Communication by Ultrasound Using Radio Modulation Techniques

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There are many methods to send electronic signals, including by wire, radio, light, infra-red light, and audible sound waves. However, little prior work has been done on communication via ultrasound. Ultrasound consists of sound waves of frequencies above the human audible range. Certain animal species use ultrasound for navigation and localization by echolocation. Ultrasound offers many benefits. For example, it does not use electromagnetic radio waves and therefore avoids issues with radio interference, crowding, and privacy. Yet, it shares the same ability as radio to communicate around obstacles, which infrared light cannot. In the natural environment, sources of ultrasound noise are less common than those of audio noise, and the signal-to-noise ratio can potentially be very good. This project involves the design, creation and testing of a communication system that can send and receive an information-bearing ultrasound signal, using modulation-demodulation techniques commonly used in radio. The information is converted back to the audible range for interpretation. The system is analog and utilizes standard transistor design. This is a study of the feasibility of using ultrasound to send information, including the distance and signal fidelity that can be achieved. The device is able to send a variety of modulation signals, including tone, voice, music and digital. Using amplitude modulation with a carrier frequency of 25 kHz, with 100% modulation using voice information, 2W peak envelope power and 99 dB SPL peak sound level, the system was able to send a signal 61 meters line-of-sight. Further, it was able to send a digital signal with 0.2W peak envelope power and a baud rate of 1000 over 11 meters. The sound fidelity is comparable to that of a handheld AM radio.

Awards Won:

Third Award of $1,000