran dengan mengurangkan biaya input dan menyelamatkan alam sekitar. Kajian terdahulu mengembangkan pengurusan padi berasaskan web, Sistem Maklumat Geografi Padi Web (Web-GIS) (Web Precision Farmer ©). Kajian ini mengatasi batasan kajian sebelumnya, seperti kebolehcapaian dan kemampuan, pengguna untuk menggunakan sistem dari komputer. Sebilangan besar maklumat pengurusan padi terdapat dalam sistem berasaskan kertas. Aplikasi mudah alih semasa hanya tertumpu pada satu komponen dalam pengurusan sawah sahaja. Penyelidikan ini bertujuan untuk merancang dan mengembangkan aplikasi mudah alih untuk pengelolaan padi (PADI2U), mengisi pangkalan data ke dalam aplikasi mudah alih, dan menguji Uji Penerimaan Pengguna (UAT) aplikasi mudah alih. Aplikasi mudah alih PADI2U adalah aplikasi mudah alih berasaskan Android yang dikembangkan menggunakan perisian dalam talian Master App Builder (MAB). Kelebihan PADI2U adalah bahawa ia mengandungi analisis NDVI dari gambar udara yang diambil oleh UAV untuk memantau status kesihatan padi. UAT dilakukan untuk mendapatkan maklum balas dan tahap penerimaan dari pengguna prestasi aplikasi mudah alih PADI2U. Dari hasil UAT menunjukkan peratusan penerimaan aplikasi PADI2U yang tinggi. Sumbangan penyelidikan ini kepada masyarakat petani adalah pengembangan teknologi aplikasi bergerak untuk menguruskan sawah mereka.

.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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Declaration by Members of Supervisory Committee

This is to confirm that:

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LIST OF ABBREVIATIONS

PA	Precision Agriculture
GIS	Geographic Information System
MAB	Master App Builder
RS	Remote Sensing
IRRI	International Rice Research Institute
PhilRice	Philippine Rice Research Institute
MARDI	Malaysia Agriculture Research and Development Institute
DOA	Department of Agriculture
ITAFoS	Institute of Tropical Agriculture and Food Security
UAV	Unmanned Aerial Vehicle
LiDAR	Light Detection and Ranging
NDVI	Normalized Difference Vegetation Index
GUI	Graphic User Interface
UAT	User Acceptance Test
GPS	Global Positioning System
ICT	Information and Communication Technologies
SMS	Short Message Service
NIR	Near infrared
AMB	App Master Builder
API	Application Program Interface
KADA	Kemubu Agriculture Development Authority
MADA	Muda Agricultural Development Authority
IADA	Integrated Agricultural Development Area

CHAPTER 1

INTRODUCTION

1.1 Background

Precision agriculture (PA) is the use of information technology for farm management and for decision-making (Schimmelpfennig, 2016). Many researchers conducted the development of precision agriculture to increase crop productivity (Mogili & Deepak, 2018). This method will help farmers to choose the right application of pesticides using PA technology. It also will suggest a suitable crop and the precise pesticide application based on the site-specific analysis (Pudumalar et al., 2017). Precision agriculture is the best agriculture practice for farmers in this modern world and can achieve the sustainability of agriculture based on the right application of a treatment, the right amount of input to the crop, the right time of application and at the right place (Hunt & Daughtry, 2018). Agriculture sector in Malaysia is one of the main industries that helps the economy (Dilipkumar et al., 2017)—increasing population results in increased rice production demand (Rahim et al., 2017). According to the Ministry of Agriculture and Food Industries self-sufficiency level of rice in Malaysia is about 75% (Malaysia must prioritise attaining self-sufficiency in rice production, 2020). The government targeted to increase rice self-sufficiency level to 100% to meet the population's increasing demand (Rahim et al., 2017). In a previous study, the decision support system for paddy management known as Web Precision Farmer© for farmers and farm managers had been developed by Norasma et al. (2013). Web Precision Farmer© is a very useful tool because it provides information on paddy management such as a map for fertilizer application, information of farmers, photo gallery, and forum for discussion (Norasma et al., 2013). The limitation of the Web Precision Farmer© is that this system is available as web-based and requires a computer device to access the system. The interface is not compatible with the mobile interface. Thus, as a solution, a smartphone application was developed to fulfil the gap from the previous study.

