Consumer Access Device

The present invention relates to a consumer access device (CAD) for use with at least one smart meter (or other usage measurement device) which can interact with at least one other consumer access device. The present invention further relates to methods of linking CADs and methods of interaction between CADs.

Consumer access devices are known to be provided to domestic utility consumers to inform them of their current energy consumption and also communicate some data to the cloud. In more sophisticated cases they can also inform a consumer when a cheaper tariff is available. Generally speaking, CADs are intended to encourage lower and/or smarter energy consumption.

One problem is that a typical consumer struggles to truly understand or get a “feel” for their energy consumption. Energy data can be rather dry and it can be difficult to generate enthusiasm within a household for saving energy.

It is an object of the present invention to ameliorate this problem.

According to the first aspect of the present invention there is provided a consumer access device for a smart energy system, the consumer access device comprising:

a processor,

first memory for storing at least one application,

second memory for secure storage of data representing utility usage,

a first transceiver configured to communicate with a domestic smart meter or Current Transformer (CT) clamp to receive secure utility data representing utility usage from the domestic smart meter or CT clamp, and

a second transceiver configured to communicate with at least one server,

the processor being programmed to store the secure utility data representing the utility usage received via the first transceiver in the second memory,

the processor also being programmed to execute at least one application stored in the first memory,

the processor further being programmed to request that the server establish a link to another consumer access device,

the processor additionally being programmed to respond to a request from a server to establish a link with at least one further consumer access device, to accept the request.

The first communication means preferably comprises a ZigBee™ transceiver and the second communication means preferably comprises a WiFi™ transceiver.

In order to enhance flexibility, the CAD is preferably further arranged to communicate with more than one smart utility meter to receive utility data representing consumption of more than one utility.

According to a second aspect of the present invention there is provided a method of linking at least first and second consumer access devices located at separate premises in a smart energy system so that, after linking, their respective consumers can interact via their respective consumer access devices, each of the first and second consumer access devices comprising a processor, first memory for storing at least one application, second memory for secure storage of secure utility data representing utility usage, a first transceiver configured to connect to a respective smart energy meter or Current Transformer (CT) clamp to receive the secure utility data from the domestic smart meter or CT clamp, and a second transceiver configured to communicate with at least one server, the processor being programmed to store the secure utility data received via the first transceiver in the second memory, the processor also being programmed to execute at least one application stored in the first memory, the processor further being programmed to request that the at least one server establish a link with another consumer access device, the processor additionally being programmed to respond to a request from the server to establish a link with the another consumer access device, to accept the request, the method performed by the server and comprising:

receiving, from the first consumer access device or a first user device associated with the first consumer access device, an indication of the identity of another consumer,

confirming that the another consumer has the second consumer access device,

sending an invitation to the second consumer access device or to a second user device associated with the second consumer access device, the invitation identifying the consumer associated with the first consumer access device, and

in response to a positive reply from the second consumer access device or from the second user device associated with the second consumer access device, storing data identifying that the first and second consumer access devices are linked and communicating link data to the first and second consumer access devices to enable the first and second consumer access devices to link to each other and to interact with each other after linking.

The indication of the identity of the another consumer may comprise at least one of street address, customer number, customer name, postal code and property number, and unique consumer access device identity.

According to a third aspect of the present invention, there is provided a method of communicating first data to both a first consumer access device and a second consumer access device, each of the first and second consumer access devices comprising a processor, first memory for storing at least one application, second memory for secure storage of data representing utility usage, a first transceiver configured to communicate with a domestic smart meter or CT clamp to receive second data comprising secure utility data representing utility usage from the domestic smart meter or Current Transformer (CT) clamp, and a second transceiver configured to communicate with at least one server, the processor being programmed to store the second data received via the first transceiver in the second memory, the processor also being programmed to execute at least one application stored in the first memory, the processor further being programmed to request that the server establish a link with another consumer access device, the processor additionally being programmed to respond to a request from a server to establish a link with at least one further consumer access device, to accept the request the method performed by a server and comprising:

receiving, at a server, a request from a first consumer access device or a first user device associated with the first consumer access device to communicate first data to the first and second consumer access devices,

confirming that the first and second consumer access devices comprise linked consumer access devices, and

communicating the first data to the first and second consumer access devices.

The linking data may comprise address data for peer-to-peer linking of the first and second consumer access devices.

