

Method And Apparatus For Providing Prepaid Telephone Service**Field of Invention**

5 The present invention relates to a method and apparatus for prepayment of telephone call charges using customer premises equipment and a remote server. More particularly, it relates to a use of a chip card enabled telephone set for identification purpose and then sending appropriate signals to
10 a remote server to determine the amount of calling time permitted by the available balance.

Background to the Invention

15 The use of devices or systems for providing prepaid service for calls are known in the prior art. More specifically, apparatus/systems for enabling a user friendly prepaid service heretofore apparatus and system are known to consist basically of familiar, expected and obvious structural configurations,
20 notwithstanding the myriad of designs encompassed by the many prior arts which have been developed for the fulfillment of countless objectives and requirements.

Telephone calls obtained by means of a communication network
25 may be charged by various alternative manners. Normally, calling time is used to determine the call charges. There are many instances where it is preferred to be able to charge the price of the call beforehand, so that the operator will avoid any credit losses of unpaid bills. The end-users may also
30 prefer this mode of payment in favour of not being surprised by a huge telephone bill.

One method of pre-charging the calls is by using a coin telephone that requires a lot of maintenance. Moreover, it is

cumbersome for the user to have large amount of coins when making an international call. Another possibility is for the operator to sell prepaid calling cards including a desired amount of preloaded balance for the calls. These cards maybe
5 provided with a magnetic strip whereby during a call the amount of balance stored within the card decreases from the card and once all the balance has been spent the call is terminated. Thus, if the card is misplaced or lost, the user losses the balance left on the card. However the person who
10 finds or steals the card stands to gain by being able to make calls he did not pay for. In addition, this method suffers from the possibility that some parties may be able to reprogram the magnetic strip, thereby increasing the balance on the card to its original value. Such fraudulent practices
15 would result in a loss of revenue to the service operator.

Another possibility is to use prepaid calling cards that are not provided with magnetic strips, but which announce e.g. a specific (personal) numeric string or code to the user, which
20 the user then needs to dial in when initiating a call. The user has to call to a special telephone service where the user has an individual user account, which includes preloaded balance for the calls. These cards may be e.g. so called scratch- surface calling cards. Although these cards can be
25 used from almost every telephone, since they do not require any reading devices, the user in addition to dial the number to the service provider will have to follow certain instructions and then keying in the numbers revealed on scratched card and only then will the user be able to dial the
30 intended number. This method is lengthy and inconvenient when used on a regular basis or during emergency.

Background of the Invention

US Pat 5719926 discloses a long distance telephone service system that provides for accounting and flexible, customizable control of long-distance telephone usage by customers, especially prepaid long-distance service customers. The system maintains a set of global operating parameters associated with each access number. It further maintains a database of user accounts or card numbers, and a set of card processing parameters associated with each card number.

US 5946380 discloses a communication system which includes a network switch coupled through a telephone line uniquely associated with each customer for budgeted telephone calling time and amount, either pre-paid or post paid, the budgeted amount being recorded in the system for calling purposes. A server is coupled to the switch for automated control of the budgeted telephone calls and costs. The server includes a control processor having access to databases for recorded budgeted amounts and call routing. A voice response unit is coupled to the processor and sends messages to the calling customer at the beginning of each budget telephone call indicating remaining budgeted telephone calling time and amount available for calling purposes. The processor debits the customer account by an amount reflecting the call charges as the call proceeds. The system sends at least one message to the caller indicating the amount of time available to the caller as the call progresses. Prior to the expenditure of the budgeted calling amount, the system provides the caller with several options. Depending upon customer preference, the call may,

- (i) terminate when the budget amount is exceeded, or
- (ii) continue subject to a warning that the call budget has been exceeded, with a prompt to obtain

additional prepaid budgeted calling time and cost,
or

(iii) continue and subsequent calls subject to later
payment by the calling customer.

5 Calls are placed directly to the calling party without
accessing a special toll number or providing a credit card
number.

