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# *Attraction Sound in the Swiftlets House*

Siti Nurzalikha Zaini Binti Husni Zaini, Sunardi, Kamarul Hawari Bin Ghazali.
Faculty of Electrical Engineering
Universiti Malaysia Pahang
Pekan, Malaysia
snzhz.ct89@gmail.com, sunardi@ump.edu.my, kamarul@ump.edu.my

Saiful Nizam Bin Tajuddin
Faculty of Science and Industrial Technology
Universiti Malaysia Pahang
Gambang, Malaysia
e-mail: saifulnizam@ump.edu.my

***Abstract*—This research about the analysis of attraction sound for swiftlets to enter the swiftlets house. There are important thing for industry to attract swiftlets enter and build their nests in man-made house. Swiftlet house usually house fitted bird-call recording from original sound in the cave to attract attention bird go inside house to be doing nest. Therefore, this study analyze sound features that has attracted attention bird. Ten samples of swiftlets sound were analyzed by using Fast Fourier Transform in Matlab software to identify sound characteristic that attract swiftlets. Specific sound characteristic for swiftlets attraction on frequency and magnitude of original sound and noise have been identified.**

***Keywords—swiftlet, sound, attraction, FFT***

## I. Introduction

Health care is very important to human life. Because of that, we might need to choose health nutrition such as bird's nest from swiftlets. The nests of some species are built entirely from threads of their saliva, and are collected for the famous Chinese delicacy bird's nest soup.

Swiftlets's nest make skin whiting agent and also good for eye's health. For asthma sufferer, it also became best agent restore respiratory system and strengthens lungs. The bird's nest benefiting all age level such as collagen nutrient which include in every swiftlets's nest can launch blood vessel increase appetite and improve alimentary canal.

The nests can give high potential and also benefiting for health although the value added. Within more this a decade, entrepreneurs explored various methods and new technology to increase production. There are a few factors to make swiftlets attract such as aroma, light, temperature, humidity and sound.

The swiftlets character is sensitive toward sound. Previously, sound that produced at swiftlets husbandry premise actually is produced from recording audio sound bird voice. Therefore, the research and development about sound characteristic for swiftlets attraction needed to develop swiftlets industry. This is used for industry to attract swiftlets enter and build their nests in man-made house. The income can give benefits for good economic and healthy.

Nowadays, bird house for swiftlets farming usually developed and equipped with recorded sound of chirping and mating from cave (natural habitat) to attract swiftlets to enter and build nest. These sounds just taken using trial and error method without analysis (frequency, amplitude, wavelength, or other element) of sound involve in signal to attract the swiftlets. This method is sometimes successful to attract the swiftlets, but certainly these sounds contains noisy and disturb by another sound.

The objective of this research is to identify the sound of characteristic for swiftlets attraction. There are 10 samples of sound have placed at external location in swiftlets's house to be analyzed for frequency and magnitude.

## II. Swiftlet Attraction using Sound

This section discusses on topics about swiftlets, sound, swiftlets attraction, sound characteristic, and sound analysis. Furthermore, discussion on sound classification FFT (Fast Fourier Transform) Algorithm and FFT application are presented.

### *A. Swiftlets Attraction*

Swiftlets are birds contained within the four genus Aerodramus, Hydrochous, Schoutedenapus and Collocalia. They form the Collocaliini tribe within the swift family Apodidae. This group contains around 30 species which is mostly confined to southern Asia, south Pacific islands, and northeastern Australia. All of them are within the tropical and subtropical regions. They are in many respects typical members of the Apodidae, having narrow wings for fast flight, with a wide gap and small reduced beak surrounded by bristles for catching insects in flight.

A small-sized swift (*Family Apodidae*) have 24 species worldwide. The main producers of edible nest are White-nest Swiftlets (*Aerodramus fuciphagus*) and Black-nest Swiftlets (*A. maximus*). Two unique characters are salivary gland to build nest and Echolocation [1].

Figure 1. Swiftlets build nest from threads of their saliva

The distinguishes are many but not all species from other swifts and indeed almost all other bird is their ability to use a simple but effective form of echolocation to navigate in total darkness through the chasms and shafts of the caves where they roost at night and breed. The nests of some species are built entirely from threads of their saliva, and are collected for the famous Chinese delicacy bird's nest soup.

