

SYSTEM FOR DELIVERING ON DEMAND DATA TO A WIRELESS MOBILE
RECEIVER

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Field of the Invention



159159

This invention relates to a system for delivering on demand data to a wireless mobile receiver, and more particularly to such a system in which a user having a mobile receiver can specify the data which the user desires to receive, in response to which a transmitter in the system broadcasts digital signals representative of the data specified by the user.

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Background of the Invention



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One of the biggest changes in society in recent years has been the widespread use of personal computers in the daily lives of many people. Such computers perform business applications such as word processing, spreadsheets, and the maintenance of databases, and also perform personal or entertainment applications such as photo and video editing and playing music. In addition to executing such applications, the computer also enables the user to access essentially endless amounts of data on a vast variety of different subjects relating to both business and entertainment pursuits. By using the Internet or World Wide Web, the user can obtain both public information that is available to anyone, or private and proprietary information for which the computer must be properly prepared and programmed before it can request and access the information. When digital signals representing the requested data are received by the computer, it then presents the data in a user understandable format such as a visual display or an audible sound. Such a two-way flow of information -- the request of information by the user and the supply of the information to the user by the system -- has properly been called an information superhighway.

The first popular manner for connecting personal computers to the Internet was the use of modems and conventional telephones through which the user communicated his needs for information "upstream" to the system, and the system sent the information back "downstream" to the user's computer. Such

modems initially had low transmission rates of only a few thousand bits per second. As the needs and demands for data increased, it was realized that the modem and conventional telephone line system was a major bottleneck in the system. Successive generations of modems were designed to increase the rate at which information could be transmitted over the telephone lines. The most popular modems now available have a theoretical transmission rate of 56,000 bits per second, although in practice this rate of transmission is seldom achieved by the modems.

This is still an unacceptably slow rate of transmission for many users, and substantial progress has been made in recent years to achieve broadband means for connecting a computer to the Internet so that larger amounts of data can be transmitted and displayed in shorter amounts of time. (The term "broadband" initially referred to the frequency bandwidth in a channel used to transmit the information, since the basic laws of physics allow the transmission of larger amounts of information over a channel having a wider frequency bandwidth. However, in the computer industry the term has come to include any arrangement for increasing the rate of transmission of information, regardless of the means used to achieve that increase. The term is so used in this specification.)

Those skilled in the art have now devised a number of means that have greatly increased the rate at which computers can communicate with the Internet. Such means include T1 and ADSL telephone lines and modems that work with television cable systems. Such arrangements allow communication rates of several hundred thousand bits per second, or even faster under ideal conditions. In addition, systems have been devised and implemented in which the information is delivered to the computer through a satellite orbiting the Earth. These satellite systems require a relatively large antenna whose size is determined by the nature of the satellite signal they use. They also require significant signal amplification before the signals can be used, since the satellites are positioned thousands of miles above the earth, and their signal is substantially attenuated by the time it reaches the user. Although it has been proposed that such satellite systems can also use the satellite to "uplink"

information from the computer to the central system, most satellite systems depend upon a modem and telephone line connection for upstream communication, since the cost for the transmitter and antenna to enable the upstream communication is substantial.

5 In addition to "full function" personal computers such as desktop computers and laptop computers, today many people also use devices known as Personal Digital Assistants (PDA), which are small wireless portable handheld devices. The size of these devices allows them to be readily carried in a pocket or a purse, but still provide at least elementary computer functions such as
10 calendars, appointment management, task management, address book, memo pad, calculator, and basic word processing and spreadsheet capability. PDAs typically include a liquid crystal display (LCD) to provide a visual display of information to a user.

 The widespread use of PDAs has led to a natural demand that some
15 manner be devised to allow their connection to the Internet, so that the user can receive and utilize data other than that which is stored in the PDA. The efforts to date to provide means for connecting handheld devices to a central data source such as the Internet have focused upon the use of a mobile telephone system such as a cellular phone. A number of proposals have been made to use a
20 cellular phone as a stand-alone device to connect with the Internet or as a sub-system to be integrated into a PDA to allow the PDA to have access to the Internet.

 However, a cellular phone is definitely not a broadband device. The frequency bandwidth allocated to cellular phones is quite narrow, and present-
25 day cellular telephones which do have access to the Internet must do so at extremely low speeds of less than 10,000 bits per second. For example, NTT DoCoMo Inc. of Japan has recently announced that it has developed a mobile phone system that can connect to the Internet at a rate of 64,000 bits per second, which it claims is nearly seven times the speed of existing cellular
30 telephone Internet connections, such as the WAP protocol. Even if this is achieved, it is still inadequate to provide the level of service desired by many users today.

Further, the broadband connection means described above simply are not applicable to handheld devices such as a PDA. For example, the broadband telephone line systems and the cable television systems require that the receiving device be physically connected to the lines. This is clearly impractical for handheld, mobile and portable devices such as a PDA or the like. The satellite-based systems are, if anything, even more impractical for handheld mobile devices, because they require antennas and amplifiers of significant size and weight.

Summary of the Invention

It is accordingly an object of the present invention to provide an economical and practical system through which a user may use a wireless mobile handheld device to communicate with a data source such as the Internet to receive user specified data on the handheld device.

It is another object of the present invention to provide such a system that can provide broadband data such as graphics, pictures and streaming video on demand to a user.

It is another object the present invention to provide an improved receiver for use in such a system.

The present invention achieves its results by the judicious merger of technology from the recently developed Digital Audio Broadcast (DAB) protocol, and the well-known cellular telephone systems. By using this existing technology, it is possible to implement the present invention on a wide scale without having to spend substantial amounts to develop the underlying technology or to install the infrastructure needed for its implementation.

There are now many radio stations broadcasting under the Digital Audio Broadcast protocol in Europe and Asia, and at least one such station presently broadcasting in North America. The stations use a protocol known as Eureka 147. This protocol originated with the European Telecommunications Standards Institute. It governs encoding and decoding of the content that is broadcast in accordance with the protocol. However, the protocol does not restrict the format

of data that is to be broadcast, nor does it restrict pre-processing and post-processing of that data.

Under the international agreements that govern the allocation of frequency bandwidth for particular broadcast applications, DAB stations
5 operate on assigned frequencies within the VHF Band III (174-240 MHz) and L-Band (1452-1492 MHz), with each station being allowed a bandwidth of 1.5 MHz. When suitable known multiplexing techniques are used, this is a sufficient bandwidth to allow a station to simultaneously transmit a number of separate programs. For example, a station may simultaneously broadcast a music
10 program hosted by a disc jockey, a talk show and financial and stock market reports. Some of the programs, such as the music program, may be broadcast in an open or free, advertiser supported format so that it can be received by any DAB receiver tuned to the station. Others of the programs may be broadcast on a subscription basis, and can be received only by a DAB receiver which is
15 suitably configured to receive that program. However, the user is restricted to the reception of program content that is selected for broadcast by the station. The user thus has only indirect control over the selection of data which is available to be received and acted upon.

Because DAB receivers typically include an LCD display as well as audio
20 speakers, DAB can be used to broadcast pictures and video. It is not even necessary that the specific programs include any audio content. They can be text or graphical information in their entirety, with their content being presented to a user as a visual image on the LCD display. Digital Audio Broadcast using the Eureka 147 protocol is definitely a multimedia system. Thus, though the format
25 is commonly called Digital Audio Broadcast or DAB by those skilled in the art (and it is so referred to throughout this specification), it is not necessary that the content of the program being broadcast be entirely or even partially audio content.

Briefly stated, and in accordance with the presently preferred
30 embodiment of the invention, a system for delivering user specified data to a mobile data receiver is provided which includes a digital data transmitting station. The transmitting station includes a transmitter for generating a carrier

signal having a predetermined frequency and a data source having access to large amounts of data that can be delivered to a user. For example, the data source could include both a connection to an Internet portal and access to a large databank. The transmitting station also includes a modulator that receives
5 digital signals from the data source and causes the carrier signal to be modulated by the digital signals, and a land-based antenna for propagating the modulated carrier signal into the atmosphere. Such a transmitting station could be, for example, a conventional DAB transmitting station.

The system also includes a mobile receiver that can be tuned to the
10 predetermined frequency for receiving and demodulating signals from the transmitter, extracting the data from the signal and presenting it in a user understandable format such as a visual display and/or an audible sound. The mobile receiver also includes an input element, such as a touch screen or keyboard, through which the user can designate the data that the user desires to
15 receive through the system. A mobile telephone such as a cellular phone is also included which is operatively connected to the mobile receiver and which, in response to the user's designation of desired data, transmits a corresponding selection signal on the mobile telephone network. A second receiver is provided which is operatively connected to the mobile telephone system and to the
20 transmitting station. When the second receiver receives the selection signal from the mobile telephone, it causes the data source to supply digital signals representing the desired data to the modulator for broadcast by the transmitter.

Brief Description of the Drawings

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For a complete understanding of the invention, together with an appreciation of its other objects and advantages, please see the following detailed description of the attached drawings, in which:

30 FIG. 1 is a block diagram of a system in accordance with the present invention;

FIG. 2 is a functional block diagram of a receiver for use in the system of FIG. 1 which incorporates additional features of the invention;

FIG. 3 is a perspective view of the receiver of FIG.2; and

FIG. 4 is a block diagram which illustrates the electrical and mechanical layout of the receiver of FIG. 3.

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Detailed Description of the Drawings

Fig. 1 is a systematic block diagram of a system in accordance with the present invention for delivering user specified data to a mobile data receiver. In accordance with the presently preferred embodiment of the invention, the system uses a DAB transmitting station 10 that operates under the Eureka 147 protocol.

The transmitting station 10 includes a data source 12 that is the source of the content material which the station 10 broadcasts. Digital signals representing the data or content material are applied to a suitable modulator 14 which modulates the data onto a carrier signal generated by the transmitter 16 which has the pre-assigned frequency of the DAB station. The modulated carrier signal is then supplied to a suitable land-based antenna 18 for propagation into the atmosphere.

In accordance with conventional DAB technology, the data source 12 can simultaneously supply a plurality of different data signals to the modulator 14, each of which represents a separate program having different content material. This is represented by the plurality of lines flowing from the data source 12 to the modulator 14. For example, one or more of the different signals could be entertainment and news programs, while other signals could represent data such as stock market reports and the like. The modulator 14, using suitable multiplexing techniques well known to those skilled in the art, then modulates all of the supplied signals onto the carrier signal for broadcast by the station 10.

As is also known in conventional DAB technology, the separate programs could be broadcast in an open format for reception by any receiver within range of the antenna 18, or one or more of the programs can be broadcast in a format which can be demodulated only by the receiver of a subscriber authorized to have access to that particular program or data.

The system includes a mobile handheld receiver 20 which is described in detail in connection with the description of FIG. 2 below. The receiver 20 includes a suitable antenna system 22 that receives the signals propagated by the antenna 18 and suitable reception and demodulation means for extracting
5 the data and for presenting it in a user understandable format. In the preferred embodiment, the receiver 20 includes a color liquid crystal diode (LCD) screen 24 and an audio output jack (not shown in FIG. 1) into which a user can plug a lightweight earphone set, thereby enabling the user to both see and hear the desired data.

10 In accordance with one of the primary features to the present invention, the system allows the user to select particular data which he wishes to receive and to command the transmitting station 10 to transmit that selected data on an on demand basis to the user. To implement this feature, the receiver 20 includes suitable input means by which the user can designate the desired data. In the
15 preferred embodiment, this is effected by providing an LCD display 24 which also has touch screen capabilities. This allows the user to enter the designation or address of the desired data. For example, if the user desires to view a particular Web site on the Internet, it is only necessary that the user enter the URL address of the Web site on the touch screen, in much the same manner as a
20 user would enter the address on the keyboard of a computer.

The system also includes a mobile telephone 26 such as a conventional cellular telephone that is operatively connected to the receiver 20. In the presently preferred embodiment, this connection is through an infrared link 28 through which data can be exchanged by the receiver 20 and the cellular
25 telephone 26 through the well-known IrDA protocol. This enables the user to use a conventional cellular telephone which he is probably carrying anyhow, thereby keeping the receiver 20 small and lightweight, and does not require any incremental hardware. Alternatively, the cellular telephone 26 could be physically integrated within the housing of the receiver 20.

30 A selection signal representing the desired data is then propagated into the atmosphere by the cellular phone 26, where it is received by a conventional fixed antenna 30 of a mobile telephone network 32. Again, this is preferably the

well-known cellular telephone network, whose technical description is not required by those skilled in the art. A control receiver 34 is provided at the transmitting station 10 that is operatively connected to both the mobile telephone network 32 and the transmitting station 10. When the control receiver 34 receives the selection signal representing the data desired by the user, a suitable signal is applied to the data source 12, instructing it to retrieve the selected data and to supply it to the modulator 14 for transmission to the user. The system thus provides data to the user on an on demand basis.

FIG. 2 shows an enhanced DAB receiver 20 that supports delivery of multimedia content using the Eureka 147 compliant protocol for use with the present invention. In addition, generic multimedia applications are provided in the DAB receiver 20 for post processing and presentation of data delivered via DAB broadcasts in accordance with users' selected preferences. This provides the DAB receiver 20 with a variety of graphics, video, and over the air programming features.

In FIG. 2 the enhanced DAB receiver 20 has the antennae system 22 for receiving a digital broadcast radio frequency signal 105 that is transmitted in accordance with the Eureka 147 standard. The antennae system 22 comprises two radio antennae, a VHF Band III radio frequency antenna operating between 174-240 megahertz (MHz), an L-Band radio frequency antenna operating between 1452-1492 MHz, and an antenna switch for switching between the two antennae. Further details of the antennae system are described in connection with the description of FIG. 4 below.

A digital broadcast receiver module 110 is a DAB compliant receiver which comprises a DAB radio 115 and a DAB decoder 120. The DAB radio 115 receives and demodulates the digital broadcast signal 105, and provides a demodulated data signal. The DAB decoder 120 is connected to the DAB radio 115 to receive and decode the demodulated data signal, and produces a received data signal.

A controller 122 is connected to the digital broadcast receiver module 110, and controls its operation, together with the operation of the other units and functions of the receiver 20. The controller 122 may be, for example, a functional program on a microprocessor-based system which operates on a

multi-thread software operating system (OS) such as Windows CE, Linux and VxWorks. In addition to the controller 122, a variety of other functional blocks are also functional software programs that operate on the microprocessor-based system. These functional blocks are identified as their operation is described
5 below. The functional blocks and other physical blocks are coupled to the controller 122 as indicated by thicker lines 126, and data flow between the blocks is represented by thinner lines 127.

For example, a personal digital assistant (PDA) engine 123 is a functional program that is coupled to the controller 122 and provides the receiver 20 with
10 all the functionalities provided by a PDA. These functionalities include calendars, appointment management, task management, to-do lists, address book, memo pad, electronic mail, and calculator.

Continuing the description of the operation and structure of the receiver 20, a high-speed data interface 125 is a physical interface connected between the
15 digital broadcast receiver module 110 and a data identifier 130 to transfer received data to the data identifier 130. In the presently preferred embodiment of the invention, the high speed data interface 125 complies with the enhanced parallel port (EPP) protocol. However other high-speed protocols may be employed. These protocols include serial peripheral interface (SPI), and the
20 high baud rate universal asynchronous receive-transmit (UART).

The processor 122 controls the high-speed data interface 125, which allows all data managing and decoding to be controlled by the processor 122. For example, the processor 122 allows data from the high speed data interface 125 to be provided directly to the processor 122 for storage and/or execution.

25 Digital signals representing various types of data may be broadcast by the transmitting station 10 of the present invention in a variety of formats or digital file types, depending upon the nature of the data represented by the signal, whether the digital signal is intended for general reception or only for a specific subscriber, and the use to which the signal is to be put to by the receiver 20. For
30 purposes of this specification, these different varieties of file types are characterized as open or standard file types and as customized file types.

Open or standard data file types refers to file types that are known and

used throughout the industry to represent specific information in a standard, agreed-upon format. Examples of such files include text files, HTML files for Internet data, JPEG and GIF files for pictures utilizing known compression techniques, and MPEG-1 and MPEG-2 files for video images. Such file types, 5 their designations and their protocols are well known to those skilled in the art.

Customized data files designate data that is intended only for use in the system. Customized data files, as used herein, are further divided into two subcategories which may be characterized as being enhanced or non-standard presentation data files, which include data to be presented in a user 10 understandable format by the receiver 20, and as command data, which is data which is transmitted by the transmitting station and which is intended to control the operation of the receiver 20.

Data identifier 130 operates as a data interpreter to identify different data types being received by receiver 20. A variety of techniques may be used for this 15 identification. One relatively simple way is to indicate different file or data formats by using unique data file extension types. Other methods can include unique information headers embedded in a data file, where when a data file is converted to a particular format, the header information identifies that format. In addition, an encryption key could be included in a data file, and the 20 information in the data file is decoded only when the encryption key in the receiver matches the one in the data file.

The data identifier 130 initially determines whether the received data is a standard data format type or a customized format type. Standard file types are readily recognized and executable by standard commercial software browsers 25 such as Microsoft Internet Explorer and Netscape Navigator. Customized data may require further processing in the receiver 20 before the received data is interpreted and presented by the receiver 20 and is displayed and presented to a user only after the received data has been decoded by the receiver 20. Data identifier 130 provides the received data to a variety of decoders in a decoding 30 engine 135, dependent on the data type that is received. The decoding engine 135 includes a standard data decoder 140, a non-standard data decoder 170, an audio data decoder 145 and a command data decoder 146.

When the data identifier 130 determines that the received data is the standard data type, the data identifier 130 provides the standard data to the standard data decoder 140. The standard data decoder 140 includes four sub-decoders, a text sub-decoder 141, a hypertext mark-up language (HTML) sub-decoder 142, an image sub-decoder 143, and a video sub-decoder 144.

When the standard data represents text, HTML, image or video content, a standard browser, in the presentation processor 160, is used to decode and present the content on a LCD display 24. In the presently preferred embodiment, the presentation processor 160 is a software module that is embedded in the processor, and performs the function of presenting the data on the LCD 24 of the receiver 20, using the conventional browser software.

When the data identifier 130 determines that the received data is audio data type, the data identifier 130 provides the audio data to the audio data decoder 145. The audio data decoder 145 determines whether the audio data is conventional audio streaming data, such as audio data received in the I2S standard protocol, or Media Player 3 (MP3) audio data. When the audio data is conventional audio streaming data, the audio data decoder 145 decodes the conventional audio streaming data and provides an audio streaming signal to the presentation processor 160, which then provides a corresponding audio signal to an audio transducer 165 for listening by a user.

When the audio data decoder 145 determines that the audio data is MP3 data, it can be processed in two ways. One way is to receive a file in the MP3 format, and then play the file back with an MP3 player, akin to streaming audio. The other way is to record the normal DAB audio channel in MP3 format for storage in the enhanced DAB receiver. Then, at a later time, a user could select the stored audio for play back using, for example, the PDA functionality as a user interface. The selection of where the audio data decoder 145 provides the MP3 audio data stream is determined by the controller 122 in accordance with user selection or stored user preferences.

When the data identifier 130 determines that the received data is command data type, the data identifier 130 provides the command data to the command data decoder 146. The command data decoder 146 determines

whether the command data is system control data or tuning control data, and provides the control and/or tuning data to the controller 122. In response, the controller 122 provides control signals to the digital broadcast receiver module 110 to effect a variety of system control functionalities including, tuning of the DAB radio 115, frequency selection, and detection of on-air channel information. The command data, sometimes referred to as command messages, are system messages that cater more for communication within the DAB receiver 20, and for simple on-air messages and indications. Command messages are communicated with defined message events between the digital broadcast receiver module 110 and the controller 122. The command data provides a communication link between a broadcasting system and the DAB receiver 20 that enables the DAB receiver 20 to maintain optimized reception of the digital broadcast signal 105.

Non-standard presentation data can also be presented on the LCD display 24 by the presentation processor 160. The non-standard data type is data that is not formatted in accordance with the protocols which are decoded in standard data decoder 140. For example, a non-standard data type may be data formatted in accordance with a proprietary format or protocol. Non-standard data may be identified using a method mentioned earlier or a unique file extension employed to allow recognition of a non-standard data file. The non-standard data requires additional processing prior to presentation.

When the data identifier 130 determines that the received data is the non-standard data type, the data identifier 130 provides the non-standard data to the non-standard data decoder 170. The system uses two non-standard data types. These are enhanced data type and integration data type.

When the non-standard data decoder 170 determines that the received data is the enhanced data type, the non-standard data decoder 170 provides the enhanced data to an enhanced data decoder 171, and when the received data is the integration data type, the non-standard data decoder 170 provides the integration data to an integration data decoder 180.

The enhanced data decoder 171 includes four sub-decoders. These are a graphics sub-decoder 172, an additional video sub-decoder 174, an over-the-air-

programming (OTP) sub-decoder 176, and a program sub-decoder 178.

When the enhanced data represents graphics content, the graphics sub-decoder 172 decodes the enhanced data and provides a graphics data signal to the presentation processor 160. The presentation processor 160 processes the graphics data signal and provides graphics display data to the LCD display 24 which presents the graphics content for a user. Similarly, when the enhanced data represents additional video content, the video sub-decoder 174 decodes the enhanced data and provides the additional video data signal to the presentation processor 160. The presentation processor 160 processes the video data signal and provides it to the LCD display 24.

The additional video data could be delivered to the receiver 20 in a variety of ways, and dependent on the method employed to deliver the video data, the presentation processor 160 processes the received video data accordingly. For example, instead of using the full capacity of 1.5 megabits per second of the receiver 20 to deliver video streaming data, a smaller portion of the capacity, perhaps 500 kilobits per second, can be employed, with the video data now being sent at a lower frame or refresh rate. The presentation processor 160 would recognize the slower bit rate, and decode and present the video content at the lower refresh rate. An alternative method would be to break a video file into several portions, and transmit the portions separately. Then, at the receiver 20, the presentation processor 160 recognizes and assembles the received portions, decoding and presenting the portions in the correct sequence.

When the enhanced data represents OTP, the OTP sub-decoder 176 decodes the enhanced data and provides a OTP indicator data signal to the presentation processor 160. The presentation processor 160 processes the OTP indicator data signal and provides OTP indicator display data to the LCD display 24, which presents an OTP indicator, which indicates to a user that OTP data is being received by the receiver 20. An example of such data is data representing a greeting card that has been sent to the user.

When the enhanced data represents executable program content that is intended to be used by the receiver for internal control purposes, the program sub-decoder 178 decodes the enhanced data and provides program data to the

controller 122 for execution. This data is an executable program which when executed by the controller 122 determines the operation of the receiver 20. This feature advantageously enables new functionality to be added to the receiver 20 by delivering additional software to the receiver 20. In addition, updates to
5 existing software can be conveniently delivered without the need for user intervention.

Non-standard data which is integration type data represents data which is to be supplied to another component, either by wireless or wired connection. When the non-standard data decoder 170 determines that the data is
10 integration data, it supplies it to integration data decoder 180, which includes two modules, a wireless data module 182 and a wired data module 184. When the integration data represents wireless data, the wireless data module 182 processes the data and provides the processed data to input/output (I/O) ports 194, through which it is connected to the wireless device, such as the mobile
15 telephone 26 for which it is intended. Similarly, when the integration data represents wired data, the wired data module 184 processes the data and provides it to the I/O ports 194 for connection to the desired wired component, such as the user's personal computer.

Receiver 20, when it is operating in the manner described above, is
20 functioning only as a one-way receiver which is receiving, displaying or otherwise acting upon data and signals that the director of the transmitting station of FIG. 1 has chosen to broadcast. As was described in connection with FIG. 1 above, one of the important features of the present invention is that it allows a user to specify the particular data that he desires to receive from the
25 station. This allows the system to be a two-way system in which the receiver can receive on demand data which the user needs for immediate application.

To provide this function, the receiver 20 includes user inputs 124, which may be a conventional means such as a keyboard, switches, or a microphone. However, in the presently preferred embodiment of the invention, the LCD
30 display 24 is of the touch screen variety so that a user can also enter information into the receiver by touching the appropriate portions of the display 24 when the receiver 20 is placed in this mode. When the user enters information

representing the data that he wishes to receive, the receiver 20 transmits this information to the mobile telephone 26 for retransmission back to the transmitting station 10.

For example, the user may wish to view a particular Web site on the Internet. The user enters the URL address of the Web site on the user inputs 124 which, under the control of controller 122, provides the information to data selection engine 192. Data selection engine 192 then processes this information to generate a suitable signal to command the mobile telephone 26 to dial the desired telephone number of the control receiver 34 of transmitting station 10 and to send a selection signal to control receiver 34 indicative of that URL address. Data selection engine 192 then provides this information to I/O ports 194, which emits an infrared signal having the IrDA protocol. This infrared signal is received by mobile telephone 26, which then follows its command and sends the selection signal to the transmitting station 10 so that it will then broadcast the desired data for reception by receiver 20.

As is shown in FIG. 2, I/O ports 194 also includes USB and serial output ports for communicating with other computer devices so that, for example, PDA engine 123 can be updated from the user's desktop computer and the processed signals which are received by receiver 20 can be provided to another computer. Additional means, such as the provision of IEEE 1394, Ethernet and RS232 ports and Bluetooth connections could be provided if desired.

FIG. 3 is a perspective view of the receiver 20 that illustrates the physical layout of a handheld wireless receiver incorporating the features described in connection with FIG. 2 above. The receiver 20 includes an LCD display 24, an infrared output port 200 and a plurality of selector switches 202 and 204 which allow the user to perform functions such as mode selection, volume control and the like.

In the presently preferred embodiment of the invention, the external dimensions of the receiver 20 of FIG. 3 are approximately 10 cm by 7 cm by 2 cm, and it weighs approximately 150 grams. The LCD display 24 is 320 pixels by 240 pixels, which are contained on a screen that is 8 cm by 6 cm. The electronic components that make up the receiver 20 are, for the most part, mounted on a

two sided printed circuit board (PCB) which is supported within the housing of the receiver 20. The remaining components, such as the antenna system, the I/O connection points and the battery, are also supported within the housing of the receiver 20.

5 FIG. 4 shows the primary electronic components from which the receiver 20 is formed. As was noted above, most of these components are mounted on a two sided PCB within the housing of the receiver 20. CPU 220 is the microprocessor which, in association with main memory 222, RAM 224 and ROM 226, performs the data processing functions of the receiver 20 to convert
10 the received DAB signals into a user understandable format such as a visual display on the LCD display 24 or sounds from the audio transducer 165, and into control signals for internal use within receiver 20.