While these devices fulfill their respective, particular
10 objectives and requirements, the aforementioned patents do not
disclose an apparatus and method similar to the one explained
later.

Summary Of The Invention

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A method and apparatus for providing prepaid telephone calls
comprising:

(i) A fixed line telephone set, hereinafter referred to
as consumer premises equipment or CPE, having a
20 means to read and send data from chip cards for ID
verification and a display to show status messages
from the remote server.

(ii) A remote server, workstation and node system for
receiving and processing the information so
25 provided.

(iii) A means of connecting the CPE and remote server via
a telephone exchange such that when the CPE handset
is lifted, it is automatically connected to the said
remote server.

30 (iv) A connection between the telephone exchange and said
remote server for verifying the identity of the
caller when the CPE handset is lifted.

When the user lifts the CPE handset, the local exchange, through a hotline connection, triggers the remote server to request the chip card with individual code to be inserted into the chip card reader of the CPE apparatus; sending the
5 individual code to the remote server to ensure sufficient account balance before sending signal to request the user to dial number to desired destination. The server tracks the cost of the call and decreases the balance in the account accordingly until either the call terminates or the remaining
10 balance in the account expires.

It is a primary object of the invention to provide a convenient method of making prepaid telephone calls.

15 It is a specific object of the invention to provide the use of a chip card to store only the user's verification identity for the purpose of making the prepaid call, eliminating the need for the user to remember any code.

20 It is also a specific object of the invention to provide the user a means to make a call almost instantaneously upon lifting the handset from the telephone apparatus and inserting the chip card provided into the appropriate slot on the apparatus.

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It is also an object of the invention to provide a card with only identification codes stored in it and not the account balance to avoid phone card fraud.

30 It is also an object of the invention to provide the user unlimited access to the phone network when receiving calls.

It is also an object of the invention to provide a central computer system to maintain the amount of credit of the user.

Another object of the invention is to provide simple and cheap telephone apparatus (CPE), that is line powered.

It is also an object of the invention to help telephone
5 companies avoid problems in collecting their bills.

While the preferred embodiment is suitable for situations where all calls are charged, and the subscribers are making the calls from their homes, other embodiments can be
10 implemented to cater for different situations.

The subscriber's account data is stored in a central server, and the chip card is only used to verify his identity. Basically, the means subscriber is free to use any CPE to
15 place a call, the cost of the call being deducted from his outstanding balance. In one alternative embodiment, the CPE is used as a public payphone. In this embodiment, the subscriber slots in his chip card into any available payphone CPE and dials his call as per the sequence elaborated earlier. The
20 payphone CPE is a CPE that is placed in a public area for the purpose of letting subscribers with a valid chip card make telephone calls.

Some telephone companies offer free local calls to their
25 subscribers. In this instance, the caller does not need to be connected to the server to verify his balance if he only wants to make a local call. In another alternative embodiment, an extra pushbutton is added to the CPE. A preprogrammed number is associated with the pushbutton. To make a local call, the
30 caller simply lifts up the handset and commences dialing, as he would with a normal telephone. To make a charged call, he first lifts the handset and presses the pushbutton, thereby triggering the CPE to dial the server. Once connected to the

server, the call sequence that follows is the same as in the preferred embodiment.

Brief Description of the Drawings

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Figure 1 shows the schematic diagram of the invention.

Figure 2 shows the flow chart of the present method of making prepaid calls.

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Figure 3 shows a call flow chart illustrating the status of the phone and the server at every stage.

Figure 4 illustrates the communication call flow.

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Figures 5a and 5b show the circuit diagram of the preferred CPE embodiment.

Detailed Description of the Preferred Embodiment

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To facilitate a complete understanding of the invention, the description of the preferred embodiment is arranged within the following sections:

1. GLOSSARY OF TERMS AND ACRONYMS

25

2. OVERVIEW OF SYSTEM COMPONENTS AND OPERATION

1. GLOSSARY OF TERMS AND ACRONYMS

The following terms and acronyms are used throughout the detailed description:

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CPE - Customer Premises Equipment - A telephone apparatus with a chip card reader and a means to display text messages, preferably housed within the same unit

CAS- CPE Alert Signal

The characteristics of the CAS signal are:

- Frequency Limits: Lower tone: 2130 Hz+/-0.5%
Upper tone: 2750 Hz+/-0.5%
- Dynamic range : -32 to -14dBm per tone
- Power differential within dynamic range: 0 to 6db
between tones
- Tone Duration : 75 to 85 ms

10 DTMF- Dual Tone Multi Frequency

The characteristics of the DTMF tones are:

- DTMF tones (send only) Frequency limits:
- High or Low Frequency tolerance: +/- 0.5%
- Power level (lower tone): -9.5 +/- 1dB
- Power level (upper tone): -7.5 +/-dB
- Tone duration: 55 to 65 ms

FSK- Frequency Shift Keying

The physical characteristics of the FSK signal are:

- Bell 202 1200 baud FSK (Frequency Shift keying) signals.
- Modulation Type: Continuous phase binary frequency shift
keying
- Mark(logical 1) :1200+/-12Hz
- Space(logical 0) :2200+/-22Hz
- Received Signal Level 1200 Hz: Between -32dBm and -12dBm
- Received Signal Level 2200 Hz: Between -36dBm and -12dBm
- Signal-to-distortion ratio: >=25dB
- Transmission rate: 1200 +/- 12 baud
- Application Of Data: Serial, Binary, asynchronous

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SPCS- Stored Program Controlled System, which will be referred to commonly as a server which is a processor and operational platform to provide the network to access interface and to

perform the functions of controlling, processing, monitoring, managing and maintaining the telephone system. Among its network access functions are PSTN, intelligent network, WAN and LAN. However, it is not restricted to the above and may
5 perform other functions that can be carried out using a telephone link.

Hotline connection- a connection between the user's CPE and the server, whereby this connection allows the CPE to be
10 actively connected to the server as soon as the handset is lifted. The said connection is configured at the local exchange and will only allow the subscriber to make a call through the server.

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2. OVERVIEW OF SYSTEM COMPONENTS AND OPERATION

Figures 1 to 4 illustrate the described method of making prepaid calls. The method basically comprises a CPE apparatus (10), a server (15) or a Credit Management System (hereinafter
20 known as CMS), Public Switching Telephone Network (PSTN) (20) and means of interconnecting them. The combination of the CMS, CPE and means of interconnecting them through the PSTN shall be referred to as the system.

25 According to the flowchart in Figure 2, the CPE (10) goes into off-hook state when the handset is lifted. The server detects the CPE being in off-hook state and sends a CPE alert signal (CAS) to the CPE, causing the CPE to enter the Data state whereby the CMS will send a message requesting the card to be
30 inserted, said message being displayed on the LCD screen of the telephone (10). The CMS (15) then sends an Enable Card Reader message to the CPE, causing the CPE to wait for the card (14) to be inserted. Once the card (14) is inserted, data

on the card (14) is read and sent to the CMS (15). The method in which the data is sent will be elaborated later.

Once the data is received and processed by the CMS, it
5 acknowledges this by sending a text message showing the balance in the said account. The user (12) then enters the destination telephone number using the keypad, the CMS acknowledges this by sending an appropriate text message. During the rest of the call, messages from the server maybe
10 displayed.

When the CMS sends a message to be displayed on the CPE's LCD screen, it first sends a CAS tone while the telephone is in off-hook state. After the CPE detects this tone, it disables
15 the keypad and mutes the microphone and receiver. Now the CPE enters the DATA state. After reception of the CAS signal, the CPE acknowledges the detection of this signal by sending a DTMF 'A' to the server. Once this is done it starts sending a message by using FSK transmission.

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The CPE sends the chip card (14) data using FSK transmission. During this time the CPE is in the Data state. After the FSK transmission, the CPE un-mutes the microphone and the receiver, which then enables the keypad and enters the normal
25 off hook state (non Data state).

The system is capable of communicating with the (off-hook) CPE. The communication serves two basic functions:

- Remote reading of the chip card (14) data.
- 30 - Sending messages to the said CPE's display e.g. request for chip card (14) insertion, inform the user about his credit or the number dialled, etc.

The CPE according to the present invention is for use in customer premises. The said apparatus is basically a conventional telephone with basic functions such as:

- Handset voice communication.

5 - Ringer to alert the user of incoming calls

- Keypad

- The said apparatus is added with two other features i.e.

i) LCD display device that is used for:

- Displaying messages from the server.

10 - Displaying user key entries while dialing.

ii) chip card (14) receiving means preferably within the housing of the apparatus,

- Reads the data on the chip card and sends it to the server for verification.

15

The CPE has two basic operational modes whereby the user can place a call provided he has sufficient credit with the service provider or a user may accept a call regardless of his credit balance.

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A user employs a chip card (14) to identify himself to the system and the CMS decides whether the user has enough credit to place a call.

25 Basically the connection between the CPE and the PSTN is through the remote server. The Credit Management System monitors the line and is capable of controlling access to the PSTN to allow or prevent a connection, depending on available balance and circumstances.

30

The call flow is illustrated in detail in Figure 3. Without first inserting a chip card (14), a user picks up the handset, taking the CPE off-hook, after which the message "Ezeephone

Ready" or a similar message is displayed. The Credit Control System then sends a Card Request message and the display shows a text similar to "Please insert Card" (this text is defined by the Credit Management System). The Card Request message
5 however, may include a field that causes the keyboard being blocked from further use.

The user now has to insert his chip card whereby inserting the card triggers a message to be sent to the server. If the CMS
10 decides there is still sufficient credit for the user, the server sends a message containing screen data informing the user about the amount of credit available and a special field that un-blocks the keypad. At this stage the user may dial a number, in this case a public number.

15 If the user has no more credit the server has the option to block (or not un-block if already blocked) the keypad through a special field in a data message. This message will usually contain screen data to inform the user about his lack of
20 credit.

In a situation where the card (14) is inserted before the handset is lifted, the operation is almost identical to the one described above, whereby after reception of the CAS
25 signal, the CPE acknowledges the detection of this signal by sending a DTMF 'B' to the server. Only the 'card request screen' data from the server is suppressed. The CPE immediately sends the card data without showing the request message to the user.

30 When accepting a call, the process starts with a ring signal from the Telephone Exchange. Like any other phone the CPE operates its ringer. When the user lifts the handset the voice path is established. The Credit Management System can

interrupt the voice path to display a message on the screen, for example, the caller ID. Replacing the handset activates the hook switch, which terminates the call. Any messages from the Credit Management System will be cleared, the display is
5 switched off and the telephone goes back in low power mode.

Due to the absence of a mains line power supply, the CPE is fully powered by the exchange, just like a normal telephone. In off-hook mode, care is taken to limit the power consumption
10 to an absolute minimum. However to meet the high on-hook impedance requirement, current drawn from the exchange must be minimal. This is accomplished by switching off the LCD display and other peripherals and placing the controller in a low-power (sleep) mode. While in the low power mode no part of the
15 system will be serviced and keypad entries are ignored.

The ring signal is handled by an independent circuit which, seen from the exchange, is functionally similar to an old fashioned, electro-mechanical ringer. This circuit is extended with a sample and hold circuit, which informs the MCU (Main
20 Controller Unit) that there has been a ring signal during the last 5 seconds.

The hook-switch is the only means of awakening the system from its power down mode. The CAS-FSK mechanism shall be enabled
25 during all calls, both incoming and outgoing.