There are environmental factors such as temperature, light intensity, humidity and sound is the key of successful place for swiftlets [2]. Sound is the main attraction for swiftlets for place in their house. The most interesting feature of swiftlets is that many species utilize a sonar-like system [3]. The swiftlets's voice proven very effective attracts swiftlets to be nested in bird house for swiftlets farming. This is shown that swiftlets very sensitive on sound.

The previous research state that swiftlets hearing responses to the frequency 1 - 16 kHz [2] and which most energy on 2 - 5 kHz [4]. This frequency falls into normal hearing. This statement is shown that in general, the animals generate sounds to communicate with members of the same species [5]. In 1990, technique for swiftlets attraction by using recording began to be expended but recording quality that is adverse. Through technology development, swiftlets recording voice that produced with quality, clear and similar authentic swiftlets voice. This swiftlets's recording voice usable to increase swiftlets population to build nest. There are two locations to attract the swiftlets entered the swiftlets farming house which are puller and external.

The locations at puller swiflets's house is on the roof house. Mostly, this location will fit the swiftlets voice when they gather. The location at external swiflets's house is on the outer house. Mostly, this location will fit the adult swiftlets voice. External sound is focused in this research.

Figure 2. Puller locations at the swiflets's house

Figure 3. External locations in swiflets's house

## B. *Sound Characteristics*

Sound is produced by the vibration of sound pressure waves in the air. Sound pressure levels are used to measure the intensity of sound and are described in terms of decibels. Sound is composed of various frequencies, but the human ear does not respond to all frequencies [6]. Sound is the important thing for this project to find the characteristic of sound can attract the swiftlets and to know that the frequency of swiftlets most attract can be heard by human or not. The perception of sound in any organism is limited to a certain range of frequencies. For humans, hearing is normally limited to frequencies between about 20 Hz and 20,000 Hz, although these limits are not definite. The upper limit generally decreases with age [12].

Sound can be heard from different quality of sounds, i.e. loud or soft, high pitch or low pitch, audible or inaudible etc. [6]. A sound can be characterized by the following three quantities are pitch, quality and loudness. Sound waves are often simplified to a description in terms of sinusoidal plane waves, which are characterized by these generic properties; frequency, magnitude, and amplitude [6].

## C. *Fast Fourier Transform (FFT) Algorithm*

Fourier analysis is useful for data analysis, as it breaks down a signal into constituent sinusoids of different frequencies. It is particularly used in area such as signal processing [9].

Therefore, short time Fourier Transform (STFT) have been deployed using a variety of "windows" with different relative advantages to address principally difficulties in analyzing short term transient sound behavior [10]. Two things that are different about the FFT implementation in MATLAB than the presentation the FFT uses complex numbers and the FFT computes positive and negative frequencies [11].

There is better way to compute the Fourier transform of discrete data called the FFT. The FFT was a truly revolutionary algorithm that made Fourier analysis mainstream and made processing of digital signals commonplace. The power of the FFT is that it allows computing the Fourier coefficients faster. The FFT has become such a commonplace algorithm that it is built into Matlab. The coefficient FFT is quite complex.

Use of complex numbers introduces some mathematical simplicity in Fourier transform algorithms and provides a convenient representation. Real numbers are often represented on the real number line and complex numbers are often visualized on the two dimensional complex plane. In the complex plane it is clear to see that the absolute value is simply the distance of the complex number from the origin.

The real part of the FFT corresponds to the cosines series and the imaginary part corresponds to the sine. When taking an FFT of a real number, data set the positive and negative frequencies turn out to be complex conjugates.

# III. Methodology

Analysis for the sound is by taking a few sample of sound to form a raw data of sound from different locations. Then, the data will be compared based on the similarity elements in different location for characterizations which are involved attracting the swiftlets.

The pre-processing and analysis are really important for signal processing because the process where the sample will

be produce signal with waveform. The programming signal in time domain and programming signal are developed using Fast Fourier Transform (FFT) and waveform results are produced.

### A. *Sound Development*

The recording sound is mp3 format and need convert format of and need to be converted into wav format by using Mp3 to Wav converter. Then, cut the sound to 60 seconds (10MB) and 120 second (20MB) at beginning, last and two random locations at middle in sound by using Easy Audio Cutter. The reasons to cut the sound because MATLAB cannot run the memory of sound larger than 20MB. Then, process the all the sample to obtain the waveforms produced from sound signal. Detail sound development as a flowchart is shown in Fig. 4.

