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Survey Paper on Private Audio Wave Technology

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Abstract: The purpose of this technology to design a system that would actively direct audio in desired directions and locations. Private audio wave is a technology that produces focused beams of sound similar to light beams coming out of a flashlight. It is very useful in security. By shining sound to one location, sound projected toward the required listeners. And another nearby listener unable to hear it. It uses a combination of non-linear acoustics and some fancy mathematics. But it is real and is fine to knock the socks of any conventional loud speaker. This acoustic device minimizes a speaker that fires inaudible ultrasound pulses with very small wavelength which act in a manner very similar to that of a narrow column. The ultra sound beam acts as an airborne speaker and as the beam moves through the air gradual distortion takes place in a predictable way due to the property of non-linearity of air. The targeted or directed audio technology is going to a huge commercial market in entertainment and consumer electronics and technology developers are scrambling to tap in to the market. Being the most recent and dramatic change in the way we perceive sound since the invention of coil loud speaker, Private audio wave technology can do many miracles in various fields like Private messaging system, Home theatre audio system, Navy and military applications, museum displays, ventriloquist systems etc.

Keywords: Acoustics, Airborne, Transducer, Hyper Sonic Sound, Ventriloquist.

INTRODUCTION

Private audio wave uses a beam of ultrasound as a "virtual acoustic source", enabling control of sound distribution. It is a narrow beam of sound that can be controlled with similar precision to light from a spotlight. This gives rise to audible components that can be accurately predicted and precisely controlled. The ultrasound modulation system simply does that, it modulates a carrier wave that operates in the ultrasound frequency range with the desired audio signal. By doing this, the system takes advantage of the non-linearity of air at those Frequencies thereby causing demodulation of the desired signal for hearing.

GOAL AND NEED

GOAL**:** With every going day the need to provide private and secured data in communication. And also have to make life personal without disturbing others life, for this purpose this system is introduces private transmission audio or sound.

NEED**:** To develop a Private audio wave there is needed modulation to convert source signal into ultrasonic signal. Modulation is used for this purpose. Also to reduce distortion without loss of efficiency, there is needed some correction. Modulation index reduce this distortion.

LITERATURE SURVEY

Observation of the Existing System:

This technology was originally developed by the US Navy and Soviet Navy for underwater sonar in the mid-1960s. In 1975, the first publication appeared which demonstrated that these nonlinear effects indeed occur in air. While these researchers had not attempted to reproduce audio, also they nonetheless proved that such a device can be possible. The technology was briefly investigated by Japanese researchers in the early 1980s, but these efforts were abandoned due to extremely poor sound quality (high distortion) and substantial system cost. These problems went unsolved until a paper published by Dr. F. Joseph Pompeii of the Massachusetts Institute of Technology in 1998 fully described a working device that reduced audible distortion essentially to that of a traditional loudspeaker. Due to this we can say that the Private audio wave technology will cover this entire disadvantage.

The existing System is very inefficient and not provides proper communication.

THE PROPOSED SYSTEM

The present system has obvious problems, and not advance hence need to overcome that entire problem so, we developed a technology that will overcome this entire disadvantage and provide some addition facility and also go for addition feature.

Advantages

1. Thin and flat ultrasonic emitter devices not require a mounting cabinet.
2. You can focus sound only at the place of desired target.
3. The focused or directed sound travels much faster in a straight line than conventional loudspeakers.

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4. Dispersion can be controlled – very narrow or wider to cover more listening area.
5. We able reduce or eliminate the feedback from microphones.
6. Low cost maintenance required as compared to conventional
7. Loud speakers and have longer life span.
8. Requires only equal power as required for normal speakers.
9. While reproducing the sound there is no lag.

Disadvantage
1. Lack of mass production. i.e., each unit must be handmade.
2. The most common form of distortion is clipping

DESIGN PHASE

Normal human voice or music is applied into a Private audio wave emitter device which is original low frequency sound wave. This low frequency signal is frequency modulated with ultrasonic frequencies ranging from 21 kHz to 28 kHz. The result of the modulator will be the modulated form of normal human voice or music sound wave. Since ultrasonic frequency is used the wavelength of the combined signal will be in the order of few millimetres. Since the wavelength is smaller the beam angle will be around 3 degree, as a result the sound beam will be an audio one with a small dispersion.

