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Ambient Noise Analysis on Sound For Use in Wireless Digital Transmission

Kuruvilla Mathew
School of Computing
Swinburne University of Technology
Kuching, Malaysia
kmathew@swinburne.edu.my

Biju Issac
School of Computing
Teesside University
Middlesbrough, UK
b.issac@tees.ac.uk

Tan Chong Eng
Faculty of CS and IT
University Malaysia Sarawak
Kuching, Malaysia
cetan@ieee.org

***Abstract*—Ambient noise is present everywhere in varying degrees of frequencies and amplitudes. This paper tries to analyse the ambient noises in various environments ranging from quiet room to busy public places to remote jungle type locations in order to study the impact of noise while using sound as a low frequency wireless carrier for digital data. We try to find the suitable frequency band for text transmission using soundby identifyingthe sound spectrum band least susceptible to ambient noise and do some test communication.**

Keywords—noise analysis;ambient sound noise; digital transmission, wireless, data communication

I. INTRODUCTION

In response to the need for lower power wireless network signals, a proposal to evaluate use of sound as a network signal carrier was examined and we were able to successfully complete short rage communication between low powered smart devices using sound signals as the data carrier. However, even as the ubiquitous nature of sound makes it an adequate candidate for use as carrier signals, the same nature also presents a good amount of "noise", in the form of ambient sounds present in various environments. This is a challenge with potential to become a strong obstacle in using sound as the wireless carrier signal in real life practical scenarios. This paper attempts to analyse the ambient noise conditions in different environments ranging from quiet office room, busy street, quiet streets (in-roads), busy shopping malls, market place, normal household, quiet jungle terrains, etc. It will first evaluate the possible effect of such noise over normal data communication and try to find a suitable frequency band for text transmission using sound by identifying the spectrum band least susceptible to ambient noise.

II. RELATED WORKS

Mathew and Issac proposed making use of sound as carrier for low bandwidth, low power communication in the ubiquitous paradigm [1]. The paper attempted ubiquitous data communication using existing hardware in smart devices and sound as the carrier signal. Successful data transfer was achieved as a proof of concept and future work on furthering this towards practical application was suggested. M Weiser, proposed in 1991 pervasive computing as technologies which disappear as they ubiquitously blend into everyday life so that they are indistinguishable [2]. The concepts called tabs, pads and boards were introduced, and also opened up the networking challenge the nature of the devices will present.

Madhavapeddy, Scott, and Tse worked on audio networking which was a forgotten technology [3]. Theysuccessfully sent and received data and over sound using common computing platforms to do high frequency (ultrasonic) communication.

Chen and Leesubmitted a bibliographic study on Ubiquitous Computing looking at inter-relationships among major research themes in ubiquitous [4].

Jurdak, Lopes and Baldi proposed an acoustic identification scheme for location systems [5] which uses acoustic signals to uniquely identify and locate a user.

Madhavapeddy, Scott, and Sharp presented context aware computing with sound [6]. A number of location aware applications, namely, pickup and drop interface, digital attachments in voice, etc. were analysed.

Mandalet.et al. presented indoor positioning with 3D multilateration algorithms using audible sound [7]. It gave accuracy levels of about 2 feet in about 97% times using cheap consumer use hardware.

III. SOUND – THE NOISY SIGNAL

Close range transmission of data using sound as the carrier signal was tested to be possible in the real life scenario [1] and the transmission was accomplished using the Android smart devices with their standard built-in microphones and speakers.

Sound is a good choice in an attempt to identify a ubiquitous wireless signal, because of its low frequency, ubiquitous presence and low power requirements. The fact that sound is a ubiquitous signal also brings with it a challenge, that is, the good amount of sound present in most environments, which translates as noise when attempting data transfer. The challenge is to ensure successful data transmission even when noise is present.

The noise profiles in various environments are also expected to be different, which is analysed in this paper. We collected sound samples, from the Free Sounds website [9] from various environments including quite office, home, shopping mall, market, roadside, etc. and did a comparative