BlueMsg: Hands-Free Text Messaging System (Proposal)

Wireless Communication Systems

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Abstract

This project will develop a hands-free system of communication, between a person and a phone. This system will incorporate Bluetooth technology and/or wifi system and synchronize with a regular smart phone to generate a text message without the use of fingers, enabling this activity in a car or in a mobile environment amicably. The hands-free system will be used to integrate speech to text algorithms, from concepts of digital signal processing, and wireless communications to compose a text message by command of voice; providing a option of listening to the composed message before the message is sent automatically. The completion of such a project will provide safer means of communicating in a car which will be a step beyond the production of hands-free Bluetooth for phone calls.

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1 Introduction

With the evolving of technology, we have been able to accommodate our short comings in multi tasking and prevail through hands-free systems. This system enables us to be productive and sometimes less destructive. Hands-free has allowed man to engage in a phone call without having to hold the phone up with hand, preventing hands off the wheel in a car. However, this system has not been developed enough to solve other such limitations, as composing a text message, a more lethal activity to incorporate while driving. The fruits of DSP (digital signal processing) in speech to text conversion and wireless communications can be integrated to generate this basic solution as an implementation of bluetooth hands-free technology. The success of such a system would modify such a dangerous synchronization of two tasks into a feasible and efficient possibility and carry the growth of technology beyond the recent trend of luxury to a primal necessity.

1.1 Motivation

We drove our motivation from the simple fact that cell phone usage while driving poses a great danger. According to the research at Harvard[1], 1 out of 20 car accidents are caused by cell phones. Moreover, there are a grave percentage of people who send out SMS while driving.

- Ages $18 - 24 \longrightarrow 50\%$ [2]

- Ages $25 - 34 \longrightarrow 30\%$

- Ages $35 - 44 \longrightarrow 19\%$

Recent technological advances in state-of-the-art wireless communication have harbored improved and efficient hands-free system to receive phone calls. However, these commercial hands-free systems are not self-suficient; they do not provide a solution for a hands-free text messaging.

1.2 Proposed Idea

A hands-free wireless text messaging system which will allow for the dictation of text message via voice and convert it to text for automatic transmission. It will be geared to be utilized in-car and PC (Personal Computers).

1.2.1 Wireless Communication Components

1. Bluetooth

2. Wi-Fi

Details of each of these technologies are explained later on.

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[1]CBS News: Dec 2002 http://www.cbsnew.com/stories/2002/12/02/tech/main531320.shmtl

[2]Website:Edgar Snydar & Associates Date:Sept 2008 Article name: Almost Half of Young Drivers Text While Driving http://www.edgarsnyder.com/news/auto-accident/young-drivers-text.html?ref=http%3A//www.google.com/search%3Fhl%3Den%26sa%3DX%26oi%3Dspell%26resnum%3D0%26ct%3Dresult%26cd%3D1%26q%3Daccidents+caused+by+cell+phones+edgar+snyder%26spell%3D1
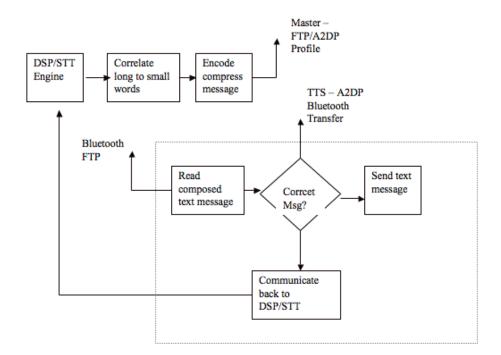
Figure 1: System Block Diagram

2 System Overview

Figure 1 has the block diagram of the entire system. User's speech will be picked up via microphone and will be processed by the signal processing block for conversion to recognizable text format. After the text conversion, data will be passed to the machine learning block, which will correlate words with some common words which are normally used in abbreviated form. Converted text message will be read back to the user for confirmation. From there on, the information will be modulated and sent via bluetooth to the cell phone device.

Cell phone will receive the information from the computer via bluetooth and will pass the information to the custom software for the transmission of the text message via service provider (SMS).

Another adaption of this system is to send wireless emails by talking into the mic using the Wi-Fi technology. Process is completely similar for this adaptation.

3 Tentative Methodologies And Technologies

3.1 DSP - Speech To Text

Speech recognition (SR) systems allow people to control a computer by speaking to it through a microphone, either entering text, or issuing commands to the computer. Early systems used discrete speech, i.e. the user had to speak one word at a time, with a short pause between words. Over the past few years most systems have used continuous speech, allowing the user to speak in a more natural way[3]. Microsoft have included their own speech recognition system within recent versions of Windows and have made the API available for programmers. Speech-to-Text(STT) synthesis is an essential part of this system as it takes the users voice and converts it to text for further processing and wireless transmission.