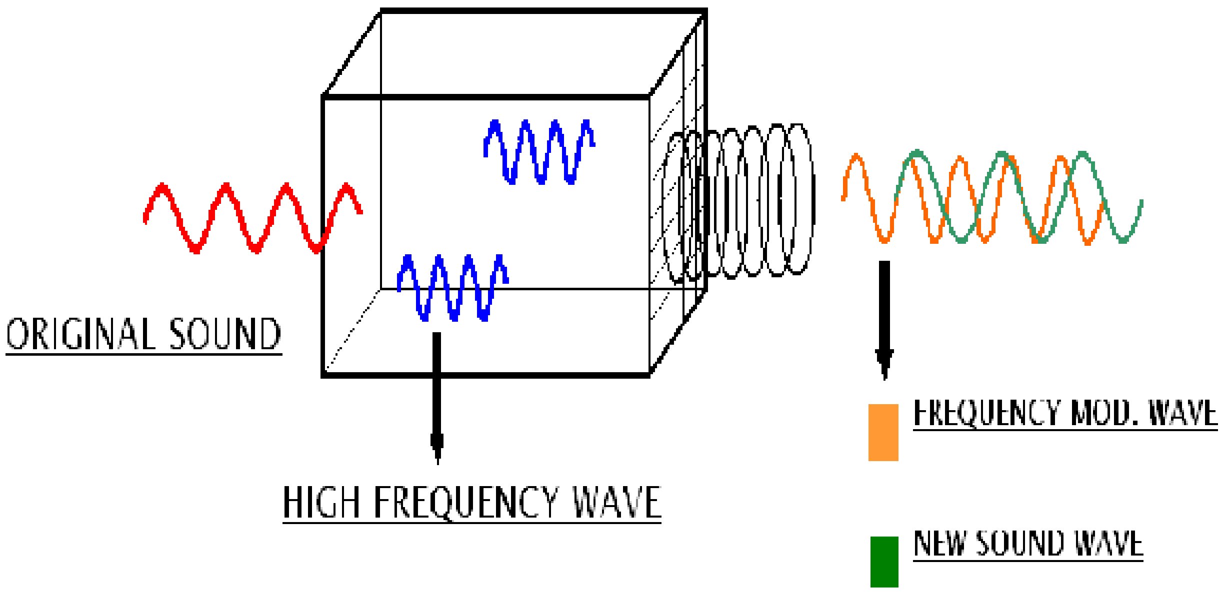

Fig 1: Audio spotlighting emitter

DIRECTIVITY:

While the frequency modulated signal propagate in the air, slightly change in the sound wave due to nonlinearity property of air. If there is a change in a sound wave, different new sounds are formed within the wave.

Therefore if we know how the air affects and change the sound waves, we can predict exactly what new frequencies (sounds) will be added into the sound wave by the air itself.

The new sound signal generated within the ultrasonic sound wave will be corresponding to the original information signal with a frequency in the range of 20 Hz to 20 kHz will be produced within the ultrasonic sound wave. Since we cannot hear the ultrasonic sound wave we only hear the new sounds that are created by non – linear action of the air.

Thus in a Private audio wave there are no actual speakers that produces the sound but the ultrasonic envelope acts as the airborne speaker.

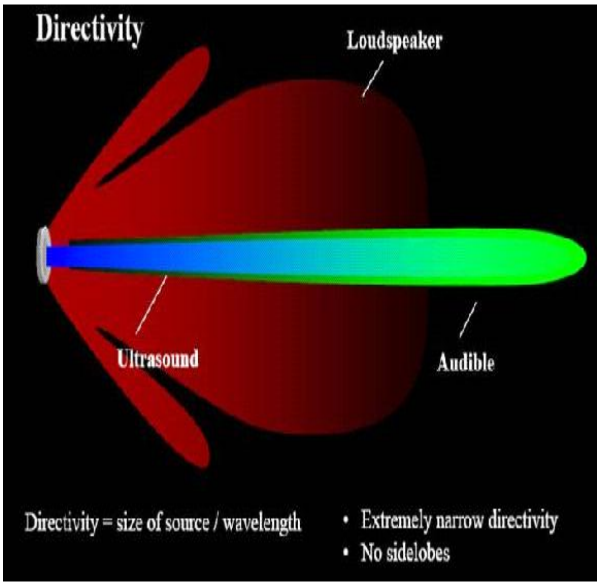

Fig 2: Directivity

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BLOCK DIAGRAM COMPONENTS:

a) Power Supply.
b) Frequency oscillator.
c) Modulator.
d) Audio signal processor.
e) Microcontroller.
f) Ultrasonic amplifier.
g) Transducer.

