CONCEPTUAL DESIGN FOR WEB GIS IN PEST AND DISEASE CONTROL SYSTEM FOR PADDY CROP

FATEN NUR' SYAHIRA BINTI ZAINAL ABIDIN

FP 2018 19

CONCEPTUAL DESIGN FOR WEB GIS IN PEST AND DISEASE CONTROL SYSTEM FOR PADDY CROP

FATEN NUR' SYAHIRA BINTI ZAINAL ABIDIN

FACULTY OF AGRICULTURE

UNIVERSITI PUTRA MALAYSIA

SERDANG, SELANGOR

2017/2018

CONCEPTUAL DESIGN FOR WEB GIS IN PEST AND DISEASE CONTROL SYSTEM FOR PADDY CROP

BY

FATEN NUR' SYAHIRA BINTI ZAINAL ABIDIN

A project report submitted to Faculty of Agriculture, Universiti Putra Malaysia, in fulfillment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science.

Faculty of Agriculture

Universiti Putra Malaysia

2017/2018

ENDORSEMENT/ CERTIFICATION

This project report entitled Conceptual Design For Web GIS in Pest And Disease Control System For Paddy Crop is prepared by Faten Nur' Syahira Binti Zainal Abidin and submitted to the Faculty of Agriculture in fulfilling the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science.

Student's Name : Student's Signature :

Faten Nur' Syahira Binti Zainal Abidin .....

Certified by :

.....

Dr Nik Norasma Binti Che'Ya

Department Of Agriculture Technology

Faculty Of Agriculture

Universiti Putra Malaysia

Date :

ACKNOWLEDGEMENT

I would like to thank all those people who made this proposal for Final Year Project (FYP) possible and an enjoyable experience for me. First I wish to express my sincere gratitude to my supervisor Dr. Nik Norasma Binti Che'Ya for all her guidance and advice during the completion of this proposal.

I am grateful to all lecturers from Agriculture Technology Department who had given me a lot of knowledge in order to complete this proposal and make it become reality especially Assoc. Prof. Dr Farrah Melissa Binti Muharam.

Finally, I would like to express my greatest gratitude for a constant support and emotional understanding that I receive from my family, especially my mother, Wan Maheran Binti Wan Hussin, my father, Zainal Abidin Bin Dzulkifli and also my friends, Nur Najehah, Dg Rosezzah and Hilmi Azfar who have helped me a lot in making this proposal a success.

TABLE OF CONTENT

LIST OF TABLE

LIST OF FIGURE

LIST OF ABBREVIATION30

Abbreviation	
SSL	Self-Sufficiency Level
IoT	Internet Of Things
MOA	Ministry Of Agriculture
DAN	Dasar Agromakanan Negara
GIS	Geography Information System
ICT	Information And Communication Technology
IT	Information Technology
PND	Pest And Disease
BLB	Bacterial Leaf Blight
BSB	Bacterial Sheath Blight
LBP	Leaf Blight Disease
RTBV	Rice Tungro Bacilliform Virus
KADA	Kemubu Agriculture Development Authority
MADA	Muda Agriculture Development Authority
MARDI	Malaysia Agricultural Research Development Institute
IADA	Integrated Agriculture Development Area
SRI	System Of Rice Intensification
IRRI	International Rice Research Institute
GPU	General Public License
GUI	Graphical User Interface
SMS	Short Messaging System

PHP	Hypertext Preprocessor
CSS	Cascading Style Sheets
HTML	Hypertext Markup Language
JUPEM	The Department of Survey & Mapping
DOA	Department of Agriculture

