Wireless Sensor Networks for Swiftlet Farms Monitoring

Al-Khalid Othman, Wan A. Wan Zainal Abidin, Kee M. Lee, Hushairi Zen, Tengku. M. A. Zulcaffle, Kuryati Kipli

***Abstract*—**This paper provides an in-depth study of Wireless Sensor Network (WSN) application to monitor and control the swiftlet habitat. A set of system design is designed and developed that includes the hardware design of the nodes, Graphical User Interface (GUI) software, sensor network, and interconnectivity for remote data access and management. System architecture is proposed to address the requirements for habitat monitoring. Such application-driven design provides and identify important areas of further work in data sampling, communications and networking. For this monitoring system, a sensor node (MTS400), IRIS and Micaz radio transceivers, and a USB interfaced gateway base station of Crossbow (Xbow) Technology WSN are employed. The GUI of this monitoring system is written using a Laboratory Virtual Instrumentation Engineering Workbench (LabVIEW) along with Xbow Technology drivers provided by National Instrument. As a result, this monitoring system is capable of collecting data and presents it in both tables and waveform charts for further analysis. This system is also able to send notification message by email provided Internet connectivity is available whenever changes on habitat at remote sites (swiftlet farms) occur. Other functions that have been implemented in this system are the database system for record and management purposes; remote access through the internet using LogMeIn software. Finally, this research draws a conclusion that a WSN for monitoring swiftlet habitat can be effectively used to monitor and manage swiftlet farming industry in Sarawak.

***Keywords*—**Swiftlet, WSN, Habitat Monitoring, Networking.

I. Introduction

THE swiftlet farming industry has the potential to grow into a multi-billion dollar industry due to the industry's relatively profitable risk-return profile as well as a continuously growing demand for edible birds' nests by wealthy countries. There is also a discernable world-wide trend pursued by international home grown pharmaceutical and herbal products companies in using edible birds' nests as base materials for producing natural and organic health supplement products.

Malaysia is among the largest producer (7%) of edible birds' nest in the world behind Thailand (20%) and Indonesia (60%) with estimated annual weight value of approximately 160 tons for the world consumption in 2006. The total consumption value of edible birds' nest throughout the world in 2006 is estimated in the vicinity of USD1.5 to USD4 billion. The main markets are Hong Kong (50%), China (8%), Taiwan (4%), Macau (3%), Japan, and South Korea. Their demand will continue to grow at double-digit rates for the next 2 decades or so in line with their strong economic growth rates. The delicacy is catching quickly in the United States [1].

Breeding the swiftlet is not an easy task. The birds itself are very sensitive to human being and require special care to produce a high quality nest and productivity [2]-[4]. About more than 1,500 swiftlet farms in Sarawak, Malaysia has been setup but none of the farms has real time monitoring. These farms are mostly equipped with electrical equipments including humidifier, audio system and timers, thermometer and humidity tester.

The temperature and humidity of the farms are monitored manually only once in every four to six weeks. The farmers are unable to constantly monitor the temperature and humidity of their farms due to the remote access and sensitivity of swiftlet habitat. Sudden extreme change of temperature and humidity could cause the swiftlets to migrate to other places. Farmers used audio system with special sound alternately to attract female and male swiftlet and this is done manually at a farm. Manual monitoring and controlling of equipments in the farms will frighten the swiftlets away. All the above problems could negatively affect the production of birds' nests and hence result in a great lost to the investors of the swiftlet farms.

The application of WSN for swiftlet farms monitoring will have enormous potential benefits for scientific communities and society as a whole. This application will enable long-term data collection, monitoring and remote management to be done [5]-[9]. Interconnectivity with the physical environment at a swiftlet farm will allow sensors (such as temperature and humidity) to provide localized measurements and detailed information that is hard to obtain through traditional method.

This paper develops specific monitoring applications for swiftlet habitats. It presents a collection of requirements, constraint and guidelines that serves as a basis for general sensor architecture for many such applications. This includes identifying the current problems and proposes the solution. It describes the main components of the sensor network for such application – the hardware and sensor platforms, network services and communications.

The remainder of the paper is organized as follows. Section II identifies the system requirements for swiftlet farms

Al-Khalid Othman is with the Faculty of Engineering, Universiti Malaysia Sarawak (UNIMAS), 94300 Kota Samarahan Sarawak, Malaysia (phone: +6082583244; fax: +6082583409; e-mail: okhalid@feng.unimas.my).

Wan A.Wan Zainal Abidin, Hushairi Zen, Tengku. M. A. Zulcaffle, Kuryati Kipli are with the Faculty of Engineering, Universiti Malaysia Sarawak , 94300 Kota Samarahan Sarawak, Malaysia (e-mail: wzazlan@feng.unimas.my., zhushairi@feng.unimas.my., ztmafendi@feng.unimas.my., kkuryati@feng.unimas.my.).

Kee M. Lee, was with the Faculty of Engineering, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia.