Designing Android Applications using Voice Controlled Commands

For Hands free interaction with Common Household Devices

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***Abstract*—Utilizing assistive technology to aid persons with neuromuscular disabilities, this study improves upon previously created offline voice control of household devices through an input-output peripheral interface control processor driven using an application on the Galaxy S Android smart phone. In trial, the most effective type of voice recognition software for offline communication was Pocketsphinx. This offline capability is used and tested for accuracy of several commands on a direct television remote though the exchange of Bluetooth signals between the phone (input) and transfer station(Output). The application was designed to recognize keyword commands and send signals to corresponding pins on the input-output board. The execution of a command was enabled through the interface of the smart phone with a television remote. In the laboratory, experiments were testing for accuracy taking into account distance between person and device as well as level of ambient noise and the vocalization of the subject.**

Assistive technology; smartphone; Android,;voice recognition; environmental control system

I. Introduction

The aim of this project is to use assistive technology (AT) to help persons with disabilities. Persons with quadriplegia are affected by limitations in physical function and independence [1]. A field of biomedical engineering, AT is dedicated to increasing the independence and mobility of these persons [2]. In this project, voice recognition is explored as a template upon which the independence of persons with neuromuscular disorders can be expanded. Previous studies have suggested that this provides a viable means for control of devices by persons with disabilities [3, 4]. For this reason, Android applications were developed on a smart phone to operate a television remote via Bluetooth exchange and PIC processing. Offline voice-controlled Android applications were created for accessibility to those with and without wireless fidelity and/or the use of a mobile data plan. This internet independent application uses Carnegie Mellon's PocketSphinx as the application for offline Bluetooth communication [6]. Electronics, in addition to the Bluetooth chip integration; we have harnessed a peripheral interface controller to establish control of the remote using Android application [7].

II. Materials and Methods

A. The Interface

Figure 1 provides a schematic diagram of the material set up. The Android Galaxy S Smart Phone (A), the transfer station (B), Direct Television remote (C), and Generic Television (D). The laboratory phone is a Samsung Galaxy S Android device model number (SAMSUNG-SGH-I897). The phone currently runs Android firmware 2.1.6 with a Touchwiz user interface.

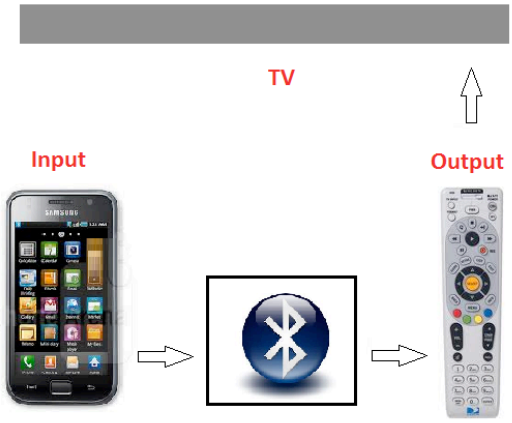

Figure 1. Android Galaxy S Smartphone (Left), Bruetooth Transfer Station (Middle), Direct TV Remote (Right), Generic Television (Top)

B. Software Development

The Android smartphone contains the application Bluetooth Chat which is used for direct communication with the Bluetooth transfer station which can be seen in figure 2. Eclipse 4.2 with the eclipse software development kit (SDK) is used as the computer programming environment for application development. This SDK provided an environment for Java programming; though the eclipse SDK can facilitate multiple computer languages. An android emulation system delivered a temporary substitute during test trials.

C. Hardware Development

The majority of the hardware components are located within the transfer station seen in figure 1 (B) and figure 2. An AC/DC power supply delivers 6 volts DC 200mA via a male power connector to a voltage regulator which supplies the entire circuit with 5 volts. The degree of shock protection is

Class I according to the standards of section 6.2 of IEC 60601-1. The hardware implements a Bluetooth modem, BlueSMiRF sliver (WRL-10269), which receives the commands from the android application software that was developed for the smart phone. The BlueSMiRF modem communicates with the PIC ® Microcontroller (PIC18f4525-I/P) via the EUSART transmit and receive pins on the microcontroller, pins 25 and 26, respectively. Each function in the android application recognizes keywords which then send a specific signal via Bluetooth connection to the microcontroller. A simple code in the microcontroller interprets the signals received from the modem and sends a corresponding signal out of one of the seven outputs of port B to the quad bilateral switches. In order to trigger specific buttons on the Direct TV remote control, reverse engineering was used by soldering wires from a ribbon cable to the specific button locations inside the remote. Each remote button has two corresponding wires, which when connected, complete the circuit and trigger the button on the remote control. The connections were completed using quad bilateral switches that are triggered by the port B output of the microcontroller. In order to prevent the switches from floating, a 1MΩ resistor was added to ground the 5 volt input.

Figure 2. Bluetooth Transfer Station Laboratory Testing

The Bluetooth chat applications ability to accurately recognize each of the five commands (Channel Up, Channel Down, Power, Volume Higher, and Volume Lower) was tested. The power command controls the television for both the on and off functions. Each command was tested individually at 1,5,10 and 15 ft. using ambient noise levels of 50,55,66,73, and 80 db. The reliability test results are located in figure 3.

III. Discussion Segment

A smartphone based speech recognition system was developed to operate a generic television remote control with simple voice commands essential to television operation. This technology was implemented into a user

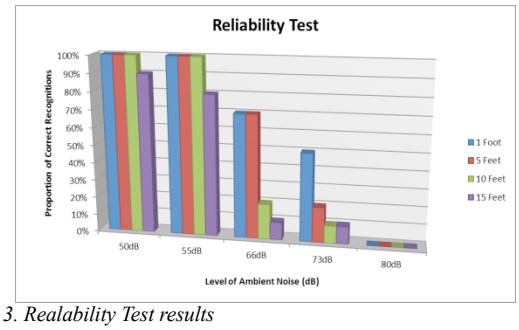

Figure 3. Realability Test results

friendly and compact device. By using an entirely offline application for voice recognition and Bluetooth data transfer the user isn't required to purchase additional monthly subscription for the use of this device. The research and development demonstrates the capability of modern day mobile phone technology and its endless applications. It also provides persons with physical disability with an increased ability to operate independently within a household environment. The laboratory testing shows that quality voice recognition and command execution can be executed at increased distances even in the presence of ambient noise. This project continues to provide a socially modern means of wireless voice control to simplify common household activities. The device also proves to potentially deliver significant application in the assistive technology fields increasing household independence for the user.

IV. References

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