In the presently preferred embodiment, CPU 220 is an NEC VR 4121 microprocessor that operates at a clock frequency of 160 MHz. Main memory
15 222, in which software such as the operating system, the component drivers and custom GUI software is stored, is a 16 MHz flash memory. RAM 224 is a 16 MHz SDRAM, and serves the usual function that a random access memory serves in any computer system. ROM 226, in which is stored relatively permanent
20 information such as the default settings of the system and the user identification number, is an EEPROM. These four components, all of which are commercially available, standard electronic components, perform in the manner well known for those skilled in the art to effect the desired data processing functions.

The components that form the digital broadcast receiver module 110 are also commercially available components which are known to those skilled in the
25 art. In the presently preferred embodiment, the DAB radio 115 is an RF 800 module and the DAB decoder 120 is a D-Fire 2 decoder module, both of which are manufactured by Robert Bosch GmbH of Germany.

Because the Eureka 147 protocol allows transmission on two widely separated frequency bands -- VHS Band III and L Band -- the antenna system
30 22 of the preferred embodiment includes two separate antenna elements, an L Band antenna 228 and a Band III antenna 230. A selector switch 232 controlled by CPU 220 selects the appropriate antenna for connection to the digital

broadcast receiver module 110 depending upon the assigned frequency of the DAB station to which the receiver 20 is tuned. In the preferred embodiment, the Band III antenna 230 is a tuned antenna that includes a tuner 234 controlled by CPU 220, which tunes the antenna 230 to the assigned frequency of the selected
5 DAB station. The Band III antenna 230 itself is encapsulated within the housing of the receiver 20. In the preferred embodiment, the L Band antenna 228 is formed by a suitable deposit on one side of the PCB.

The receiver 20 also includes other components that, while useful or necessary to its operation, are well known to those skilled in the art and do not
10 form part of the invention per se. For example, in the preferred embodiment, electrical energy is supplied by a lithium ion battery that is mounted within the housing of receiver 20 and that has suitable electrical connections to energize the PCB board. The receiver 20 can also included suitable charging circuits for the battery and suitable power management circuits to optimize usage of the
15 battery between charging cycles.

While the invention is thus disclosed, and the presently preferred embodiment described in detail, the invention is not limited to the shown and described embodiment. Instead, many modifications will occur those skilled in the art which lie within the spirit and scope of the invention. For example, the
20 invention is described while being used in a DAB system operating under the Eureka 147 protocol. The invention could also be implemented for use with other digital broadcasting systems. It is accordingly intended that the invention be limited in scope only by the appended claims.

What is claimed is:

Claims

1. A system for delivering user specified data to a mobile data receiver, comprising:
- 5 a digital data transmitting station including:
- a transmitter capable of generating a carrier signal having a predetermined frequency,
- a data source having access to a plurality of digital signals each of which represents specific data which can be delivered to a user,
- 10 a modulator which receives digital signals from the data source and applies the digital signals to the transmitter, thereby causing the carrier signal to be modulated by the digital signals, and
- a land-based antenna for propagating the modulated carrier signal into the atmosphere;
- 15 a mobile receiver which can be tuned to the predetermined frequency for receiving and demodulating the modulated carrier signal, extracting the data from the digital signal and presenting it in a user understandable format such as a visible image or an audible sound, the mobile receiver further including an input element through which a user can designate the desired data which is to
- 20 be supplied by the source to the modulator;
- a mobile telephone operatively connected to the mobile receiver which, in response to the user's designation of desired data, transmits a corresponding selection signal on the mobile telephone network; and
- a second receiver operatively connected to the mobile telephone system
- 25 and to the data source, the second receiver for receiving the desired data request from the mobile telephone, and in response, the second receiver causes the data source to supply digital signals representing desired data to the modulator for broadcast by the transmitter.
- 30 2. The system of claim 1 in which the digital data transmitting station is a Digital Audio Broadcast transmitting station.

3. The system of claim 2 in which the data transmitting station broadcasts in the Eureka 147 protocol.
4. The system of claim 1 in which the mobile telephone is a cellular phone.
5. The system of claim 4 in which the operative connection between the mobile receiver and the cellular telephone is an infrared link.
6. The system of claim 2 in which the transmitting station broadcasts a data signal having at least two components, the first component being a standard component which is compliant with a known digital broadcast standard, and the second component being a non-standard component which does not comply with the known digital broadcast standard.
7. The system of claim 6 in which the mobile receiver comprises:
a digital broadcast receiver having an input for receiving a digital broadcast signal, and having an output for providing a data signal, wherein the data signal is extracted from the digital broadcast signal; and
a data identifier having an input coupled to the output of the digital broadcast receiver, the data identifier for receiving the data signal and for determining whether the data signal is compliant with a known digital broadcast standard, the data identifier having a first output for providing standard compliant data when the data signal complies with the known digital broadcast standard, and the data identifier having a second output for providing non-standard compliant data when the data signal does not comply with the known digital broadcast standard.
8. A mobile receiver for receiving data contained in digital signals which have been modulated onto a carrier signal by a transmitter, comprising:
means for receiving signals which have been broadcast by the transmitter, demodulating the received signals and extracting data signals from the demodulated signal;