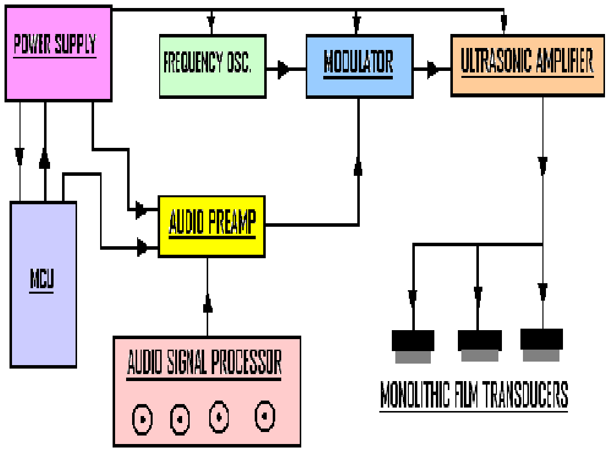

Fig3: Block diagram of a Private audio wave system

a. Power Supply: The Private audio wave system works off DC voltage, like all electronic systems. Ultrasonic amplifier requires 48V DC supply for its working and low voltage for microcontroller unit and other process management.
b. Frequency oscillator: The frequency oscillator generates ultrasonic frequency signals in the range of (21,000 Hz to 28,000 Hz) which is required for the modulation of information signals.
c. Modulator: In order to convert the source signal material into ultrasonic signal a modulation scheme is required which is achieved through a modulator. In addition, error correction is needed. By using a DSB modulator the modulation index can be reduced to decrease distortion.
d. Audio signal processor: The audio signal is sent to electronic signal processor circuit where equalization and distortion control are performed in order to produce a good quality sound signal.
e. Microcontroller: A dedicated microcontroller circuit takes care of the functional management of the system. In the future version, it is expected that the whole process like functional management, signal processing, double side band modulation and even switch mode power supply would be effectively taken care of by a single embedded IC.
f. Ultrasonic Amplifier: High – efficiency ultrasonic power amplifiers amplifies the frequency modulated wave in order to match the impedance of the integrated transducers. So that the output of the emitter will be more powerful and can cover more distance.
g. Transducer: It is 1.27 cm thick and 17” in diameter. It is capable of producing audibility up to 200 meters with better clarity of sound. It has the ability of real time sound reproduction with zero lag. It can be wall, overhead or flush mounted. These transducers are arranged in form of an array called parametric array in order to propagate the ultrasonic signals from the emitter and thereby to exploit the nonlinearity property of air.

TESTING AND DATA

The different tests employed for this project included sound inspection as well as measurements taken with a standard microphone and oscilloscope. Although the sound inspection method is not necessarily objective, it served its purpose with the applications in mind. To test the audio equipment, an oscilloscope was used in conjunction with a microphone.

Initially, all the outputs of the Private audio wave were tested to make sure there was no phase delay between output channels; this was confirmed. Next, the output of each channel was measured against the Private audio wave output to measure the delay across the audio equipment. These measurements were taken directly off of the oscilloscope and no attempt was made find correlations based on frequency to find an overall delay figure because that is unnecessary. The purpose here is to confirm that at given frequencies, there is a relatively uniform delay for each channel.

RESULT AND DISCUSSION

What makes a sound source directional?

The inherent directivity (narrowness) of all wave producing sources depends on little more than the size of the source, compared to the wavelengths it generates. Audible sound has wavelengths ranging from a few inches to several feet, and because these wavelengths are comparable to the size of most loudspeakers, sound generally propagates omnidirectionally. Only by creating a sound source much larger than the wavelengths it produces can a narrow beam be created. In the past, loudspeaker manufacturers have created large speaker panels or used reflective domes to provide some directivity but, due to the sound's large wavelengths, the directivity of these devices is still extremely weak.

Sound is literally made from thin air.

Note that the source of sound is not the physical device you see, but the invisible beam of ultrasound, which can be many meters long. This new sound source, while invisible, is very large compared to the audio wavelengths it's generating. So the resulting audio is now extremely directional, just like a beam of light. The technique of using high-frequency waves to generate low-frequency signals was pioneered over forty years ago.

Sound Fields:

The actual measured sound fields of our commercial Audio Spotlight models are below. All measurements

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were done in an anechoic (reflection-free) room, with laboratory-grade microphones at 1 kHz.

CONCLUSION

Private audio wave is really going to make a revolution in sound transmission and the user can decide the path in which audio signal should propagate. Due to the unidirectional propagation it finds application in large number of fields. Private audio wave system is going to shape the future of sound and will serve our ears with magical experience. As sound technology matures, and more and more audio and multimedia messages and sessions are sent and logged, the testimony of sound may come to rival that of the written word. Audio windows are away of organizing and controlling sound. Handy Sound was conceived as a feasibility study, testing purely auditory presentation and purely gestural control. Deployed only brief in an expensive lab environment, only a few users had a chance to play with it (before support for the project was terminated). Maw was designed to exploit more I/O modalities, and is consequently more accessible; it is deployed in an environment, where it currently enjoys frequent demos. New media spend their early years recapitulating the modes of older media the research described by this paper hopes to abbreviate this phase for audio windows by accelerating its conceptual development. Neologisms introduced by this research include piggyback-channels, whose sonic instances employ learns to react control state, and atomic sound mixing elements.

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