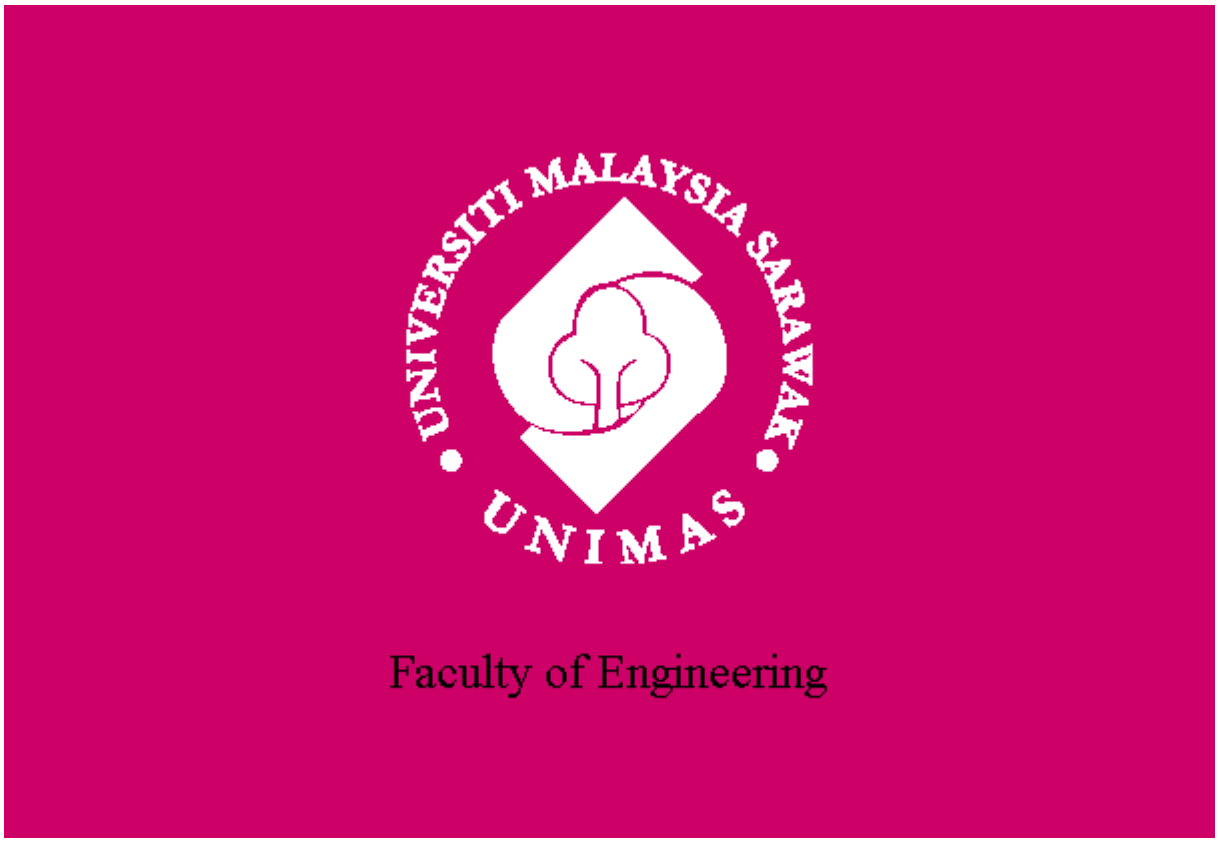

WIRELESS SENSOR NETWORK FOR MONITORING SWIFTS HABITAT/ BIRDNEST

Kee Mee Lee

Bachelor of Engineering with Honors
(Electronic & Computer Engineering)
2009

Borang Penyerahan Tesis
Universiti Malaysia Sarawak

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Title : WIRELESS SENSOR NETWORK FOR MONITORING SWIFTS HABITAT/ BIRDNEST

Prepared by : KEE MEE LEE

Matric No. : 14262

is hereby read and approved by:

