Investigating an Urban Noise Nuisance – *The Ranchlands' Hum*

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***Abstract*—This paper proposes a method to capture, analyze and monitor sporadic low-frequency community noises. Known world-wide, such '*Hums*' causes adverse health effects including anxiety, sleeplessness, and vibro-acoustic diseases.**

I. Introduction

Sporadic low frequency noise nuisances, known collectively as *'The Hum',* have been reported worldwide. Such noises cause adverse health effects including anxiety, sleeplessness, and vibro-acoustic diseases [1, 2]. Smith et al. [3] performed a preliminary analysis of anonymized audio recordings made by Patching Associates Acoustical Engineering Ltd. in response to community requests for assistance in solving the Calgary Ranchlands' "40 Hz" Hum. They identified several potential Hum variants, one with a possible seasonal variation, but were handicapped by the limited availability of industrial recording devices. This paper provides preliminary information on a long term plan to allow "interested" householders to compare Hum changes across time and community locations using a custom cell-phone application.

II. Objective and Methodology

Gaspard et al. [4] provided a basic open source Android cell-phone application enabling a householder to confirm the Hum's physical existence. This generic functionality overcomes concerns that the noise arises from physical health issues (tinnitus, cardiovascular, etc.) and reduces social stigma from accusations of hysteria or mental health issues. A frequency spectrum display of the average of a series of audio signals was provided to allow a simple comparison between recordings captured on different householders' phones.

Since the Hum is sporadic in nature, our goal is to generate the capability to gather noise data over a period of time in order that a more systematic and comprehensive analysis can be performed across communities [5]. This required that the run time performance of the original application be improved and permanent storage in a cell-phone based *SQLite* database be provided. This makes for an easier, more detailed single-phone comparison between Hum recordings from various community households and industrial noise sources.

The availability of multiple individual householder recordings stored within the data base allowed a tracking of changing signal content using the acoustic noise metrics suggested in [3] which offer two potential opportunities to the householder. They can capture, analyze and compare the high SNR night-time noise nuisance signals with which they are probably more familiar. This allows a reliable single-phone comparison across several days and neighborhood locations. In addition, the variety of more complex metrics provides the opportunity of continued tracking of these night-time nuisances into the day-time hours. The householder might be unaware of the presence of the day-time noises as they have a lower SNR ratio caused by masking from sound from local traffic and householder activities.

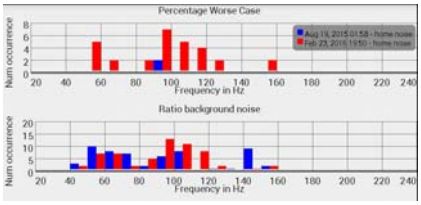

Figure1. Two sound recordings from an author's private dwelling show different characteristics when analyzed using the metrics suggested in [3]; Percentage Worse Case (high SNR noise nuisances) and Ratio background noise (low SNR noise nuisances).

III. Discussion and Future work

Two recordings from an author's household are compared in Fig. 1 using the metrics from [3]. Percentage Worse Analysis and Ratio background noise allow cross-comparison of night-time and day-time noise characteristics. A community wide study involving a phased array of sparsely located "Hum" detectors is under consideration using a secure cloud data base. However, we must first compensate for the known low frequency bandwidth limitations of a standard cell-phone before community release of the app. Industrial, wide-band, plug-in microphones exist, but are an expensive approach when multiple householder phones are used simultaneously. An alternative is to extend the application to permit calibration of individual householder cell microphones, but poor quality phone speakers make self-calibration unreliable.

IV. References

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