

# Data Transmission for Proximity Devices Using Ultrasonic Sound Waves

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**Abstract** - A range of information transfer using ultrasound by encrypting IoT applications in which sender and receiver are physically co-located by socket interface. The intention is to transfer text commands by interacting with mobile devices. Nowadays, user needs more secure information to be transferred which is a case sensitive. To enhance this situation, our approach is use of ultrasound high frequency waves based on the frequency of connected devices. Our aim is to provide user authentication, confidentiality, commercial application, sound generation, sound customization and device control based on proximity network.

**Key Words:** ultrasound, proximity, socket interface, text commands, High frequency.

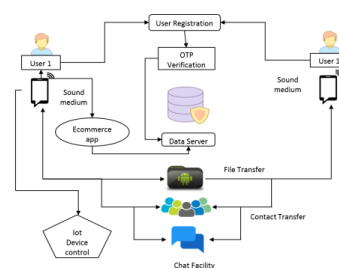
## I. INTRODUCTION

Ultrasound may be used for short-range wireless communication i.e., such as text commands, online shopping and banking purpose. Ultrasonic transmissions are unregulated and interference free to most electronic devices. Ultrasonic signals provide good privacy and increases network security of the environment. Users now expect a simple and easy way of exchanging small pieces of information between these devices. A key application which is a sharing information with a friend or colleague. The information transmitted in these scenarios may be considered sensitive; while one user may be willing to tell another their phone number, they may not want random third parties to overhear it. To support this, we propose the use of high frequency sound (ultrasound) transmitted and received using low quality speakers and microphones like those commonly found on modern smart phones. Our project work mainly concentrates on data transfer and reduces proximity networking problems.

## II. MODULATION SCHEME

The idea of a multi-carrier system is to use many carrier waves over different frequency channels within the available bandwidth instead of only one, and using each carrier wave for part of the message. In a traditional frequency division multiplexing system, the sub-channels are non-orthogonal and separated by guard bands to prevent inter-channel interference, resulting low spectral efficiency. The orthogonal frequency division multiplexing scheme overlaps individual carriers, yet ensures the carriers are orthogonal. This method can significantly improve bandwidth efficiency. In the spectrum of a typical signal, the main lobe of each carrier lies on the nulls of the other carriers. Therefore, at each sub-carrier frequency, there is no interference introduced from any other adjacent sub-channels, and the inter-carrier guard bands are not required. To maintain the orthogonal, channels are separated at a spacing equal to the bit rate of the data message. Sub-carriers over each channel are then modulated before being added together into a single waveform. The ultrasounds can be modulated and demodulated for data transferring.

## III. EXPERIMENTAL SETUP



### A. User Authentication & Verification

During registration the user has to specify some basic details like username, mobile number, email-id etc. When they initiate the registration process, their details get uploaded to the Server successfully. To authenticate the newly registering user, the Application Server will generate an OTP and send to respective email-id of that user. So once when the user enters the OTP, they will be considered as the legitimate user and thus the authentication get completed successfully.

### B. Ecommerce web-application

We have developed an ecommerce application in-order to do a purchase and basic payment methodology. Here the user when enter into the application they can do their desired purchases and all the selected products will be added to the Cart. The user when proceed to check-out the total amount will be calculated and they will be allowed for payment procedure. In-order to precede payment the user has to register with our Bank Application. Once the user's account got generated, they can do various transactions and secure privacy can be ensured.

### C. Sound Generation & Sound Customization

From the user's mobile phone they can decide the mode of sound they are going to use in specific application. There will be various sounds listed down, the user can customize their own sound selection. After the sound customization they can be able to send data through sound waves while using each developed applications. The applications are namely a chat application, an ecommerce application, file transfer application and an IOT Device monitor application.

### D. Data Transfer and IOT Device Control

The users can monitor the device's While you go for Chat application any two registered users can do chat using sound medium from their mobile device through our application. For doing contact transfer the selected contact will be sent through sound to the receiver's application. Likewise while users are in a scheduled

corporate meeting they can share seminar URLs or links through sound medium using this application. In case of IOT device activity like switch ON or OFF.

## IV. SYSTEM DESIGN

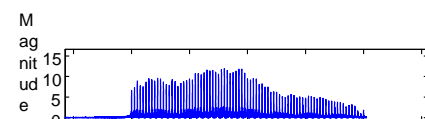
Our ultrasound software used for both transmitting and receiving the text commands. To provide flexible implementations, our project concentrates and makes available as a java library for android, which exports socket classes that can be used for both transmitting and receiving data and text commands. our project uses hardware and software that can use ultrasound for transferring data commands. The system design provides data transfer depends on the frequency of mobile devices. The system enhances the audible sound of data to the limited extend and effectively achieve the data rate based on certain factors of frequency response of ultrasound. System design is flexible, easy to achieve efficient data transferring of text commands.

## V. CHALLENGES

Our project work has faced several technical challenges. First, we aim to transmit data while remaining inaudible. Second, we face poor frequency response in the ultrasonic spectrum. Third, the sample rate is limited and not always consistent, causing various accuracy and audibility problems. Finally, we face synchronization issues between the sender and receiver. Both sender and receiver faced the frequency responses poor. Some of the examples for demonstrating frequency response where two cells frequency were compared as follows,

FIG: FREQUENCY RESPONSES OF TYPICAL CELLS

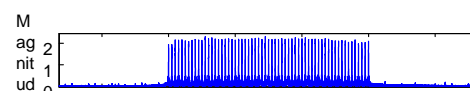
a) cell A



X Axis - frequency

Y Axis - Magnitude

b) cell B



The frequency responses is poor in system implementation. The frequency response of cell phone speakers and microphones is highly volatile. The physical size and price of cell phones limits their speaker and microphone quality and as a result, audio signals are heavily distorted. This is compounded by the non-linear interaction between frequencies when many are present simultaneously. The frequencies can vary according to the connected devices and data transfer rate will vary .our work proved that smart phones produce lower frequency sounds with great energy and more uniformly compared with high frequency sounds. The most tremendous challenge is achieving the effective data rate using ultrasound.

## VI. APPLICATION SCENARIOS

Our ultrasound software has been implemented and tested on commodity smart phones. However, we intend for our approach to be implemented on other IOT devices in a wide variety of scenarios. For example when giving a presentation; connecting the presenter's laptop to the projector in the room is often error-prone and generally frustrating requiring special physical connectors and specific configurations of both the display / projector and the user's computer .The slides can be projected, and the smart phone can then double as a presentation "clicker" to advance the slides using the same ultrasound technology. A second application scenario is the increasingly common consumer-oriented smart light-bulb. Typically these devices are "always-on" Wifi enabled, requiring the user to have access to a properly configured WiFi network. Final application is ultrasound software can be used for commodity purpose.

## VII. RESULTS

As a results, our project work achieved an effective data transfer rate within connected devices. The frequency response is modulated in our project work to minimize the noise we use ultrasound as a medium for data transferring .our work has achieved for secure authentication and verification for the users. Our work achieved harmless data transferring using ultrasound and it is audible to human limits .The work enhances

the frequency response of the ultrasound. Finally, effective text commands can be transferred without any wire connectivity.

## VIII. CONCLUSION

In this paper we present "ULTRASOUND" software, which utilizes very high frequency sound to send data between commodity smart mobile devices. It modulates ultrasound in a way that is fast, low error, and practically unnoticeable by users. The data which can be send via ultrasound software kit that achieves effective transmission of data. Based on the frequency we can extend the data rate to various scenarios.

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