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Smart mobile devices using ultrasound proximity networking model in IoT applications

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ABSTRACT

For sending a small amount of data such as URLs, IoT commands or encryption key are extremely common in IoT applications. Smartphones are used to transfer text commands to interact with IoT devices. This application uses ultrasound as a means of data transmission for proximity networking on commodity, consumer hardware. This application closely examines different modulation or demodulation schemes that are inaudible to humans and achieve a high data transfer rate. This application is designed a library to run well on low- powered devices, and provide a socket-like interface for easy deployment. This helps protect users from various attacks improving the security of our system.

Keywords—*Modems, Smart devices, Transceivers, Filters, Device-to-device computing, Internet of Things, Acoustics*

1. INTRODUCTION

In the modern world, the smart mobiles and Internet Of Things have become ubiquitous and has steady growth. The information which is transmitted nowadays, are considered to be sensitive. Users now expect a simple and easy way for exchanging pieces of information between their devices. The smartphones use ultrasound high-frequency waves which used to transfer a large amount of information and to communicate with IoT devices. The quality speakers and microphones which are present in smart mobiles are used to transmit and receive the information which is transmitted. The user only needed to install the application in their mobile phones Because of this it is low cost with quick access, non-intrusive, do not require special hardware and high directional with rapid air and high security.

1.1 Before you begin

Install an Android Environment which is needed and Tomcat server can be done by installing Android Studio or any other software for implementing the android application.

2. USER REGISTRATION AND OTP VERIFICATION

When a new user needs to use our application they have to register with our Application Server. 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 a One Time Password and send to respective email-id of that user. So once when the user enters the One Time Password, they will be considered as the legitimate user and thus the authentication gets completed successfully.

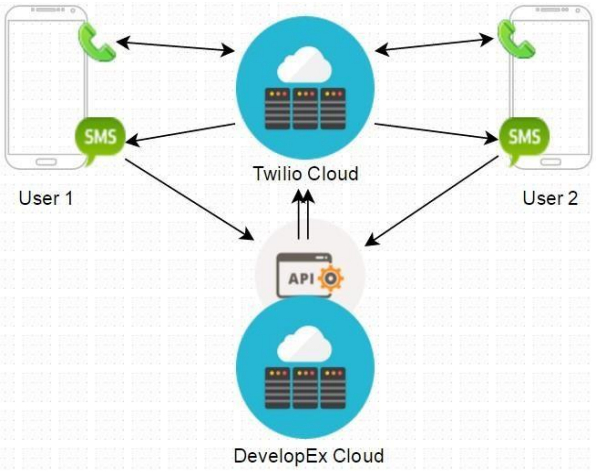

Fig. 1: User registration and OTP verification

3. E-COMMERCE WEB APPLICATION

We have developed an e-commerce application in order to do purchase and basic payment methodology. Here the user when entering into the application they can do their desired purchases and all the selected products will be added to the Cart. The user when proceeding to check-out the total amount will be

calculated and they will be allowed for payment procedure. In order to proceed payment, the user has to register with our Bank Application. Once the user's account got generated, they can do various transactions.