Figures 5a and 5b shows the circuit diagram and the explanations are as follows. Accordingly, when the CPE is in off-hook state, i.e., when the handset is lifted, power from
30 the line flows through a full wave bridge rectifier circuit D1, which consists of 4 diodes. Schottky diodes are used to provide low voltage drop in order to get maximum power from the telephone line. At this stage a remote server detects the CPE is in off-hook condition and sends a CAS (Call Alert

Signal) tone. The manner the server detects and returns signals will not be explained as it is beyond the scope of the present invention. The said diodes are connected to a filter circuit comprising a resistor and a capacitor. An off-hook
5 detector made up of a switching circuit comprising a transistor is connected in parallel to the filter circuit. The output of the switching circuit is fed to the micro controller so that it can detect the CPE in its off-hook state. When the CPE is in off-hook state, the line voltage VL activates the
10 integrated phone circuit. It should be noted that the CPE according to the present invention may still work but less efficiently without the use of the filter circuit and the switching circuit. In this embodiment, instead of using the output of the switching circuit, VL is fed to the micro
15 controller to determine if the CPE is off-hook or not.

According to the preferred embodiment, once the CAS signal is received from the server, an appropriate DTMF signal is sent by the CPE as acknowledgment. At this stage the micro
20 controller sends relevant signals to the integrated phone circuit switch to mute the receiver, microphone and disable the keypad. The server, upon detecting the appropriate DTMF signal, sends an FSK message, and a signal to the micro controller to enable the card reader. The micro controller
25 receives the data sent from the server and displays the message on the LCD display unit. Once the complete message is received and the checksum verified, the CPE sends appropriate DTMF tones as acknowledgment. The checksum is a means of identifying whether an erroneous message has been received. If
30 the checksum is not okay, the micro controller un-mutes the microphone and receiver, enables the keypad and rejects the whole message.

After a short period of around 100ms after the transmission of the last DTMF tone, a check is made where before the message to insert card is sent to the micro controller, the micro controller un-mutes the receiver but keeps the microphone
5 muted and waits for card insertion. If the said message was not passed then the micro controller un-mutes the microphone and receiver and enables the keypad. The CPE goes back to off-hook state. The software stored in the micro controller checks the validity of the received message.

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If a message is not sent within a certain period, the micro controller un-mutes the microphone and receiver and enables the keypad. The message basically requests the user to insert the chip card. The user upon reading the message inserts the
15 said chip card. The micro controller detects card insertion, then reads the data stored in the card and sends it to the remote server through FSK data burst. During this state, the receiver and microphone are muted and the keypad disabled. A short period (within milliseconds) after the FSK transmission,
20 the micro controller un-mutes the microphone and receiver and enables the keypad, and the CPE is in off-hook state.

If the card is valid, the phone receives the message in FSK transmission and displays it. The micro controller also
25 receives keypad enable signal from the server to enable the keypad. The micro controller accordingly sends signal to the Integrated phone circuit to enable the keypad and also to un-mute the receiver and microphone.

30 The user upon looking at the display unit requesting for a number to be dialed, keys in the desired number. The numbers are displayed on the display unit for the convenience of the user. The keyed digits are sent via DTMF tones to the server, which forwards the call to the PSTN. As in any conventional

phone call, when the call goes through, the caller hears a ring back tone and when the called party answers, the user starts conversing. At this stage the micro controller receives messages at a predetermined interval from the server to
5 display the amount left in the user's account. The manner in which the amount is decremented is done by the server unit and is beyond the scope of the present invention.

When the handset is placed on-hook, the CPE is in on-hook
10 state where D2 is connected to the power supplied by the telephone line. The phone has a conventional ringer circuit connected to it. To detect a ring signal, an opto-coupler and said D2 circuit is added. Instead of an opto-coupler, other galvanic isolation means maybe used. The circuit is also
15 extended with a sample and hold unit that informs the micro controller that there has been a ring signal during the last 5 seconds and also to determine if a call is incoming or outgoing.

20 In the payphone embodiment, the CPE, in an appropriate housing, is placed in a public area so that members of the public with a valid chip card may place calls from the CPE. The sequence of actions is the same as elaborated above.