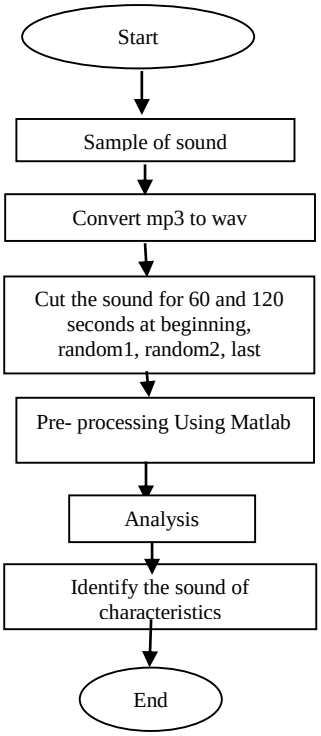
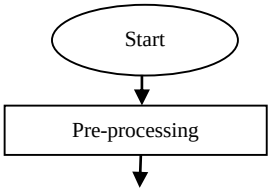



Figure 4. Block diagram for sound development

### B. *Software Development*

The flowchart in Fig. 5 illustrated the sequence of steps for this research. The first method is designing the programming for produce the signal of sound in time domain. Secondly, used programming FFT to produce signal of sound in the frequency domain.



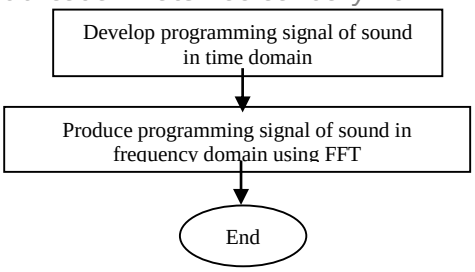




Figure 5. Block diagram for software development

## IV. Results and Discussion

Results of the measurements and further discussion have been considered. The analysis the waveform of swiftlets sound in time domain is presented. The magnitude and frequency in original sounds and noise are presented in the frequency domain. The comparison between original and noise sound in 60 seconds and 120 seconds are discussed. Finally, discussion on the sound characteristics for swiftlets attraction is presented.

### A. *Swiftlets Sound in Time Domain*

The samples of recording sound in 'mp3' format are converted into 'wav' format using mp3 to wav converter. There are 10 samples of sound have been measured. The measurement procedure is a sample taken to be cut at first, end and random audio in the middle by using easy audio cutter. Each sound deduction produced in period 60 seconds and 120 seconds.

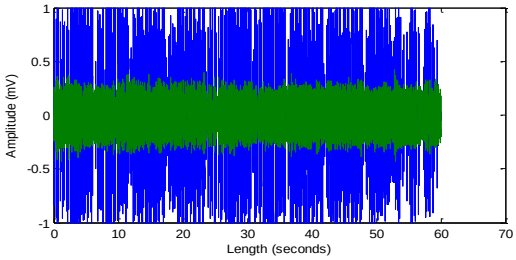



Figure 6. Signal of swiftlet sound for 60 second

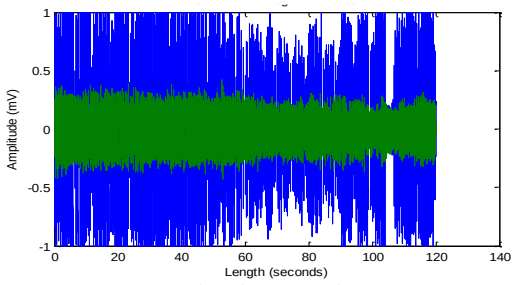



Figure 7. Signal of swiftlet sound for 120 seconds

Fig. 6 and Fig. 7 shows that acquired MATLAB consist of continuous waveform and converted into its spectral. This waveform performed in time domain are contains certain peaks and valleys in the particular range. The sounds can analysis maximum memory at 20 MB only.

Based on the sounds profile is in 1 minute (60 seconds) have 10 MB memory, 2 minute (120 seconds) has 20 MB memory and further. Thus, the sound can analysis maximum in 120 seconds. The waveform have irregular pattern with different amplitude and time it make difficult to pick the best sound.

Waveform performed two types of color which is blue and green after processing. The blue color representing the original sound while the green color representing the noise sounds.

## B. *Swiftlets Sound in Frequency Domain*

The waveforms for swiftlets sound successfully recorded. Next, the signal in the time domain converted into frequency domain by using FFT.