_____ 06 APRIL 2009

Dr. Al-Khalid bin Haji Othman Date

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WIRELESS SENSOR NETWORK FOR MONITORING SWIFTS HABITAT/ BIRDNEST

KEE MEE LEE

This project is submitted to

Faculty of Engineering, Universiti Malaysia Sarawak

in partial fulfillment of the requirements for the degree of

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(Electronics and Computer)

2008

Dedicated to my dearest Mom, Chris, Vina,

and Abok

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ABSTRACT

Swift farms that resemble the natural habitat of cave for swifts breeding have been designed and growing very fast in Malaysia. The swiftlet farming industry has the potential to grow into a multi-million ringgit industry due to the industry's relatively profitable risk-return profile as well as a continuously growing demand for edible birds nests by wealthy overseas countries. There is also a discernable world-wide trend pursued by international as well as home grown pharmaceutical and herbal products companies in using edible birds' nests as base materials for producing natural and organic health supplement products for local and overseas consumption. It is known that the ideal temperature for swifts breeding is between 27°C to 29°C. However, a real-time monitoring system has never been designed for a swift habitat. Temperature and humidity of the farms can only be monitored manually by entering the farms once in every four to six weeks. There has yet to be a monitoring system to monitor the essential natural requirements of a swiftlet farm which are the temperature, humidity and the light density being developed. There is also no remote controlling system for all the equipments in the swift farm. The equipments can only be turned on and off with a timer control or manually. With research and investigation of the technology of Wireless Sensor Network (WSN), this thesis suggests a solution to the problem. To fulfill the hardware design for this project, a sensor node (MTS400), IRIS and Micaz radio transceivers and a USB interfaced gateway base station of Crossbow (Xbow) Technology WSN were employed. The Graphical User Interface (GUI) of this project is written in Laboratory Virtual Instrumentation Engineering Workbench (LabVIEW) along with Xbow

Technology drivers provided by National Instrument. As a result, this monitoring system is able to read temperature and humidity data, present data read in both tables and waveform charts, display warning on the GUI and send a notification email whenever the temperature reading is out of spec, save all the monitoring data into a database, email the monitoring data to the system operator and owner, and the system can be remote accessed and controlled from anywhere through the internet using LogMeIn software. Finally, this research draws a conclusion that a WSN Monitoring System for Swift Habitat as a tool that enable the enhancement to the current swift farming industry in Sarawak had been successfully developed.

ABSTRAK

Ladang-ladang yang menyerupai habitat semulajadi gua untuk burung walid telah direka bentuk dan semakin meningkat di Malaysia. Industri penternakan burung walid mempunyai potensi untuk menjadi satu industri berjuta-juta ringgit yang amat menguntungkan risiko akibat permintaan yang meningkat secara berterusan untuk sarang burung oleh negara asing yang kaya. Terdapat juga satu trend yang dikejar di seluruh dunia oleh farmaseutikal antarabangsa dan syarikat-syarikat produk herba dalam menggunakan sarang burung sebagai bahan-bahan asas untuk mengeluarkan produk makanan tambahan kesihatan organik untuk penggunaan tempatan dan luar negara. Suhu antara 27°C untuk 29°C adalah paling sesuai untuk pembiakan burung walid. Bagaimanapun, tiada sistem pemantaun pernah direka bentuk. Suhu dan kelembapan bagi ladang-ladang hanya dapat dipantau secara manual dengan memasuki ladang-ladang dalam setiap empat atau enam minggu. Masih belum wujud satu sistem pemantauan untuk memantau sifat-sifat semula jadi bagi satu ladang burung walid iaitu suhu, kelembapan dan ketumpatan cahaya. Sistem kawalan jauh bagi semua peralatan-peralatan dalam ladang burung walid juga belum wujud. Peralatan hanya boleh dikawal dengan menggunakan satu kawalan penentu masa atau secara manual. Dengan pengajian teknologi Wireless Sensor Network (WSN), tesis ini mencadangkan satu penyelesaian kepada masalah itu. Untuk memenuhi reka bentuk perkakasan projek ini, satu buku penderia (MTS400), radio transceiver IRIS dan Micaz dan satu stesen pangkal get laluan USB sebagai ruang hubung kait Crossbow (Xbow) Teknologi WSN telah digunakan. Antara Muka Pengguna Grafik (GUI) projek ini ditulis dengan menggunakan Laboratory Virtual Instrumentation

