UNIVERSITI PUTRA MALAYSIA

DEVELOPMENT OF OIL PALM FRESH FRUIT BUNCH MATURITY ASSESSMENT SOFTWARE FOR PERSONAL DIGITAL ASSISTANT

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DEVELOPMENT OF OIL PALM FRESH FRUIT BUNCH MATURITY ASSESSMENT SOFTWARE FOR PERSONAL DIGITAL ASSISTANT

By

NADER KAVANDI

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

April 2011

DEDICATION

This thesis is dedicated to my parents for their endless support and instilling the importance of higher education.

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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 OIL PALM FRESH FRUIT BUNCH MATURITY ASSESSMENT SOFTWARE FOR PERSONAL DIGITAL ASSISTANT

By

NADER KAVANDI

April 2011

Chairman: Professor Wan Ishak Wan Ismail , PhD , Ir

Faculty: Engineering

Precision farming or precision agriculture requires the use of new technologies, mainly Global Positioning (GPS) and Machine Vision Systems. The current trend is to make precision agriculture solutions as practical as possible which requires a high level of portability at the first step. Both of the mentioned key technologies are already available in any modern Personal Digital Assistant (PDA), nominating them as capable, programmable and ultra-mobile devices in this field. The main objective of this research was to develop a software program that enables a regular PDA to replace a conventional camera vision system used for maturity inspection of oil palm fresh fruit bunches. The developed location aware software is named “Genius Farmer” and technical aspects of its development process are described. The software allows the user to take a picture from the FFBs using the built-in camera of the PDA and analyze it inside the PDA using a wisely implemented Hue based image processing algorithm. User can review the results on the screen, Geotag it with the current location data received through the built-in GPS receiver of the PDA, and lastly save them in a database for further analysis or future referencing. The results

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include the status of the fruit, its predicted oil content and suggested optimum harvesting date. A case study was carried out to verify the capabilities of the developed software in maturity assessment of the oil palm FFBs in a plantation. User-friendliness of the interface, compatibility with PDAs running Microsoft Windows Mobile® operating system and utilization of the built-in components of the PDA (Camera, GPS receiver and CPU) are the most important focused topics. The possibility of implementing other similar applications into the described device is discussed as a guideline for interested researchers in this field.

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Abstrak tesis ini dipersembahkan kepada Senat Universiti Putra Malaysia bagi memenuhi keperluan untuk memperolehi darjah Master Sains

PEMBANGUNAN PERISIAN PENILAIAN KEMATANGAN TANDAN BUAH KELAPA SAWIT PADA PEMBANTU PERIBADI BERDIGIT (PDA)

Oleh

NADER KAVANDI

April 2011

Pengerusi : Profesor Wan Ishak Wan Ismail , PhD , Ir

Fakulti : Kejuruteraan

Pertanian persis dan perladangan persis memerlukan pengunaan teknologi baru, terutamanya kedudukan global (GPS) dan Sistem Mesin Penglihatan . Trend sekarang adalah membuat penyelesaian pertanian persis yang memerlukan mudah alih yang tinggi bagai langkah pertama. Kedua-dua teknologi kunci tersebut sudah wujud pada alat “personal digital assistant” (PDA) dan mempunyai keupayaan untuk diprogramkan dan berfungsi sebagai peranti mudah alih-ultra di bidang ini. Tujuan utama dari kajian ini adalah untuk membina sebuah program yang membolehkan PDA untuk mengganti kamera konvensional visi sistem yang diggunakan untuk memeriksa kematangan buah TBS (Tandan Buah Segar). Peranti perisian lokasi yang dibina bernama “Petani Pintar” dan aspek teknikal daripada proses pembangunan dijelaskan. peranti perisian ini membolehkan pengguna untuk mengambil gambar dari TBS dengan menggunakan kamera sedia ada pada PDA, menganalisisnya dalam PDA dengan menggunakan algoritma pengolahan pengimej Hue. Kemudian, geotagkannya dengan data lokasi semasa melalui penerima GPS yang sedia ada pada PDA. Selepas itu, meninjau keputusan di paparan dan akhir

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sekali, menyimpankannya dalam database untuk analisis yang lebih lanjut.. Keputusannya termasuk status buah, kandungan minyak yang diramalkan dan tarikh penuaian yang optimum. Sebuah kes kajian dilakukan untuk mengesahkan kemampuan perisian yang dibangunkan dalam penilaian kematangan TBS pada buah kelapa sawit di ladang. Pengunna-keramahan antara muka, kesesuaian perlaksanana bagi setiap PDA yang menggunakan Microsoft Windows Mobile ® sistem operasi dan penggunaan komponen sedia ada pada PDA (kamera, penerima GPS dan CPU) adalah fokus topik yang paling utama. Kemungkinan untuk melaksanakan aplikasi lain yang sejenis ke dalam peranti ini akan dijelaskan sebagai panduan bagi para penyelidik yang berminat dalam bidang ini.

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I certify that an Examination Committee met on ---------- to conduct the final examination of NADER KAVANDI on his thesis entitled "**DEVELOPMENT OF OIL PALM FRESH FRUIT BUNCH (FFB) MATURITY ASSESSMENT SOFTWARE ON A PERSONAL DIGITAL ASSISTANT**" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of ----------

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DECLARATION

I declare that the thesis is my original work except for quotations and citation which have been duly acknowledged. I also declare that it has not been previously and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or other institutions.

NADER KAVANDI

Date: 12 April 2011

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