25 In the alternative embodiment, with free local calls, an extra pushbutton is added to the CPE. A number can be preprogrammed to be associated with the pushbutton. Upon the button being pushed, the preprogrammed number is dialed by the CPE. In this case, a hotline connection to the exchange is not necessary.
30 To make a local call, the caller simply lifts up the handset and commences dialing, as he would with a normal telephone. The local exchange makes the connection with the called number and the call proceeds, as would a normal telephone call. To make a charged call, he first presses the pushbutton, thereby

initiating the CPE to dial the preprogrammed number. This number is the remote server's number and enables the exchange to connect the CPE to the remote server. The call sequence that follows after this is the same as in the preferred
5 embodiment.

While the invention has been described herein with reference to certain preferred embodiments, these embodiments have been presented by way of example only, and not to limit the scope
10 of the invention.

Accordingly, the scope of the invention should be defined only in accordance with the claims that follow. In the following claims, reference characters used to designate claim steps are
15 provided for convenience of description only, and are not intended to imply any particular order for performing the steps.

Claims

1. A method and apparatus for providing prepaid telephone calls comprising:

- 5 (i) A fixed line telephone set, hereinafter referred to as consumer premises equipment or CPE, having a means to read and send data from chip cards for ID verification and a display to show status messages from the remote server;
- 10 (ii) A remote server, workstation and node system for receiving and processing the information so provided;
- (iii) A means of connecting the CPE and remote server via a telephone exchange such that when the CPE handset
- 15 is lifted, it is automatically connected to the said remote server; and
- (iv) A connection between the telephone exchange and said remote server for verifying the identity of the caller when the CPE handset is lifted.

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2. A method of providing prepaid telephone calls as claimed in claim 1, wherein the CPE receives a CPE Alert Signal or CAS tone from the server as soon as it has been connected to said server by the local exchange.

25

3. A method of providing prepaid telephone calls as claimed in any claims 1 to 2, wherein said when CAS tone received by the CPE, said CPE sends a Dual Tone Multi Frequency or DTMF signal to the server and said server upon receiving the DTMF signal

30 sends a Frequency Shift Keying or FSK message to the CPE.

4. A method of providing prepaid telephone calls as claimed in any claim 1 to 3, wherein before allowing a call, the CPE enables the keypad and un-mutes the receiver.

5. A method of providing prepaid telephone calls as claimed in any claim 1 to 4, wherein the connection between the telephone and the server is via a hotline connection configured at the local exchange which is active as soon as the CPE handset is in off-hook state and is connected to the server.

6. A CPE which includes a chip card reader, a display unit and a circuitry for sending the data of the card to a remote server and receiving appropriate signals from the said server in order to enable the user to make a call if there is sufficient balance in the user's account stored in the remote server, whereby the said CPE is only line powered;

- The said CPE circuitry further comprises a CAS receiving means to acknowledge the phone is in off-hook state and accordingly to mute the receiver, microphone and disable the keypad;
- a DTMF generator means to send appropriate DTMF signal to a remote server;
- a FSK signal sending and receiving means, and means to convert and display said signal on display unit;
- a chip card reader to read an external chip card and send the data within the said card to the said remote server;
- means to enable keypad and un-mute receiver and microphone when there is sufficient balance in the user's account to allow the user to dial the intended number.

7. A CPE as claimed in any claim 1 to 6, wherein the message data to be displayed is received from the remote server via FSK signaling.

8. A method of providing prepaid telephone calls as claimed in any claim 1 to 7, where as an alternative to a hotline connection to the local exchange, the connection between the

telephone and the server is made using a preprogrammed number to dial the server.

9. A CPE as claimed in any claim 1 to 8, where alternatively,
5 an extra push button may be added, which is associated with a preprogrammed number, whereby upon pressing the push button, the CPE proceeds to dial the preprogrammed number and is subsequently connected to the remote server.