means for presenting data corresponding to the extracted data signals in a user understandable format such as a visible image display or an audible sound;

an input element through which a user can designate the desired data
5 which is to be transmitted by the transmitter; and

means for developing a control signal representative of the user's desired data and for supplying the control signal to a mobile telephone, the mobile telephone being operatively connected to the mobile receiver to receive the control signal and for transmitting it to the transmitter to instruct the
10 transmitter to broadcast signals representative of the data desired by the user.

9. The mobile receiver of claim 8 which is a Digital Audio Broadcast transmitting receiver.

15 10. The mobile receiver of claim 9 which can receive and demodulate data broadcast in the Eureka 147 protocol.

11. The mobile receiver of claim 8 which the mobile telephone is operatively connected to a cellular phone.

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12. The mobile receiver of claim 11 in which the operative connection between the mobile receiver and the cellular telephone is an infrared link.

13. The mobile receiver of claim 8 in which the mobile receiver comprises:
25 an input for receiving a digital broadcast signal and an output for providing a data signal, wherein the data signal is extracted from the digital broadcast signal; and

a data identifier having an input coupled to the output of the digital broadcast receiver, the data identifier for receiving the data signal and for
30 determining whether the data signal is compliant with a known digital broadcast standard, the data identifier having a first output for providing standard compliant data when the data signal complies with the known digital

broadcast standard, and the data identifier having a second output for providing non-standard compliant data when the data signal does not comply with the known digital broadcast standard.

- 5 14. A system for delivering user desired data to a mobile data receiver, the system comprising:

a mobile receiver having a user input for receiving an indication of desired data from a user, the mobile receiver for transmitting a desired data request, and in response, the mobile receiver for receiving at least one
10 modulated carrier signal, for extracting the desired data from the modulated carrier signal, and the mobile receiver for presenting the desired data in a user perceptible format;

a mobile telephone operably coupled to the mobile receiver and a mobile telephone network, the mobile telephone for receiving the desired data request
15 from the mobile receiver, and in response, the mobile telephone for transmitting the desired data request on the mobile telephone network;

a digital data broadcasting system comprising:

at least one transmitter capable of generating the at least one carrier signal;

20 a data source having access to a plurality of data signals, wherein each of the plurality of data signals comprises data for delivery to a user, wherein one of the plurality of data signals comprises the desired data, the data source having an input for receiving the desired data request, and in response, the data source for providing the desired data;

25 a modulator which receives the desired data from the data source, and the modulator for providing the carrier signal with the desired data modulated thereon; and

an antenna for transmitting the modulated carrier signal; and

a second receiver operably coupled to the mobile telephone network and
30 to the data source, the second receiver for receiving the desired data request, and in response to reception of the desired data request from the mobile telephone, provides the desired data to the data source.

15. The system of claim 14 in which the digital data broadcasting system is a Digital Audio Broadcast transmitting station.
16. The system of claim 15 in which the digital data broadcasting system
5 broadcasts in the Eureka 147 protocol.
17. The system of claim 14 in which the mobile telephone is a cellular phone.
18. The system of claim 17 in which the operative connection between the
10 mobile receiver and the cellular telephone is an infrared link.
19. The system of claim 14 in which the digital data broadcasting system broadcasts a data signal having at least two components, the first component being a standard component which is compliant with a known digital broadcast
15 standard, and the second components being a non-standard components which does not comply with the known digital broadcast standard.
20. The system of claim 19 in which the mobile receiver comprises:
a digital broadcast receiver having an input for receiving the at least one
20 modulated carrier signal, and having an output for providing a data signal, wherein the data signal is extracted from the at least one modulated carrier signal; and
a data identifier having an input coupled to the output of the digital broadcast receiver, the data identifier for receiving the data signal and for
25 determining whether the data signal is compliant with a known digital broadcast standard, the data identifier having a first output for providing standard compliant data when the data signal complies with the known digital broadcast standard, and the data identifier having a second output for providing non-standard compliant data when the data signal does not comply with the
30 known digital broadcast standard.