ABSTRAK (*B.MALAYSIA)*

Nasi merupakan makanan ruji di Malaysia dan tahap SSL adalah 71.5%. Kerajaan telah memutuskan untuk meningkatkan tahap SSL ke 100% menjelang tahun 2020. Penghasilan beras boleh ditingkatkan melalui pengurusan dan amalan yang baik di ladang. Petani dilatih untuk menggunakan baja dan racun perosak secara efisyen untuk meningkatkan produktiviti beras. Maklumat berkaitan serangga perosak dan penyakit amat penting untuk mencegah penularan wabak sepanjang musim penanaman. Penggunaan internet di dunia kini semakin meluas dan ia memberi peluang kepada petani untuk mencari maklumat mengenai serangga perosak dan penyakit pada tanaman. Tambahan pula, sistem berasaskan atas talian juga akan membantu petani untuk mendapatkan cara penyelesaian untuk menguruskan sawah padi. Sistem atas talian menyediakan maklumat mengenai perosak dan penyakit untuk membantu petani membuat keputusan berpandukan garis panduan yang disediakan. Objektif bagi penyelidikan ini adalah untuk mengenal pasti web perosak dan penyakit pada tanaman padi, dan mereka bentuk satu rangka yang mesra pengguna menggunakan aplikasi web. Kajian ini melibatkan dua fasa. Fasa yang pertama, mengkaji pangkalan web perosak dan peyakit yang sedia ada. Kedua, merangka sistem pangkalan berdasarkan kajian literatur. Hasil kajian ini adalah rangka konseptual yang menyeluruh untuk sistem perosak dan penyakit diatas talian. Sistem perosak dan penyakit diatas talian boleh dibina berdasarkan kajian ini. Kajian ini merupakan batu loncatan untuk melaksanakan ioT didalam pertanian. Sistem atas talian akan membantu petani untuk mendapatkan maklumat dan cara pengawalan perosak dan penyakit disawah padi. Akhir sekali, produktiviti akan meningkat dengan pengurusan yang baik. Konsep yang sama boleh digunakan untuk tanaman lain seperti kelapa sawit, getah, nenas dan jagung.

ABSTRACT

Rice is a staple food in Malaysia, and the self-sufficient level (SSL) of rice is 71.5%. Malaysian government has decided to increase SSL level-up to 100% by 2020. The rice production can be increased by good management and best practices in the rice cultivation. Farmers need to be train to apply the fertilizer, herbicides and pesticides in an efficient way to improve the rice productivity. The information of pest and disease is very important for farmers to avoid any outbreak during planting season. Internet is widely used in the world and it gives a big opportunity for farmers to access the information for pest and disease in rice. Thus, the online integrated systems of pest and disease will help farmers to find a solution to manage the rice field. The online system will provide pest and disease information and helps farmers to do a decision based on the guidelines. The objectives of the research was to identify the current web-based of pest and disease in rice and design a conceptual of the system in user-friendly interface of pest and disease information using web-based application. The methodology of this research involved with two phases. The first phase was investigating the current web-based pest and disease information in rice, and the second phase was to design the conceptual of pest and disease information based on the literature review. Result from this research were a comprehensive conceptual design for online pest and disease framework for rice. The online pest and disease can be developed based on the outcome of this research in the future. This research is a stepping stone to implement the internet of things (IoT) in agriculture. The online system will help farmers to get the pest and disease information and how to control pest and disease in the rice field. Finally, the productivity will b increase by a good management in the rice field. The same concept can be used for other crop like oil palm, rubber, pineapple and corn.

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Rice in Malaysia

Oryza sativa or commonly known as rice is the second most important crop in the world. Asia being the largest producer and consumer in rice like Malaysia. The growing population in Asia has led to estimate of 70% increase in rice production in order to meet the demand in future. Food consumption pattern of the adult population in Malaysia shows that Malaysians consumed an average of two and a half plates of rice per day (Rajamoorthy, Abdul Rahim, & Munusamy, 2015). The Ministry of Agriculture and Agro-based Industry (MOA) had implemented *Dasar Agromakanan Negara* (DAN) to ensure the supply of food is sufficient and to transform the agro-based industry to become a more competitive, sustainable and increase income of entrepreneurs in this industry. *Dasar Agromakanan Negara* (DAN) 2011-2012 highlighted that local rice production should be increased to ensure the country's stock of rice as only 7% of world's rice production is traded. In the third Malaysian plan (1976-1980), the new economic policy had given prime priority on the agriculture sector. Under this policy, government opening more agriculture lands for paddy production resulted in a positive growth in the rice production between 1970 and 1975. According to fifth Malaysian plan (1986-1990), paddy production decreased by 1.1% compared to previous five-year plan due to weather condition, pest and diseases (PND) outbreak called *"Penyakit Merah* Virus" (rice Tungro Disease). Nevertheless, in Eight Malaysia Plan (2001-2005), paddy production had improved due to

commercialization, the involvement of private sectors and consolidation of smallholding through group farming. During the world's food crisis, the government decided to increase its self-sufficiency level (SSL) to 100 percent which causes a drastic increase in ending stock from 15 to 23%. Current SSL is 71.5% and still low for Malaysia and we are importing from the neighbor country like Thailand, Vietnam, and Philipines.