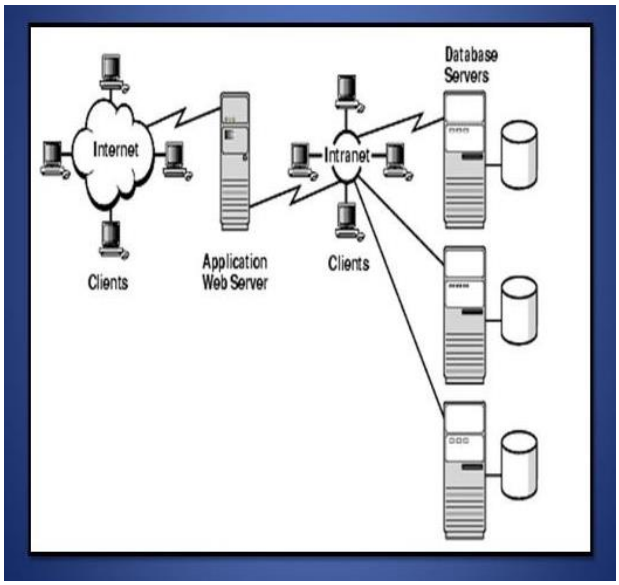

Fig. 2: Web based E-commerce architecture

4. SOUND GENERATION AND CUSTOMIZATION

When the user wishes to perform any action they generate sound signals from the user's mobile phone they can decide the mode of sound they are going to use in the specific application. There will be various sounds listed down; the user can customize their own sound selection. The sound signals which are generated are audible and tolerable 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 e-commerce application, file transfer application and an IoT Device monitor application.

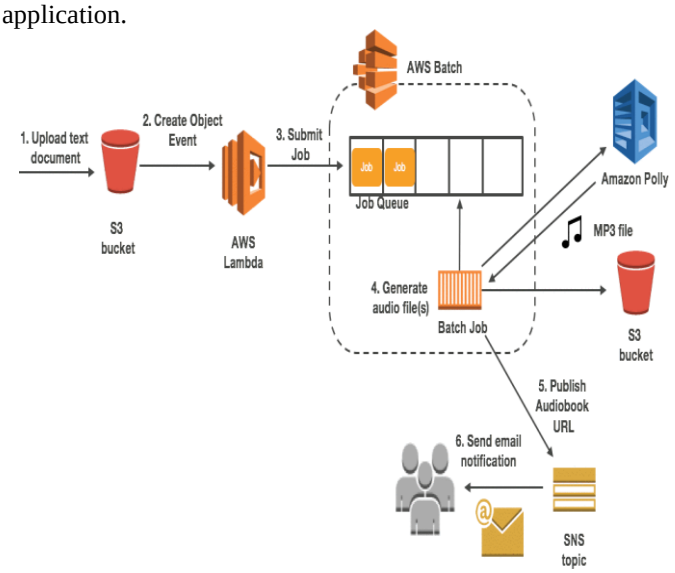

Fig. 3: Sound generation and customization

5. DATA TRANSFER AND IOT DEVICE CONTROL

We will be using our applications to do data transfer in various scenarios. 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 url's or links through a sound medium using this application. In the case of IoT device control, the users can monitor the device's activity like switch ON or OFF. Thus we have done a multiple scenario-based application for doing data transfer using the ultra-sound medium.

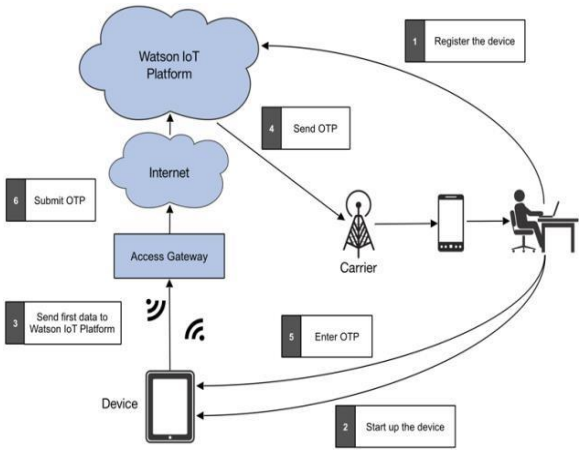

Fig. 4: Data transfer and IoT device control

6. SIGNAL GENERATION

For data to be transmitted it must be encoded as a sound signal. We designed in such a way that the user can generate a linear combination. The amplitude and phase of each wave are modulated according to the data been transmitted. The receiver can scan the data which is received and the cross-correlation can be calculated between the received signal and the known signal. When the cross-correlation is high, the receiver knows it's found a correct packet.

