Wireless Audio White Paper

Technology and Application for Wireless 2G data services

Author: Robert Yurkovic
Advanced Mobile Media
1999

1 Wireless Audio

Wireless audio will become a part of our lives and their applications ubiquitous. Wireless audio is targeted for the mobile person, mobile driver, and sight impaired offering “hands free, eyes free” information services using 2G mobile phones equipped with MP3 playback and download.

1.1 Industry Drivers

The idea is to make wireless use more ubiquitous by expanding the use of the terminal and associated services. Migrating existing mobile voice users, by offering additional information services using audio as a content transport medium, can do this. Using audio has many benefits such as: low cost, existing technology, easily adaptable to phones, content is available in audio formats, the use of MP3 players is on the rise and offers a high adoption rate.

Increased usage translates to an increase in the need for capacity and infrastructure. As a result, the growth rate for use and equipment increases at a higher rate. This is a key advantage for service providers and infrastructure providers. Another advantage is that as users become more dependent on the new services and those services become integrated into their professional and personal lives, they will be less likely to move to another service provider and thus reducing churn.

1.1.1 Evolution and Revolution

The next evolution for the Internet is:

- Full audio browsing as well as command and control
- Content subscription services in audio (Audible)
- Start with audio playback in 2G phones and move to streaming packet data as wireless data technology becomes available

Basic capabilities need to be:

- Audio playback, publishing, command and control
- Add storage to wireless phone and create a wireless internet appliance with data store, processing stays in the network

The revolution enables existing wireless 2G phones

The evolution expands with more bandwidth, content, and applications

1.1.2 Evolution of Audio Access

Start with bursty audio via wireless terminal. Bursty audio is defined as short segments of audio information such as a weather report, traffic report, appointments, ToDo’s, and stock report.

1.1.2.1 Updating terminals with content

A method of content updating to terminals is by docking the terminal to a PC to download the content. The mobile user would then disconnect the terminal and play the audio while mobile (Dock and Load). The user would get fresh content

updates when they returned to their PC. Updating is periodic and not in real time.

Another method is to download content via wireless to the terminal. The mobile user would be in contact all the time and could manually download or schedule automatic downloads while traveling. Updating can be accomplished in real time through a bursty download to minimize wireless online minutes. This approach also minimizes the use of docking for more frequent updating.

The last method is to send audio “on demand” to the terminal with full voice command and control functions.

1.2 Segmentation

The primary market is segmented in 3 key areas.

Mobility: The highly mobile person

- The Tourist - traffic, restaurants, activities, sites, weather
- The Commuter – traffic, news, calendar, stocks, music
- Regional Mobility – directions, store locator, local news, local weather, local events

Enterprise: The mobile corporate user

- Sales – Information delivery
- Management - Global communications

Lifestyles: Personal use

- Entertainment – Music, books, magazines, news, horoscopes
- Education – languages, knowledge, self improvement, distance learning

1.3 Urgency

- Infrastructure vendors need to jump into the game to stimulate growth
- Some vendors will appear to be behind other competitors if they do not have an offer
- Some vendors are offering complete solutions (products and services) and targeting new markets, i.e.; Latin America
- The technology is available now; the opportunity is high in chaotic environment
- The market window is already open; mobile users are requesting it
- Europe and Japan are in the lead for consumers
- Since time is of essence, use what is available for speed to market

1.4 Alliances

Alliances are imperative for this effort to work. Forming alliances also stimulates the economy and the use of mobile services. To tap into the enterprise market, relationships must be formed with existing players in those markets. Alliances need to be created with:

- Terminal vendors – for DataStore and mobile devices
- Engine developers – for speech processing and control functions

- Content aggregators – to feed the applications and services
- Advertisers
- ASPs – to develop unique mobile service applications
- ISVs and Wireless and Portal Service Providers to offer the complete solution

1.4.1 Alliance value pass through

- Revenue potential for provider in taking a percentage of content revenue
- Engines tested with other applications (e.g. Real Networks, Windows Media) and marketed with brand association
- Enable Content Providers to go wireless providing the technology bridge
- Align with key content providers to enter wireless market quicker and increase time to market for WSP services.
- Revenue generation for WSPs: increased services and usage increasing ARPU
- Brand association to promote providers in this market

1.4.2 Alliances in Advertising

The Just In Time (JIT) advertising model is based on:

- Time
- Space
- User preferences

Upon knowing the location of a person in space-time and their preferences provides adequate information to deliver highly targeted advertisements to users that are value added and welcomed. These advertisements are treated as instant coupons for just being in the right place at the right time.

The model to make this work can be described in the following steps:

- Locate the user in space-time
- Align services and offers to the user's preferences
- Communicate the service, advertisement, or offer
- The targeted advertisement to a defined user has the following: 1) the time (valid period) to buy, 2) location (store) to buy, and 3) what (products) to buy
- Validation code sent to terminal

An example is an offer made by Blimpie sandwich shops to stimulate sales and is sent by the WSP. It is 11:45am on a Monday and you are traveling in your car within a 4-mile radius of a Blimpie. Since it is about time for lunch, you receive a promotion on your mobile terminal for a 15% off coupon if you go to the Blimpie on 105 Main Street (1 mile away) today. You arrive at the Blimpie and provide them with your validation code and receive 15% off on your order.

1.4.2.1 JIT Advertising Scenario

- Commuter drives home and is within 5 miles of a Blockbuster video store.
- Commuter has an account with Blockbuster (owns a swipe card).
- Application knows time – so commuter is driving home.
- Application knows proximity to store.
- Application knows store inventory.

- Application knows commuter's preferences.
- Application creates a real time offer.
- Application calls commuter and communicates offer. If you come to blockbuster in the next 30 minutes, will give give you a 40% discount on xxx movie.

This is a way to bring in customers that are close, push inventory, and satisfy and build loyal customers

2 Service Models and Application

Subscription based audio information services are comprised of:

- Wireless: voice browse and request on the fly and/or push
- Dock and load: Build preferences on web and access via auxiliary unit (MP3 player) or web browser

Some issues are free versus paid subscription and how to deal with integrated applications and services.

Types of content:

- General information (news, traffic, stocks, weather)
- General reference (books, language training, navigation)
- Personal applications (calendar, action items, address book, messaging)
- Marketplace (buy it, reservations)

2.1 Target Audiences and applications

Personalized Mobile Radio: Entertainment, commuting

Corporate communications: Mobile employees, sales support

Education: Distance learning

Sight impaired: Internet content and applications access through audio interface

Figure 1 - Service Segments

2.2 Ultimate service

The ultimate service is a combination of application data and information. Application data can be acquired from calendar, task, transaction and reservation applications. Information can be acquired from Internet sources such as news, weather, and traffic.

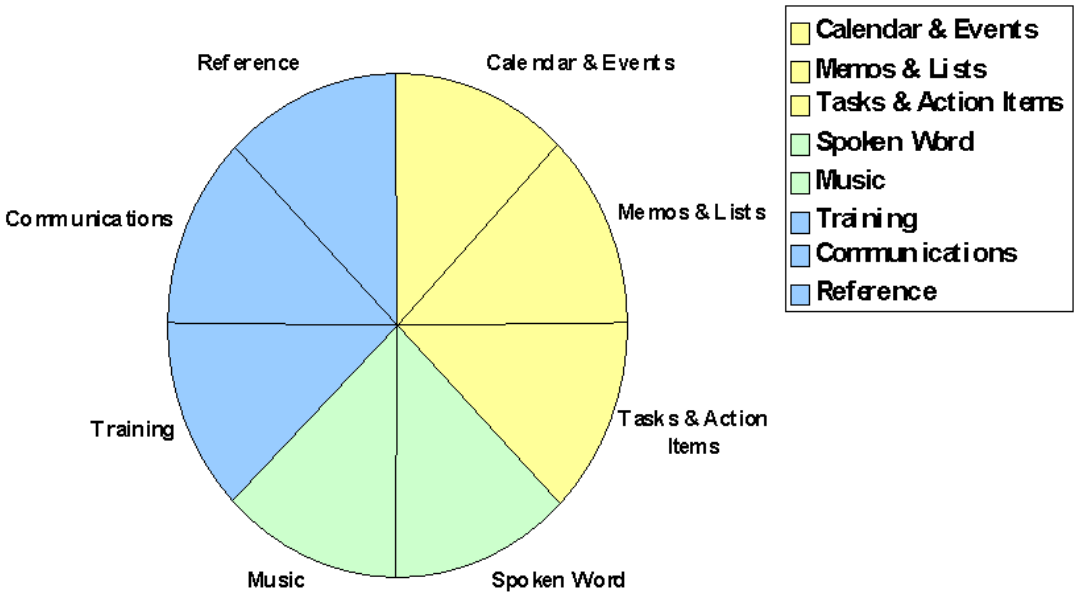

Figure 2 - Content with Integrated Applications

Legend:

- Yellow = Integrated Apps
- Green = Pre-published Content
- Blue = Self Published Content

2.3 Service derived from infrastructure vendor's products

Wireless service providers (WSP) are looking at the value of the engine that is packaged with applications and supported by content providers. This allows the WSPs to enter into the content delivery market thus retaining their user base and enhancing existing user services.

A valuable service to users should have all the pieces integrated to enhance the user experience making navigation and execution easy and fast.

An infrastructure provider integrates all the pieces for the WSPs as WSPs integrates all the service pieces for the mobile users. An infrastructure provider could provide the complete service to the WSPs getting them into the highly profitable services market.

The Service is: (1) produced content + (2) self pub content + (3) integrated apps

2.4 Applications Based on Possible Services

2.4.1 Time Based Applications

- Events notification
- Posting time based events from community, business, programs, family, and personal
- Time planning
- Scheduling events and action items to personal calendar
- Reservations
- Schedule resources to time segments
- Reminders
- Daily or JIT notifications
- Multiple calendar coordination
- Aggregating time based events based on groupings or shared views

2.4.2 Communications Based Applications

- Present mode using TTS offering usable services on 2G phones
- Application Types
- Message board
- Multiple people sharing on common topics
- Broadcasting radio
- Multiple people listening to one source
- Corporate radio
- Multiple people listening to employee communications for guidance
- Products for sales, programs and process for operations
- Learning radio
- Enhance your skills and knowledge base while mobile and in idle
- Personal notification
- Tie to calendar application

2.5 Content Segments

Location (space)

- Regional news and information
- Weather
- Traffic
- Local events

Personal Assistant (time)

- Calendar app
- Memos, reminders

Business

- Training

- Industry news
- Financial
- Corporate communications
- Programs and processes
- Product updates

Lifestyles

- Entertainment
- Music
- Books
- Personal interest

3 Technology

3.1 Space-Time Concept

The service demonstrates the space-time web portal concept (patent pending) that provides navigation assistance and automated information delivery for users as they move through time and space. An integrated management application set (patent pending), which displays a calendar view or time view portal for a series of time based applications such as event scheduling, memos with reminders, and task management. A navigation application may integrate mapping information and location-based information using geographic maps as the navigation interface.

Getting content to the user at the right time and the right space is key to automated information navigation. People move in time and space and their needs for information is directly tied to both. By categorizing content and information in applications in terms of space (location) and time (calendar), we can place significant information at the hands of users with out them navigating to find it. This adds the concept of “hands free” to information navigation as well as to the use and operation of a wireless phone in an automobile. Hands free means safer driving and faster access to what a person needs.

3.2 Why Audio Now

The AudioRunner concept started to provide a way for existing wireless phone users to enjoy the information revolution sparked by the Internet. Since data rates on existing platforms are mostly at 14.4Kbs and under, streaming packets of audio and large data downloads would take longer than a user would want to wait. By redefining data as audio playback, we convert digital text based content to audio and playback the stream of audio or concatenated audio nuggets to a user on a standard wireless phone.

3.3 2G evolution scenario for audio

The present time (1999) has limitations

- Voice is available
- Low bandwidth data via wireless

Why dock and load?

- Market stimulation: ride the MP3 market craze

- Inexpensive and high quality audio
- Need it now: sticky applications can retain users
- Gradually increasing wireless usage through enhanced and new services

Challenges

- Two devices instead of one: phone and MP3 player
- How to integrate (connect) into car systems

Future

- As costs for usage/minute drop, move to wireless downloads with MP3 player docked to wireless terminal
- As packet switch becomes available and usage costs are based on service subscription, move to wireless for live and on demand information - advanced terminals are also available

3.3.1 Why use a MP3 player

- Introduce concept of DataStore. It is readily available to store MP3 audio files.
- Since bandwidth is low at present, use audio store device to compensate using docked audio delivery to user with integrated bursty information delivery via wireless
- Stores high quality audio for quality playback (music)
- Eliminates real time drops (pauses in user attention)
- Playback control
- Speed to market

3.4 Audio Stream Layout

The personalized audio stream is a collection of concatenated audio nuggets organized by a queue. The stream header begins the audio stream to the user. The stream is personalized with the TTS (text to speech) name ID nugget. Each information nugget begins with an identifying musical header which may be selected by the user. The user can choose a sound file or 3 sec music type header (jazz, rock, classical, etc.) based on preferences. The unique sound header identifies the information to be played to when a certain type sound is played, it can always identify that weather will be played next.

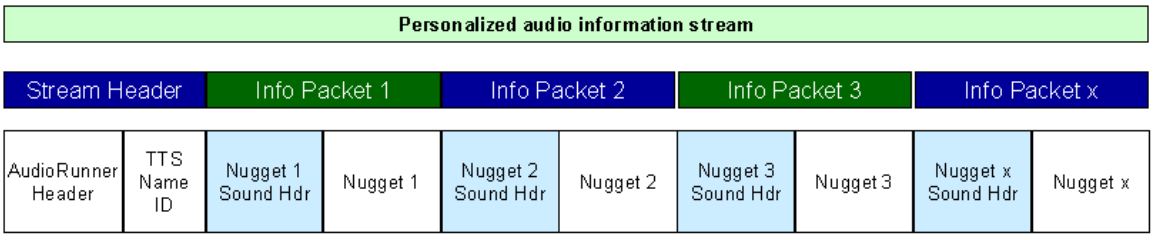

Figure 3 - Audio Stream Structure

3.5 AUDIO CONTROL

The use of audio playback and control is particularly suited to mobile users whose sight cannot be focused on a display and users that are sight impaired. Wireless Audio

Enabler allows the use of state- of- the- art CD quality audio playback, voice command and control, text to speech, web design technologies, and other distribution technologies in applications for mobile users.

3.6 TERMINALS AND MP3

A wireless phone based on the AMPS or GSM standard can be used. The use of the MP3 player provides a dock and load capability so that a user can quickly download a variety of content to a docked MP3 player without waiting for a download via phone. Such content as news, songs and training items are large and can be downloaded to a MP3 player while at home or office using a docking device. This allows for updating of audio content in seconds. Bursty and rapidly changing information, such as stocks, traffic, and breaking communications, can be acquired through the wireless phone via a quick connection to the AudioRunner service. This on request service augments the several hours of downloaded audio content on the MP3 player. The MP3 player may be docked to a vehicle's audio system or may be integrated into the latest wireless phones using MP3 technology.

4 AudioRunner and the WAE

4.1 What Is AudioRunner™

Powered by the

Wireless Audio Enabler

AudioRunner is a concept and application supporting audio-based Internet information services and applications powered by the **Wireless Audio Enabler. AudioRunner** enhances the user experience through wireless connectivity. The AudioRunner components are comprised of a Internet Portal demonstrating the service and providing a user interface via a web browser, a personal assistant application, the Wireless Audio Enabler, a content library, and a terminal interface. The Wireless Audio Enabler is a speech engine capable of TTS and ASR.

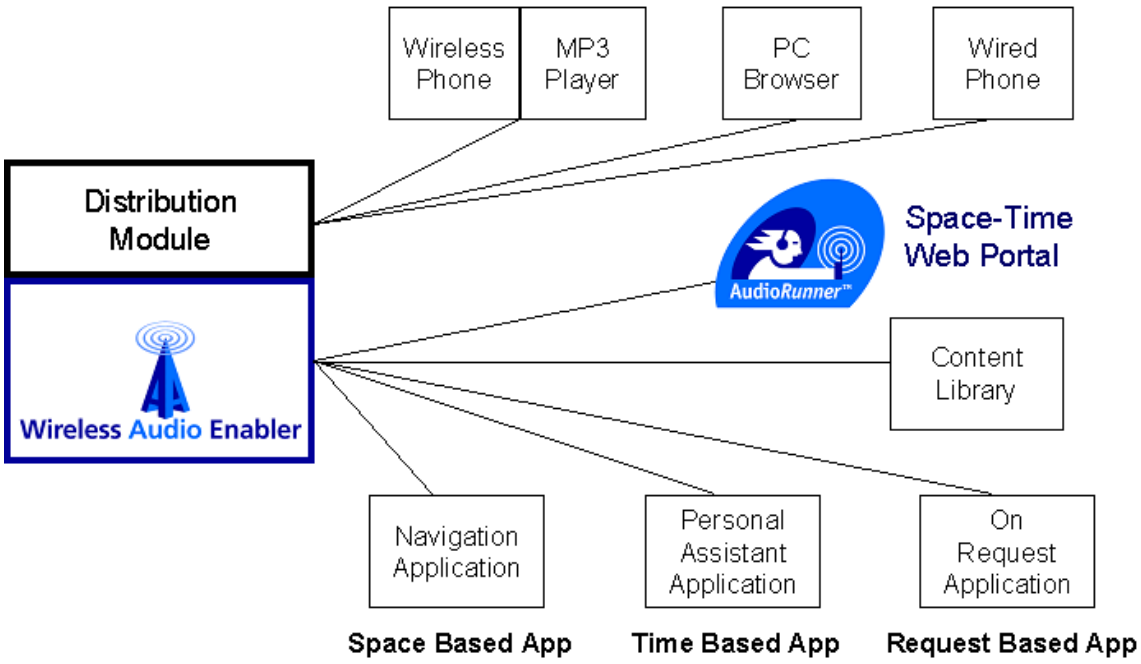

Figure 4 - WAE and AudioRunner Modules and Integration Scheme

4.2 WHO CAN USE THE WIRELESS AUDIO ENABLER

The Wireless Audio Enabler is available to ASPs, ISVs, and WSPs to enhance their services and applications as Internet, audio, and wireless technologies converge. The Internet is rapidly moving into a new era of audio-based services including browsing and content playback. Audio, coupled with wireless phone connectivity, is the perfect vehicle for users on the go to receive content and for the sight impaired to receive assistance with geographic and information navigation.

4.3 SERVICES CONTENT

The following types of information may be provided: location (space) based services, calendar (time) based services, reminders, and to-do lists, directory services information, education, news, audio books, and music.

4.4 Wireless Audio Enabler and AudioRunner Service

The service provides the ability to set and schedule a stream of "audio nuggets" consisting of subscription based content and personal content which may be provided to the user by phone or other audio/PC device. Text to speech technology is used to produce audio content from content available in text format. The user may conduct e-commerce transactions, make reservations, obtain business news headlines, schedule appointments, get directions, modify calendars, listen to songs, learn languages, and listen to traffic reports. Advertising may also be introduced into the audio stream based on parameters, such as the users location, and the model used for subscription services, such as content paid for by advertising.

4.5 Access to the system

Mobile users access the system through two interfaces. The PC interface is a Web based application and is required to perform user functions such as login in, sign up for services, set your content preferences, customer services, and download data. The Mobile terminal interface communicates directly to the WAE.

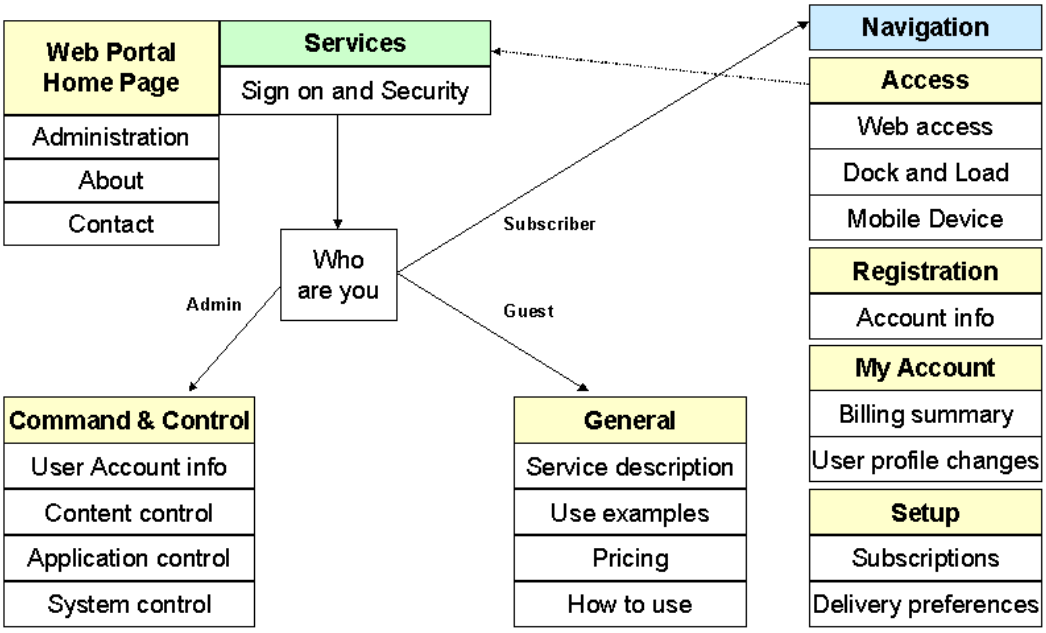

Figure 5 - AudioRunner User Interface Logic

4.6 Possible AudioRunner Functions

User selects the information needed for the day from the AudioRunner screen located on there browser. This may include news, traffic, directions, training content, e-mail, reminders, to-do-list, stock information, other web content required for the day, reports, scanned correspondence, faxes sent to PC, family members calendars, town schedules for children, personal and business appointments.

User stores information in a queue or playlist, and if desired may select the order in which the audio nuggets will be played. User may also post selections in the calendar application and make them standard each calendar or business day. For example, each calendar day user wants to get the news, local weather, calendar for self and spouse, stock information, and the latest research on business competition. On Saturdays, select children's schedules, develop shopping list from previously scanned UPC codes, check the car to see if it needs gasoline, check two local theatres for movies and times, and list my routine Saturday errands. On Sundays, play next lesson from weekly college course, 1st 3 songs from a favorite CD, and provide nighttime TV scheduling.

The user places their PDA, MP3 audio player, mobile phone/audio device, or browser-enabled device (depending on user needs) into a PC connection (USB or serial port) and starts the download. Device says download completed when all requested information is present in the PDA.

User takes PDA gets into car and puts it in a device holder. Clicks on queued list that begins to play the "audio nugget" stream through the audio system of the car. User may listen through entire schedule of audio, interrupt the stream by requesting information using voice commands, or by using DTMF on mobile phone to request geo-location information, email updates, listen to phone messages in office, etc.

While in transit, user may take advantage of the display screen on their PDA when the car is either stopped completely or placed in park. At that time, speech technology and voice commands may be used to search, update calendar application, request information on directions and have the map displayed on PDA screen.

4.7 Prototypes

4.7.1 AudioRunner System

A fully functional AudioRunner system is comprised our several components including: stored content, content acquisition module, middleware, telephony interface, Web site, and wireless terminals.

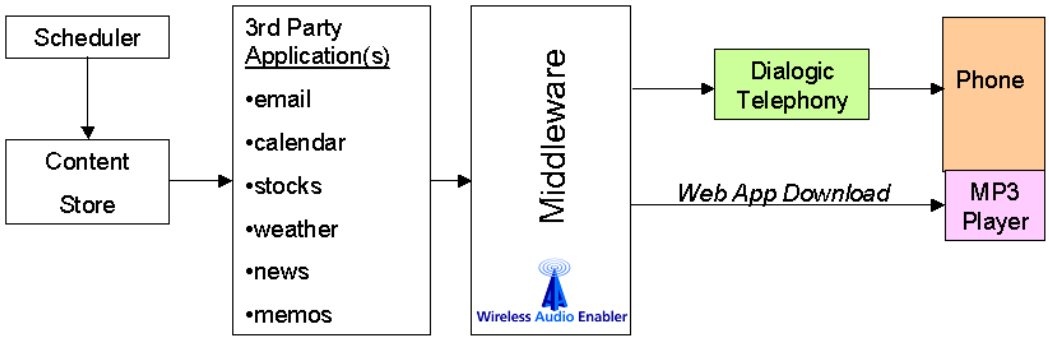

Figure 6 - AudioRunner System Prototype Components

4.7.2 AudioRunner Terminal

The AudioRunner terminal is a standard 2G phone with an integrated MP3 player. This prototype uses a Diamond Rio MP3 player and a Qualcomm phone.

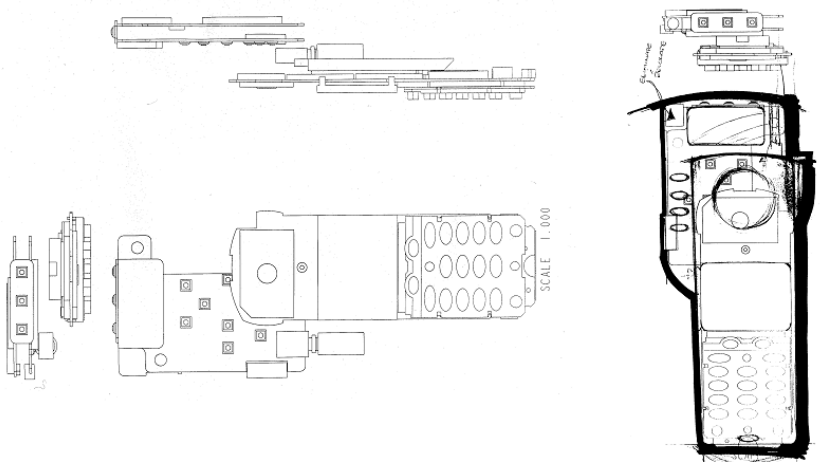

Figure 7 - AudioRunner Terminal Drawing

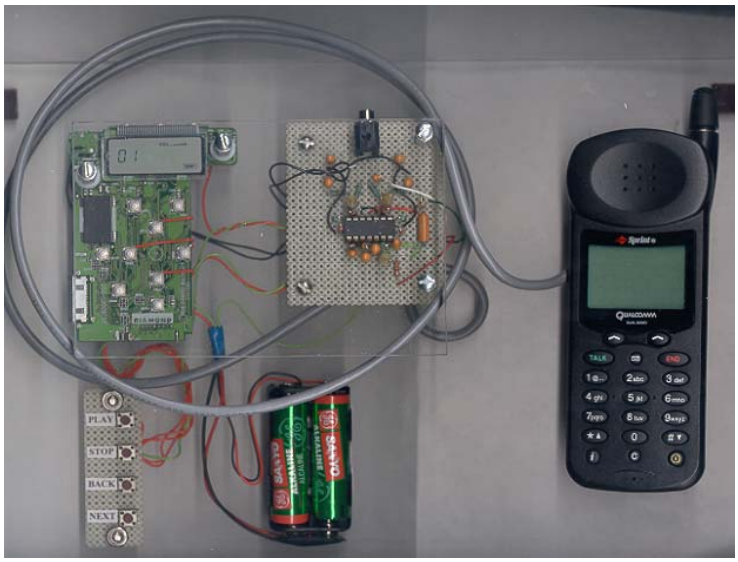

Figure 8 - AudioRunner Breadboard

Figure 9 - AudioRunner Terminal Prototype

The fabricated AudioRunner terminal is capable of audio store and playback as well as wireless phone use. The speaker function is integrated into the mobile phone.

4.7.3 AudioRunner Application

A user must login the system to access the content preference settings and the user's playback settings. Access is granted through the application's Web site. A username and password is required to gain entry.

Figure 10 - Login Page

Once a user has gained access, they may view and modify their content and playback settings. The settings determine the playback and/or download sequence of selected information.

Figure 11 - Current Selections Page

Figure 12 - Location Page

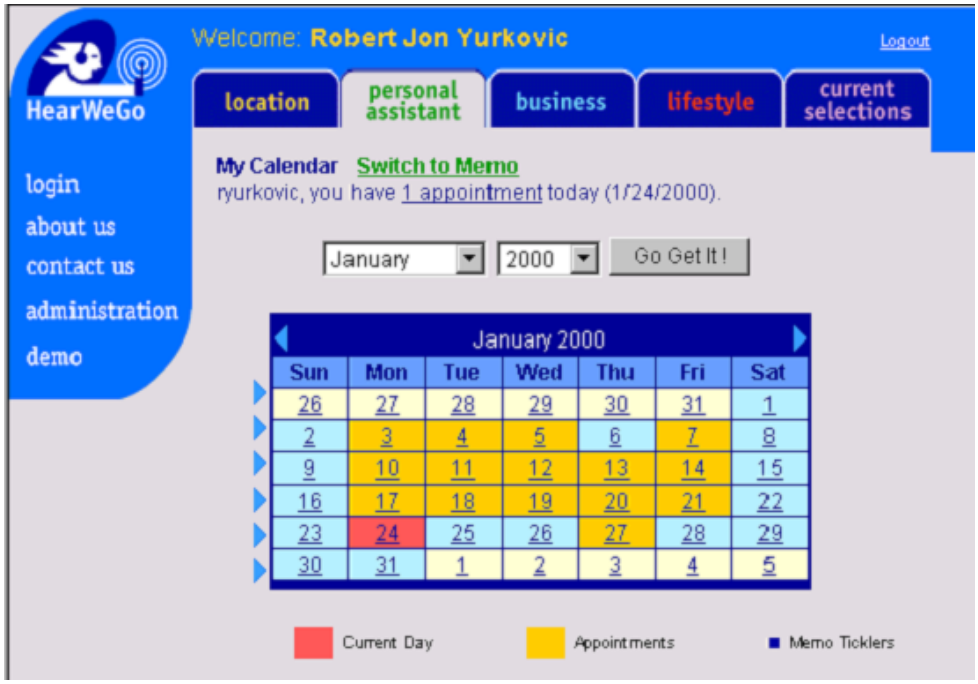

Figure 13 - Personal Assistant Page

Figure 14 - Business Page

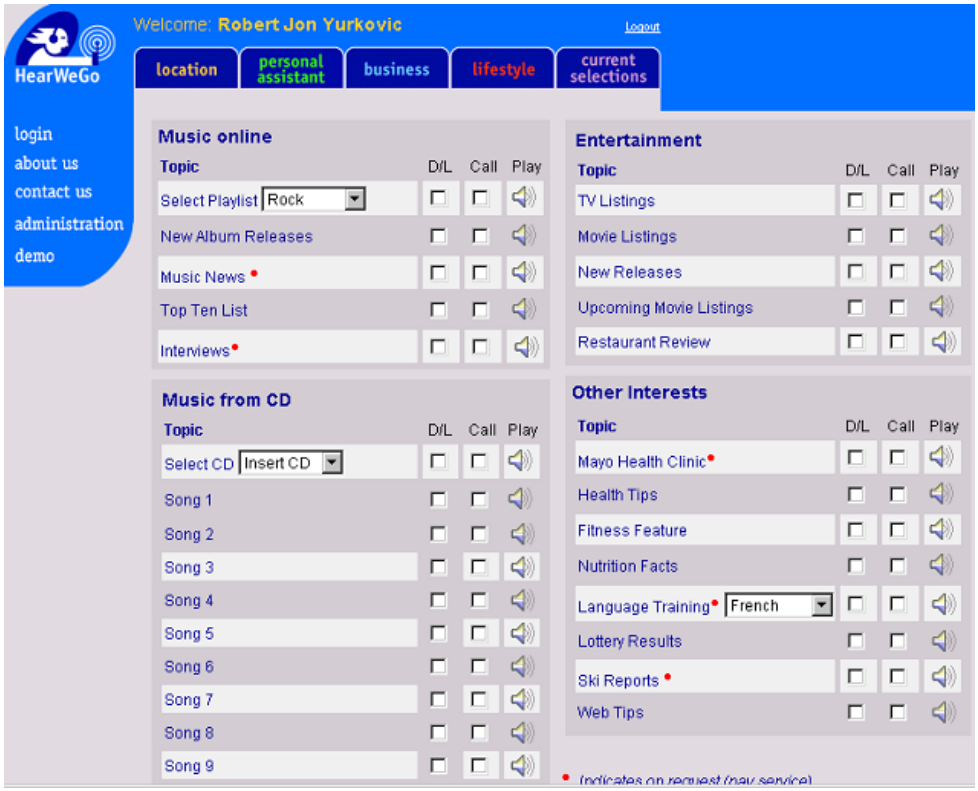

Figure 15 - Lifestyle Page

4.8 Beyond 2000

Another future offering is the "What's Near Me?" response technology which allows a user to ask the device for geo-location specific information. Examples include location of ATM, coffee shop, public transportation center, taxi service, hotels, or other requested information. A response device embedded in the corresponding service at the location would help users hone in on a requested service and provide additional assistance to the user. This scenario has a direct benefit to sight impaired users in terms of navigation and information delivery.