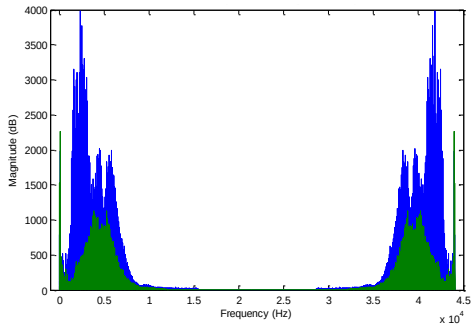



Figure 8(a). Fast Fourier Transform (FFT) wave

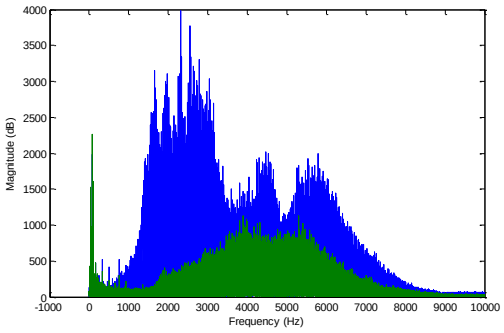



Figure 8(b). Left Hand Side (LHS) FFT wave

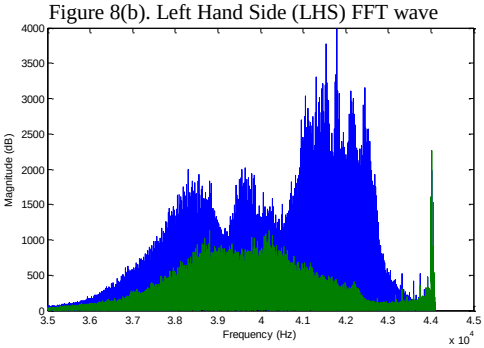



Figure 8(c). Right Hand Side (RHS) FFT wave

Fig. 8(a), (b) and (c) shown that frequency and magnitude of swiftlets sound for 60 seconds duration. Based on it appears that the FFT creates a reflection. The frequencies produced by amplitude modulation are symmetrically spaced above and below the carrier frequency and the carrier level is reduced to the lowest practical level, ideally completely suppressed.

The blue color represents the original sounds. Observations focused on magnitude and frequency domain has represented by using FFT. The original sound means it is a kind of vibration which travels through air, water, and are sensed by the ear also thing that can be heard. This is from swiftlets speech among their friends when they together.

TABLE I. FREQUENCY ON LEFT HAND SIDE OF ORIGINAL SOUND

| Sample | Frequency Begin (Hz) | Frequency Random 1 (Hz) | Frequency Random 2 (Hz) | Frequency Last (Hz) | Frequency Total (Hz) | Frequency Average (Hz) |
|---|---|---|---|---|---|---|
| **1** | 2500 | 2500 | 2500 | 2500 | 10000 | **2500** |
| **2** | 2500 | 2500 | 2500 | 2500 | 10000 | **2500** |
| **3** | 2500 | 2500 | 2500 | 2500 | 10000 | **2500** |
| **4** | 2500 | 2500 | 2500 | 2500 | 10000 | **2500** |
| **5** | 2500 | 2500 | 2500 | 2500 | 10000 | **2500** |
| **6** | 2500 | 2500 | 2500 | 2500 | 10000 | **2500** |
| **7** | 2500 | 2500 | 2500 | 2500 | 10000 | **2500** |
| **8** | 2500 | 2500 | 2500 | 2500 | 10000 | **2500** |
| **9** | 2500 | 2500 | 2500 | 2500 | 10000 | **2500** |
| **10** | 2500 | 2500 | 2500 | 2500 | 10000 | **2500** |

The original sound profile for 120 seconds has been measured. Acoustic characteristics sound attraction has been measured through signal analysis in ten samples, particularly in its frequency. Thus, the higher frequency of each samples get consistent value for left hand side 2500Hz and right hand side 42000Hz.

The green color representing noise sounds. Observations also focused on magnitude and frequency domain has represented by using FFT. The noise sound is a sound from one and more at a time which cannot be heard clearly and only mixed sounds will be heard. This is the environment sound such as wind, the deep water drops and others sound around. The measurement procedure is also by using FFT for ten samples.