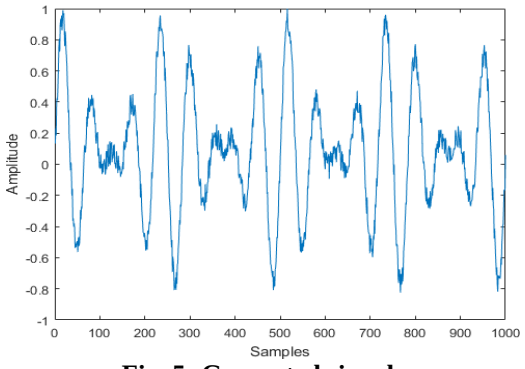

Fig. 5: Generated signals

7. SIGNAL DECODING

The sound signals are accepted continuously by the microphone, at the receiver side. The presence of a packet in the signal must be determined by the receiver before attempting to decode the packet. The root-mean-square value is computed for 100 samples using highly designed high pass filter. If the RMS value is above the chosen threshold value it will attempt to decode the packet. In smartphones, this method is effective and fast to process and execute even 100 samples at a time. The few false positives or negatives can be found by this method. If a packet is found, the audio is treated as packet data instead of advancing the window.

8. ULTRASOUND DATA TRANSFERRING

Our system enables secure data transfer using ultrasounds. The instructions to control all the IoT devices through ultrasound secure communication. Our application is mainly used to send some commands to perform the desired action. For example: to switch ON and OFF the IOT appliances, to send some contact details to another neighbour. For sharing URL to any user in case of QR codes we can transmit using ultrasound. In case of online door delivery system, there should be tokens generated

for each end customer. The delivery man can check the token with the customer by using Ultrasound data transferring application. Thus in various scenarios, our application can send data or commands securely.

9. ARCHITECTURE DIAGRAM

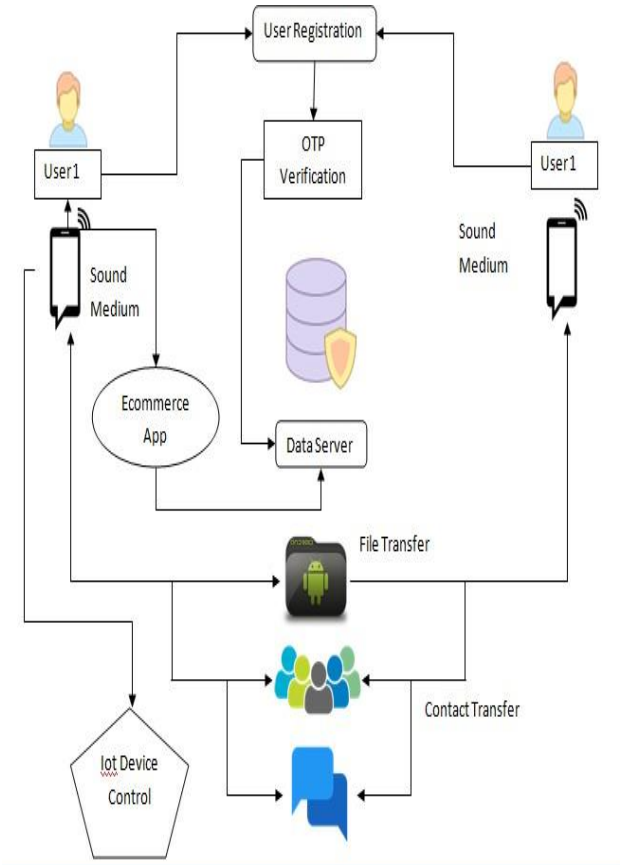

Fig. 6: Architecture diagram

10. TECHNOLOGY USED

- JSP Servlet
- Android

11. SYSTEM CONFIGURATION

11.1 Hardware Configuration

- Hard Disk: 20GB
- RAM: 4GB
- Processor: Pentium IV

11.2 Software Configuration

- Windows 7 operating system
- JDK 1.7
- Tomcat7
- My-SQL 5
- Android Studio 3.1

11.3 Android Phone Requirements

- No of Devices: 2
- Os: Jelly-Bean

12. CONCLUSION

The role of this software modem is to utilize very high-frequency sound to send data between commodity smart mobiles devices. It modulates ultrasound in a way that is fast, low error and practically unnoticed by users. It makes more difficult for attackers to masquerade by allowing the receiver to learn and recognize packets sent from the intended sender.

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