3.2 DSP - Text to Speech

The goal of Text-to-Speech (TTS) synthesis is to convert arbitrary input text to intelligible and natural sounding speech so as to transmit information from a machine to a person[4]. This particular technology will be used to read out the converted text for user's confirmation

3.3 Machine Learning - Word Recognition

The system will have an intelligent section where it will recognize common words which can be abbreviated such as "you" , "because" etc. There are various algorithms available to implement such a system namely neural networks, eigen space, adaboost etc

3.4 Wireless Communication - Bluetooth

Developed by engineers at Ericsson in the late 1990s, Bluetooth is an increasingly popular technology that enables short-range wireless communication between a variety of electronic devices. Its most significant feature is that it allows devices to "talk" (transfer and synchronize data) wirelessly with one another, eliminating the need for the seemingly endless tangle of cords, cables, and adapters necessary for a lot of today's technology.
Bluetooth uses a radio technology called frequency hopping spread spectrum. It chops up the data being sent and transmits chunks of it on up to 79 frequencies. In its basic mode, the modulation is Gaussian frequency-shift keying (GFSK). It can achieve a gross data rate of 1 Mb/s. Bluetooth provides a way to connect and exchange information between devices such as mobile phones, telephones, laptops, personal computers, printers, Global Positioning System (GPS) receivers, digital cameras, and video game consoles through a secure, globally unlicensed Industrial, Scientific, and Medical (ISM) 2.4 GHz short-range radio frequency bandwidth [1].
Bluetooth will serve as the communication apparatus for sending and receiving information between the processor and the cell phone device.

3.4.1 Bluetooth Profiles

A Bluetooth profile is a wireless interface specification for Bluetooth-based communication between devices. In order to use Bluetooth technology, a device must be compatible with the subset of Bluetooth profiles necessary to use the desired services[1].

There exists many bluetooth profiles but following are the ones that are in the interest of this project.

File Transfer Profile (FTP) Provides access to the file system on another device. This includes support for getting folder listings, changing to different folders, getting files, putting files and deleting files.

Advanced Audio Distribution Profile (A2DP) his profile defines how high quality audio (stereo or mono) can be streamed from one device to another over a Bluetooth connection.[1] For example, music streamed from a mobile phone to a wireless headset. This is going to be very usual in reading back the text to the user.

3.5 Wireless Communication - Wi-Fi

Short for "wireless fidelity", Wi-Fi is one of the most popular wireless communications standards on the market. In its fledgling stages, Wi-Fi technology was almost solely used to wirelessly connect laptop computers to the internet via local area networks (LANs), but thanks to the immense flexibility the technology provides, that's no longer the case. Wi-Fi technology is now found in a host of non-computer electronic devices as well, such as home theater receivers, portable gaming devices, DVD players, digital cameras, and even GPS devices.

Wi-fi will serve as a second protocol for communication between the processor and the cell phones. By using Wi-fi our system can be furthe expanded to send out emails from PC through speech and wirelessly.

4 Applicable Cellular Phones/ PDA

4.1 Smartphones

Cell phones have evolved by offering advanced capabilities beyond a typical mobile phone, often with PC-like functionality.offering advanced capabilities beyond a typical mobile phone, often with PC-like functionality. Newer Phones/PDAs also have both color screens and audio capabilities and portable media players. Many PDAs can access the Internet, intranets or extranets via Wi-Fi, or Wireless Wide-Area Networks (WWANs). Many PDAs employ touch screen technology. Examples of such devices are IPHONE, Blackberry etc.

Bluetooth Technology has become an industry standard for phones - regular and smart phones alike.

4.2 Benefits of using a smartphone

Most devices considered smartphones today use an identifiable and open operating system, often with the ability to add custom applications (e.g. for enhanced data processing, connectivity or entertainment) - in contrast to regular phones which only support sandboxed applications (like Java games). These smartphone applications may be developed by the manufacturer of the device, by the service provider or by any other third-party software developer, since the operating system is open.
Using the available feature of programming and deploying third party application, we will overlay a custom software inside the phone which will be talk to the processor and send out the text message automatically.

4.3 IPHONE/Blackberry for Demonstration

We will use iPhone or Blackberry for the demonstration purposes. These two phones provide an extensive framework for third-party programmers to develop custom applications.

4.4 What if the phone is not smart ?

Now a days almost every phone comes with a built-in java platform. Custom Application can be written in java to support these phones.

5 Cost Analysis

5.1 BlueMsg Cost

This system is mainly driven through algorithms and softwares. Necessary hardwares for communication and data processing are either built-in or readily available.

5.1.1 Development & Production Cost

- Bluetooth and Wi-Fi API $150

- License for commercial usage of Speech Algorithms $500 − $1000

We can market this as a free product but attach the Google Ads to the software where every unique usage of the software will be paid to us by google .

5.2 Custom processor for car

Six major chips used in the system total of $25.

- $8 application chip from Freelance semiconductor

  - It offers microcontroller solutions, such as the components of embedded control systems, including embedded processors, microcontrollers, embedded microprocessors, and digital signal processors that are used in automotive, consumer, industrial, and computer peripheral applications.

- $5 microcontroller chip from Freescale semiconductor

- $4.80 worth memory chips from Micron Technology

- $3.80 flash memory chip from Samsung

- $1.75 bluetooth chip from Cambridge Slicon Radio

- $1.65 audio chip from Cirrus Logic

With the cost of software licensing and hardware and assuming the markup of three to four times cost typical to the automotive electronics business, the estimated total to manufacture this system will be **$100 - $150**

6 Various other platforms and adaptations

This system can not only support SMS but emails and a variety of different applications. It can be adapted to send out wireless emails using the PC, control music on ipods, and to allow bluetooth enabled devices to be voice-activated.
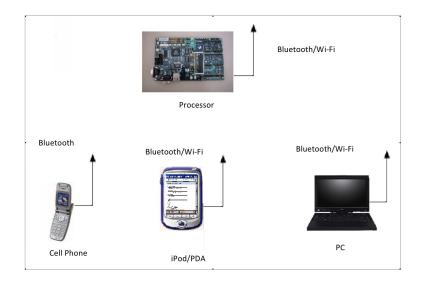

Figure 2: Various Adaptations

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[5] iSupply: Applied Market Intelligence 2008 <http://www.isupply.com>