Bird Counting and Climate Monitoring using LoRaWAN in Swiftlet Farming for IR4.0 Applications

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***Abstract*—In recent years, the edible swiftlet bird nest is a growing industry in Malaysia. Farmers simulate the swiftlet's habitat in buildings widely known as swiftlet bird houses. The suitability of the environment or condition in these houses are largely unknown as there seems very little research effort is done in this newly formed industry. This paper presents a real-time environment monitoring and control system utilizing wireless sensor network such as LoRaWAN. The monitored sensor data include humidity, temperature, oxygen, and luminance were recorded in a swiftlet bird house in Terengganu. Ambient and indoor humidity, temperature and oxygen level variations were also investigated. Internet of Things (IoT) and video analytics which are part of Industrial Revolution 4.0 (IR 4.0) technologies are used in this project. The studies have shown that the combination of suitable temperature, humidity and oxygen inside the swiftlet bird house will increase the amount of edible bird nest.**

Keywords— IoT, IR4.0, Swiftlet Farming, Video Analytics, Temperature, Relative Humidity, Light Intensity, Sensors, WSN, LoRaWAN

I. INTRODUCTION

Internet of Things (IoT) can be understood as the ubiquitous and global network that helps and provides the functionality of integrating the physical world. This is done through the collection, processing and analysis of data generated by IoT sensors and will be integrated through the public communication network. Some projections estimate that in 2020 the number of connected equipment will grow exponentially to 50 billion [1].

Application of Cyber-Physical Systems (CPSs) and IoT in industrial automation domain led to the definition of the Industrial Revolution 4.0 (IR4.0) concept [2]. IR4.0 alludes to a fourth industrial revolution enabled by Internet technologies to create smart products, a smart production, and smart services. The high-tech strategy was originally developed in Germany and the term has quickly become a buzzword on a global scale [3].

Lately, the Edible Bird Nest (EBN) has been attracting a lot of interest, especially from China due to the high nutrient contents, minerals and anti-oxidants; believed to promote good health and increase longevity [4]. Due to the high nutraceutical values the demand for EBN has increased dramatically. As such houses for swiftlets have been developed to provide an artificial habitat so that swiftlets can build their nest and can be easily monitored and harvested.

EBN is made with saliva or more commonly known as Swiftlets. Swiftlet is a type of birds similar to swallows, sparrows and house swifts. The five most common species of Swiftlets found in Malaysia and Borneo Island are *H. Gigas, C.Esculent, Asian Palm Swift, A. Maximu* and *A.Fuciphagus* [5]. *A.Fuciphagus* is a particular species of Swiftlet that produces EBN and only available in Southeast Asia region. The most expensive nest is white nest, which is produced by *A. Fuciphagus.*

The swiftlet industry in Malaysia has grown since the 18th century, when the majority of nests were collected from caves. Malaysia is a very fortunate country because it has large regions of green areas, forests and variety of plantations including palm oil and rubber. These areas are sources of food for swiftlets. Hence, this industry has expanded incrementally in the last few years and it is expected to grow continuously. The global demand for EBN has increased drastically. Asia has the highest demand for EBN. Most of the estimated 160 tons per annum of EBN produced is consumed, and most are consumed by China [6]. In Hong Kong a bowl of bird nest soup could cost USD30 to USD100 while a kilogram of white nest (around 90 to 120 nests) can cost up to USD2, 000.

The swiftlet farming industry is expanding and need a system to monitor, control, provide feedback and early prediction to create a more suitable environment. This project investigates the feasibility of deploying Wireless Sensor Network, LoRaWAN for monitoring and controlling a swiftlet farm. This paper can be a reference for swiftlet farmers to establish a more hygienic and conducive condition in the swiftlet houses. Figure 1 shows an example of edible bird-nest collected in Malaysia.

Fig.1 Edible Bird-Nest