Web-based GIS

Geography Information System (GIS) is a computer-oriented and display spatially referenced data and used to provide solutions in wide range of problems in numerals field of studies such as agriculture, geography, aviation, engineering, geology, and architecture. In this study, the application of GIS is mainly focused on agriculture. GIS is an advanced technology that makes use of hardware, software, and data. There are a few different software packages, for example, ESRI ArcGIS (Zhong, Jiang, & Hu, 2012). Some of the applications of GIS in agriculture are water quality management, determination of soil suitability for a particular use, agro-climatological importance, management of natural resources, pest and disease control.

According to ArcGIS Server (2017), Web-based GIS is a technology that used to display analyze spatial data on the internet. It combines the advantages of both the internet and GIS. It offers public a new mean to access spatial information without owning GIS software. There are a few key elements that essential to Web-based GIS, which are;

- The server has a Uniform Resource Locator (URL) so that the clients can find the web.

- The client relies on Hypertext Transfer Protocol (HTTP) specifications to send a request to the server.
- The server performs the requested GIS operation and sends responses to the client.

Internet of Things (IoT)

The internet of things is a computing concept that describes the idea of everyday physical objects being connected to the internet and being able to identify themselves to other devices (Jaabi, 2017). In a simple definition, the internet of things refers to billions of physical devices around the world that are now connected to the internet, collecting and sharing data. The IoT is significant because an object that can represent itself digitally becomes something greater than the object by itself. No longer does the object relate just to its user, but now is connected to surrounding objects and database data. As the world continues to develop, the information technology expertise also continues to expand and Malaysia is not excluded in this sector. As Malaysia is going to the Digital Era, where the internet can be utilized to connect people globally. Nowadays, more than 70% Malaysian use the internet to complete their task (MCMC, 2017). The developing of information technology can be applied in Malaysia's agriculture such as precision agriculture and Web-based GIS.

The application of IoT in agriculture could have the greatest impact. Smart farming based in IoT technologies will enable growers and farmers to reduce waste and enhance productivity ranging from quantity of fertilizer utilized to the number of journeys the farm vehicles have made. In IoT-based smar farming, a system is built for monitoring the crop field with the help of sensors (light, humidity, temperature,

soil moisture, pest and disease) and automating the irrigation system. The growers and farmers can monitor their field condition from anywhere and anytime. The application of IoT not only targetting the conventional. Large farming operation but also the new levers to uplift other growing or common trends in agricultural.

1.2 PROBLEM STATEMENT

The SSL cannot be achieved due to current paddy planting management scenario in Malaysia. Farmers do not have enough knowledge about PND management in order to manage the crops. They also have difficulty to access the PND information since the extension officer is not always available to help them. These scenarios have lead to the problems :

i. Lack of information on PND

   The information for managing the farm especially in managing PND for crops efficiently is not reachable to them since the extension officer itself visit the farm only once a week.

ii. Do not have access to PND information

   No Web-based GIS in Malaysia provide PND information.

iii. Lack of technology (ICT)

   The lack of a technology-assisted system for agricultural development will impact the conventional approach towards ensuring cost-effectiveness and increasing yield.

1.3 OBJECTIVES

The objectives of this research are as the following

I. To identify the current Web-based GIS for pest and disease in rice by reviewing published paper.

II. To design a conceptual framework of Web-based GIS for rice in user-friendly interface for pest and disease.

1.4 SIGNIFICANCE OF RESEARCH

The significance of research are as follow

I. Using Internet gives an opportunity to the farmers to access the website for pest and disease information in agriculture management.

II. The guidelines tools for users help them in farm management and decision making.

III. Web-based GIS for pest and disease management is a beginning to improve the management of agriculture by utilizing ICT in globalization era.

IV. It is also as a stepping stone to implement the Internet of Things in agriculture.

REFERENCE

Abdul Kahar, M., Mutalib, S., & Abdul Rahman, S. (2015). Early Detection and Classification of Paddy Disease with Neural Networks and Fuzzy Logic. *Recent Advances in Mathematical and Computational Methods*, 248-257.

Abdullah, M., Abdullah, M., Nik Mustapha, H., Wan Mamat, W., Wan Ali, W., Che Yahya, R., . . . Amzah, B. (2011). *Buku Panduan Pengurusan Perosak, Penyakit & Rumpai Padi, Mengikut Pengalaman Ladang Merdeka KADA.* Kota Bharu: Percetakan Zulrahim Sdn. Bhd.

Adetokunbo, A., & Basirat A, A. (2013). Software Engineering Methodologies: A Review of the Waterfall Model and Object-Oriented Approach. *International Journal of Scientific & Engineering Research*, 427-434.

Alshamrani, A., & Bahattab, A. (2015). A Comparison Between Three SDLC Models Waterfall Model, Spiral Model, and Incremental/Iterative Model. *International Journal of Computer Science Issues (IJSCI)*, 106-111.

Amanatidis, T., & Chatzigeorgiou, A. (2016). Studying The Evolution of PHP Web Application. *Information and Software Technology*, 48-67.

Amlani, R. (2012). Advantages and Limitations of Different SDLC Models. *International Journal of Computer Application & Information Technology*, 6-11.

ArcGIS Server. (2017). Retrieved from Design Concepts for Web GIS Applications: https://enterprise.arcgis.com/en/server/latest/create-web-apps/windows/about-web-gis.htm

Balaji, S., & Murugaiyan, D. (2012). Waterfall vs V-Model vs Agile: A Comparative Study on SDLC. *International Journal of Information Technology and Business Management*, 26-30.

Balamurugan, M., Kalaiarasi, K., & Arun Prasad, S. (2014). Agriculture Land Information System Using Web GIS. *International Journal of Innovative Research in Science, Engineering and Technology*, 13971-13976.

Bassil, Y. (2012). A Simulation Model for the Waterfall Software Development Life Cycle. *International Journal of Engineering & Technology (iJET)*, Vol. 2 No. 5.

Blansit, B., & MLIS. (2008). The Basics of Relational Databases Using MySQL. *Journal of ELectronic Resources in Medical Libraries*, 135-148.

Che' Ya, N., A. R, M., E., J., M. S, M., S. Kharunniza, B., & A. R, M. (2010). Web-Based Decision Support System for Paddy Planting Management. *Pertanika Journal Science and Technology*, 343-364.

Dennis, A., Wixom, B., & Tegarden, D. (2015). *System Analysis & Design.* WILEY.

Dodd, R. (2017, March 3). *Why More Companies are Adopting Open Source Technology.* Didapatkan dari GitLab: https://about.gitlab.com/2017/03/03/why-choose-open-source/

Elsheikh, R., Mohamed Shariff, A., Amiri, F., Ahmad, N., Balasundram, S., & Mohd Soom, M. (2013). Agriculture Land Suitability Evaluator (ALSE): A Decision and Planning Support Tool for Tropical and Subtropical Crops. *Computers and Electronics in Agriculture*, 98-110.

Essays, U. (2013, November). *Rice Production In Malaysia Biology Essay*. Retrieved from https://www.ukessays.com/essays/biology/rice-production-in-malaysia-biology-essay.php?vref=1

Filippis, T., Rocchi, L., Fiorillo, E., & Genesio, L. (2011). A WebGIS Application for Precision Viticulture: From Research to Operatives Practices. *CNR Institute of Biometeoroloy*, 1-6.

Guidelines for Securing Apache Web Server. (2002). *Netwoerk Security*, 343-364.

Ho, B. (t.t). Chemical Control of The Blast Disease of Rice in Malaysia. *MARDI Res*, 8-14.

Howcroft, D., & Caroll, J. (2011). A Proposed Methodology for Web Development.

Jaabi, A. (2017, September 5). Smart Farming is The Way to Go. *New Strait Times*. New Straits Times Press (M) Berhad.

Jamsheer, K. (2017, March 3). *12 Best Software Development Methodologies*. Retrieved from Acodez: https://acodez.in/12-best-software-development-methodologies-pros-cons/

Kerian, I. (2011). *Perosak, Penyakit, Sahabat Ladang dan Rumpai Tanaman Padi*. Kerian: Kawasan Pembangunan Pertanian Bersepadu IADA, Kerian.

Kuok, T. (2015). Common Insect Pests of Rice and Their Natural Biological Control. *UTAR Agriculture Science Journal*, 49-59.

LaBarre, J., Korn, W., & Hale, S. (1994). Client/Server Computing: The Current Computing Revolution. *Journal Of Computer Information Systems*, 12-15.

Manzano Jr, V., Mizoguchi, M., Mitsuishi, S., & Ito, T. (2011). IT Field Monitoring in a Japanese System Rice of Intensification (J-SRI). *Paddy Water Environ*, 249-255.

McGaghie, W., Bordage, G., & Shea, J. (2001). Manuscript Introduction: Problem Statement, Conceptual Framework, and Research Question. *Academic Medicine*, 922-924.