TABLE VI.RIGHT HAND SIDE FREQUENCY OF NOISE

| Sample | Frequency Begin (Hz) | Frequency Random 1 (Hz) | Frequency Random 2 (Hz) | Frequency Last (Hz) | Frequency Total (Hz) | Frequency Average (Hz) |
|---|---|---|---|---|---|---|
| 1 | 44000 | 44000 | 44000 | 44000 | 176000 | **44000** |
| 2 | 44000 | 44000 | 44000 | 44000 | 176000 | **44000** |
| 3 | 44000 | 44000 | 44000 | 44000 | 176000 | **44000** |
| 4 | 44000 | 44000 | 44000 | 44000 | 176000 | **44000** |
| 5 | 44000 | 44000 | 44000 | 44000 | 176000 | **44000** |
| 6 | 44000 | 44000 | 44000 | 44000 | 176000 | **44000** |
| 7 | 44000 | 44000 | 44000 | 44000 | 176000 | **44000** |
| 8 | 44000 | 44000 | 44000 | 44000 | 176000 | **44000** |
| 9 | 44000 | 44000 | 44000 | 44000 | 176000 | **44000** |
| 10 | 44000 | 44000 | 44000 | 44000 | 176000 | **44000** |

The original sound profile for 120 seconds has been measured. Acoustic characteristics sound attraction has been measured through signal analysis in ten samples, particularly in its frequency. Thus, the higher frequency of each samples get consistent value for left hand side 0Hz and right hand side 44000Hz.

TABLE VI. COMPARISON BETWEEN ORIGINAL SOUND AND NOISE

| | Frequency (Hz) | | | |
|---|---|---|---|---|
| | Sound | | Noise | |
| **Sample** | **LHS** | **RHS** | **LHS** | **RHS** |
| 1 | 2500 | 42000 | 0 | 44000 |
| 2 | 2500 | 42000 | 0 | 44000 |
| 3 | 2500 | 42000 | 0 | 44000 |
| 4 | 2500 | 42000 | 0 | 44000 |
| 5 | 2500 | 42000 | 0 | 44000 |
| 6 | 2500 | 42000 | 0 | 44000 |
| 7 | 2500 | 42000 | 0 | 44000 |
| 8 | 2500 | 42000 | 0 | 44000 |
| 9 | 2500 | 42000 | 0 | 44000 |
| 10 | 2500 | 42000 | 0 | 44000 |
| **Sum** | **25000** | **420000** | **0** | **440000** |
| **Average** | **2500** | **42000** | **0** | **44000** |

The overall samples have been measured for 120 seconds shown that noise sound give maximum frequency at 44000Hz compare than original sound at 42000Hz.

Observation of samples of sound that have analysis the factors of attraction has two elements. First, the original sound which is including swiftlets's sound while second element is noise sound around the cave. The combination of original sound and noise sound give swiftlets attraction to enter house. The main characteristic of sound can attract is the frequency of the sound because from all resulted got same value of frequency whether in 60 seconds or 120 second. Swiftlets is very sensitive toward sound give higher frequency.

That proves that previous researcher state that swiftlets hearing responses to the frequency 1-16 kHz [2] which most energy on 2-5 kHz [4] are valid for original sound (swiftlet sound) on left hand side that have been analyzed. This frequency falls into normal human hearing. But for the right hand side, we get the high frequency (higher than 1500Hz) [7] where cannot heard by human ear. Problem encountered in this study is the software cannot analysis the sound higher than 20 MB.

# V. Conclusion

Sound Characteristics for swiftlets attraction have been analyzed by using MATLAB software with 10 samples of swiftlets sound. The analysis conducted at samples by employing 120 seconds duration in each sample. The research focused on original sounds and noise sound in that sample.

FFT has been applied to sample of swiftlets sound. As the results, the frequencies spectral have been acquired. It has demonstrated that swiftlets attraction in frequency ranging of 2500Hz and 42000Hz for original sound while 0Hz and 44000Hz for noise sound.

Furthermore, sound characterization analysis has been obtained. It exhibits that perceiving emitted sound at any point of measurement is relatively similar. In other words, the frequency and magnitude of distribution for all samples of swiftlets sound is sufficiently uniform.

In addition, swiftlets attraction towards sound has been observed. A group of sounds of different types that exclude swiftlets have been determined. Finally, we have identified the sound specification to be attraction toward swiftlets without remove any sound from recording sound.

The future works will focus on generate the sound based on sound characteristic have been analyzed. Prior to the generation of sound, the study of sound characteristics is also required. Also, the many types of sound characteristic must be consider to develop the sound for make it more attraction enter in swiftlets farming.

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