Engineering Workbench (LabVIEW) dan juga pemandu-pemandu Xbow Technology yang disediakan oleh National Instrument. Hasilnya, sistem pengawasan ini berupaya membaca suhu dan kelembapan, memaparkan data dalam meja-meja dan carta-carta gelombang, menunjukkan amaran pada GUI dan menghantar pemberitahuan emel apabila bacaan suhu di luar spekulasi, menyimpan data pemantauan ke sebuah pangkalan data, emel data pemantauan kepada pengendali sistem dan pemilik, dan sistem tersebut boleh dicapai dan dikawal dari mana-mana saja melalui internet menggunakan perisian LogMeIn. Akhirnya, penyelidikan ini menyimpulkan bahawa sebuah sistem pemantauan WSN untuk habitat burung walid yang boleh digunakan sebagai satu alat untuk peningkatan industri pertanian di Sarawak telah direkacipta dengan jayanya.

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ABBREVIATION

ADC	-	Analog-to-Digital Converter
AP	-	Access Point
APs	-	Access Points
ARIB	-	Association of Radio Industries and Businesses
ASK	-	Amplitude Shift Keying
BPSK		Binary phase-shift keying
BSS	-	Basic Service Set
CAP	-	Contention Access Period
CDM	-	Combined Driver Model
CSMA/CA	-	Carrier Sense Multiple Access with Collision Avoidance
DS	-	Distribution System
DSC	-	Distributed System Concept
DSM	-	Distribution System Medium
DSSS	-	Direct Sequence Spread Spectrum
ETSI	-	European Telecommunications Standards Institute
ESS	-	Extended Service Set Networks
FCC	-	Federal Communications Commission
FCS	-	Frame Check Sum
FFD	-	Full-Function Device
FHSS	-	Frequency Hopping Spread Spectrum
FTDI	-	Future Technology Device International

GPS	-	Global Positioning System
GSM	-	Global System for Mobile -communication
GTS	-	Guaranteed Time Slots
GUI	-	Graphical User Interface
HDLC	-	High Level Data Link Control
I/O	-	Input/ Output
I2C	-	Inter-Integrated Circuit
IBM	-	International Business Machines
IBSS	-	Independent Basic Service Set
IC	-	Integrated Circuit
ID	-	Identifier
IEEE	-	Institute of Electrical and Electronics Engineers
IP	-	Internet Protocol
IR	-	Infrared
IRIS	-	Latest generation of Motes from Crossbow Technology
ISM	-	Industrial, Scientific and Medical
ISP	-	Internet Service Provider
ISP	-	In-System Processor
JTAG	-	Joint Test Action Group
LabVIEW	-	Laboratory Virtual Instrumentation Engineering Workbench
LANs	-	Local Area Networks
LED	-	Light Emitting Diode
LLC	-	Logical Link Control
LR-WPAN	-	Low Rate Wireless Personal Area Network
MAC	-	Media Access Control

MANETs	-	Mobile Ad hoc Networks
MDA300	-	Data Acquisition Board
MIB520	-	USB Interface Board
MICA/MICAz	-	Motes from Crossbow Technology
MMCX	-	Micro-Miniature Coaxial
MSDUs	-	Medium Access Control Service Data Units
MTS400	-	Sensor Board
NAT	-	Network Address Translation
NI	-	National Instuments
OEM	-	Original Equipment Manufacturer
OQPSK	-	Offset Quadrature Phase Shift Keying
OSI	-	Open Systems Interconnection
PAN	-	Personal Area Network
PC	-	Personal Computer
PDA	-	Personal Digital Assistant
PDN	-	Premises Distribution Networks
PDUs	-	Protocol Data Units
PPP	-	Point to Point Protocol
PSTN	-	Public Switched Telephone Network
QoS	-	Quality of Service
RFDs	-	Reduced-Function Devices
RH	-	Relative Humidity
RSSI	-	Received Signal Strength Indication
SAP	-	Service Access Point
SHT11	-	Single-chip humidity and temperature multi sensor module