McLaren, C., Bruskiewich, R., Portugal, A., & Cosico, A. (2005). The International Rice Information System. A Platform for Meta-Analysis of Rice Crop Data. *International Rice Information System*, 637-642.

MCMC. (2017). *Internet Users Survey, Statistical Brief Number Twenty-One.* Malaysia: Malaysian Communications and Multimedia Commission.

Nakov, S. (2011, June 29). Architectural Patterns and Software Architectures : Client-Server, Multi-Tier, MVC, MVP, MVVM, IoC, DI, SOA, Cloud Computing.

Obiyini, A., & Ibrahim, A. (2015). A Web-Based Farm 3D Visualization Management System. *Computer Science Systems Biology*, 49-54.

Omkar Software. (2017, July). *Top 5 Advantages and Disadvanrage of PHP*. Retrieved from Omkasr Soft: https://www.omkarsoft.com/blog/top-5-advantages-disadvantages-php-framework/

Pankaja, N., & Raj P K, M. (2013). Propriety Software versus Open Source Software for Education. *American Journal of Engineering Research*, 124-130.

Parent, C., Spaccapietra, S., & Zimanyi, E. (2000). Conceptual Modellinf for Federated GIS over The Web. 1-12.

Poortvliet, J. (2017, October 13). *6 Reasons Open Source is Good for Business*. Retrieved from opensource.com: https://opensource.com/article/17/10/6-reasons-choose-open-source-software

Rajamoorthy, Y., Abdul Rahim, K., & Munusamy, S. (2015). Rice Industry in Malaysia: Challenges, Policies and Implications. *International Accounting and Business Conference 2015*, 861-867.

Sarma, S., Singh, K., & Singh, A. (2010). An Expert System for Diagnosis of Disease in Rice Plant. *International Journal of Artificial Intelligence Volume 1*, 26-31.

Saxena, A., & Upadhyay, P. (2016). Waterfall vs. Prototype: Comparative Study of SDLC. *Imperial Journal of Interdisciplinary*, 1012-1015.

Saylor.org. (t.t). Didapatkan dari Freejavaguide.com: http://www.freejavaguide.com/history.html

Schmaltz, R. (2017, April 24). *Agfundernews*. Didapatkan dari agfundernews.com: https://agfundernews.com/what-is-precision-agriculture.html

Singh, A., Bansal, R., & Jha, N. (2015). Open Source Software vs Proprietary Software. *International Journal of Computer Application*, 26-31.

Suo, X., & Shi, N. (2008). Web-Based Expert System of Wheat and Corn Growth Management. *Computer and Computing Technologies in Agriculture*, 111-119.

Suprato, Sari, A., Hendarto, J., Medi, & Herwanto, G. (2016). A Web-based System of Precision Farming Based Agricultural Information for Rice Farming Field Consultant in Blora Regency. *International Journal of Electrical & Computer Sciences*, 1-8.

Suresh Babu, D., & Santosh Kumar, K. (2016). A Web GIS BAsed Decision Support System for Agriculture Crop Monitoring System- A Case Study from Part of Medak District. *Journal of Remote Sensing & GIS*, 1-20.

The Paddy Disease in Tropical Asia Biology Essay. (2018). Retrieved from uniassignment.com: uniassignment.com/essay-samples/biology/the-paddy-disease-in-tropical-asia-biology-essay.php

Tran, D., & Nguyen, N. (2006). The Concept and Implementation of Precision Farming and Rice Integrated Crop Management Systems for Sustainable Production in The Twenty-First Century. *Integrated System*, 91-100.

Wee, T. (2011). Common Paddy Disease Identifier. 1-12.

Wei Bao, Y., Xuan Yu, M., & Wu, W. (2011). Design and Implementation of Database for a WebGIS-based RIce DIsease and Pest System. *Procedia Environmental Sciences*, 535-540.

Yahaya, S., Che Musa, N., Mansor, Z., Siham, M., & Veloo, S. (2016). Remote Sensing and GIS Web-Based System for Paddy Cultivation Management in Malaysia. 1-6.

Zhang, Y., Shan, H., & Xu, D. (2008). Develop of Diseases Pest Information System Based on WebGIS. *IEEE*, 461-464.

Zhong, J., Jiang, N., & Hu, B. (2012). Research and Design of a Novel WebGIS Gramework Based on REST and RIA. *Procedia Engineering*, 903-908.