In the digital era, the adaptation of information technology will be beneficial for every sector, especially in the agriculture sector. However, most agriculture management is still done traditionally and uses minimal information technology for risk management (Ali et al., 2018). Most farm management lack online information, such as in Ketereh, Kelantan. Unmanned Aerial Vehicle (UAV) is a cheaper alternative for remote sensing (RS) technology and data analysis for agriculture monitoring (Norasma et al., 2019). It has become a replacement of using satellite and plane as UAV can produce high image resolution at low cost, fly within low altitudes, and no cloud penetration (Kim et al., 2019). UAV use with different types of camera sensors will provide multiple spectral imaging and give better results on the analysis of the field condition (Norasma et al., 2019).
Information such as UAV images usually found in paper-based such as reports, books, pamphlet, and poster or online-based can be access by the authority such

as agriculture officer and the researcher only. This paper-based information can only be accessed from the office and not from the field. The limited use of technology and the information scattered at different places in hardcopy make it difficult for agriculture management decision-making. Technology such as a smartphone is widely used for communication. In many sectors such as business, this technology was already implemented as the main part of their work. Current mobile applications developed for the agriculture sector, but none offered UAV images for crop management.

The aim of this study is to develop a mobile application for paddy management by providing information on crop status health map, pest, and disease management at Ketereh, Kelantan. The PADI2U mobile application was specially developed for agriculture officers, farmers, and other users who are interested in agriculture management by a using mobile application. This mobile application was developed using Master App Builder (MAB) software. MAB is a free programming software created by Trailblazer Trading based in Kuala Lumpur in 2013.

1.2 Problem Statement

The management system in the paddy fields is less efficient information gathering such as field activities, plot information, pest and disease, yield, and the condition of the crop at the paddy field. Farmers usually need to walk-about for field monitoring and it is time-consuming. PADI2U mobile application is developed for agriculture officers and farmers to access all information and knowledge on crop health status via their smartphones.

Agriculture officers and farmers rely on paper-based records for recording and updating information about the farm. This method caused data loss due to human error and misplaced documents. It is hard to access information because it needs to be checked from one file to another and it is time-consuming. This research allows data management to be centralized and data sharing between users for self-evaluated data.

To date, there is no literature available regarding the development of a mobile application for paddy management in Malaysia by using MAB software. There is a mobile application for pest infestation early warning systems (Nasir et al., 2018) and for the monitoring and learning of rice cultivation (Siahaan & Wijaya, 2018) by using Android Studio. MAB software is code-free, and no programming skill is required to develop the mobile application. Android Studio developed by Google and Jetbrains require coding and programming language to develop mobile application. To publish an application in Google Play Store, the developer needs to register a developer account at Google Play Console and be required to pay US$25 as an operation cost. The payment is required only once, and the

developer can use the account to publish as many applications as the developer wishes.

1.3 Goal

The goal of this research is to develop a mobile application for paddy management known as PADI2U mobile application at Ladang Merdeka, Kampung Lundang Paku, Ketereh, Kelantan, Malaysia.

1.4 Objectives

The objectives of this research are:

i. To design and develop a mobile application (PADI2U) for paddy management
ii. To populate paddy management database in mobile application
iii. To conduct the User Acceptance Test (UAT)

1.5 Scope

This research explores the use of UAV and NDVI in crop growth monitoring as part of paddy management. Mobile application is developed using MAB software as a tool for paddy cultivation management. PADI2U mobile application provides a crop health status map of paddy, planting activity, pest, and disease management. The main target user of this research is agriculture officers and farmers.

1.6 Motivation

The mobile application is not used as an information library for paddy, but it can be used as a communication tool between agriculture officers and farmers. Farmers can send a report of any problem occurring in the field to the agriculture officer. Mobile application is needed by agriculture officers and farmers for paddy management. Agriculture officers can add information on the mobile application, for example, regarding planting activity or warning of pest infestation to farmers. Farmers who receive the notification can then follow up with action from the suggested solution given by agriculture officers. PADI2U mobile application is developed with crop health status map as captured by UAV. This helps a farmer to view their crop and be aware of their crop health status via smartphone.

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Nor Athirah binti Roslin born in Kangar, Perlis on 16 December 1994. Her primary school is Sekolah Kebangsaan Beseri, Beseri Perlis and went to secondary school at Sekolah Menengah Kebangsaan Syed Hassan and Sekolah Menengah Kebangsaan Tuanku Lailatul Shahreen. After completing her secondary school, she went to Matriculation College at Perlis in 2012 until 2013.

She continued her study in Bachelor degree at Universiti Putra Malaysia (UPM) Serdang, Selangor. She studied for 4 years and graduated with Bachelor of Agricultural Science. Her passionate toward agriculture and technology grew as she decided to further her study in agriculture technology for development of mobile application. She started her Master of Science program in Agriculture technology at Universiti Putra Malaysia.

Her interest is technology and she decided to attend a few courses to expand her knowledge in agriculture technology. She learnt to develop mobile application and to fly a drone. She continued her self-learning to improve her skills in technology. By completing this thesis, she has proved that her skill in agriculture technology.

LIST OF PUBLICATIONS

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