This method allows a two-player game to be provided across two separate CADs. Each player uses their user device (or an interface built into the CAD) to control the gameplay and the game is displayed on both of the CADs. The server is preferably programmed to also communicate data from a user device associated with the second consumer access device to communicate data to the first and second consumer access devices.

For certain games, for example action games such as Pong, the server is preferably further programmed to periodically transmit the same data to the first and second consumer access devices. This allows the displays of the CADs to be updated more-or less simultaneously and to display the same image. In some circumstances it will be desired to show different images such as YOU WIN to the victor and YOU LOSE to the loser.

According to the fourth aspect of the present invention there is provided a method of communicating between a first consumer access device and a second consumer access device, each of the first and second consumer access devices comprising a processor, first memory for storing at least one application, second memory for secure storage of second data comprising secure utility data representing utility usage, a first transceiver configured to communicate with a domestic smart meter or Current Transformer (CT) clamp to receive the second data from the domestic smart meter or CT clamp, and a second transceiver configured to communicate with at least one server, the processor being programmed to store the second data received via the first transceiver in the second memory, the processor also being programmed to execute at least one application stored in the first memory, the processor further being programmed to request that the server establish a link with another consumer access device, the processor additionally being programmed to respond to a request from a server to establish a link with at least one further consumer access device, to accept the request, the method performed at a server and comprising:

receiving, at a server, a request from the first consumer access device to communicate first data to the second consumer access device,

confirming that the first and second consumer access devices comprise linked consumer access devices, and

sending the first data to the second consumer access device.

This aspect is concerned with CAD-to-CAD transmission and has particular application to protection of vulnerable consumers. Should the first CAD detect an uncharacteristic energy consumption pattern in the home of a vulnerable consumer, then carers, friends or family members can be informed by way of an alarm signal sent to their respective CADs.

Since the carers may not be at home, the server is preferably also programmed to send the data to at least one user device associated with the second consumer access device.

According to a fifth aspect of the present invention there is provided a method of sharing energy usage data between at least a first consumer access device

and a second consumer access device, each of the first and second consumer access devices comprising a processor, first memory for storing at least one application, second memory for secure storage of data comprising secure utility data representing utility usage, a first transceiver configured to communicate with a domestic smart meter or Current Transformer (CT) clamp to receive the secure utility data from the domestic smart meter or CT clamp, and a second transceiver configured to communicate with at least one server, the processor being programmed to store the secure utility data received via the first transceiver in the second memory, the processor also being programmed to execute at least one application stored in the first memory, the processor further being programmed to request that the server establish a link with another consumer access device, the processor additionally being programmed to respond to a request from a server to establish a link with at least one further consumer access device, to accept the request, the method comprising:

receiving energy usage data from the first consumer access device, and

sending energy usage data to the second consumer access device.

The sending of energy usage data may occur over a peer-to-peer connection to reduce load on the server.

The sending of energy usage data may occur via a server to provide enhanced visibility and control of the data sharing process.

In either case, the energy usage data from the first consumer access device is preferably abstracted before sending it to the second consumer access device. This abstraction reduces the accuracy or granularity of the data, improving the security of the consumer's data.

According to an embodiment, there is provided a consumer access device for a smart energy system, the consumer access device comprising:

a processor,

first memory for storing a plurality of applications,

second memory for secure storage of consumer utility usage,

first communication means for receiving secure data representing utility usage, and

second communication means for communicating with at least one server to download at least new applications for the consumer access device,

the processor being programmed to store secure data representing utility usage via the first communication means in the second memory,

the processor also being programmed to download a plurality of applications to the first memory and to execute applications stored in the first memory,

the processor further being programmed in response to a request for secure data from an application, to provide the secure data to the application.

5 By providing a secure consumer access device that is capable of downloading, storing and executing applications that can utilise energy consumption data opens up a whole host of possibilities, such as allowing third parties to develop applications. Third party applications

The second communication means preferably comprises a WiFi™ transceiver. This provides low-cost access to the Internet but could equally be replaced or augmented by a mobile data link.

The consumer access device preferably also comprises a fourth communication means for communicating with appliances on the premises. The fourth communication means could comprise a Machine-to-Machine (M2M) transceiver and/or a powerline transceiver.

The CAD is preferably programmed to receive consumption data in respect of more than one utility. For example, the CAD may be programmed to receive data from two smart utility meters.

The CAD may be programmed to execute the plurality of applications in succession. Successive applications may be launched after a predetermined time (that may differ between applications) or in response to user input. This allows the consumer to toggle to the application of interest rather than have to wait and the consumer can decide which. Alternatively, the CAD may be programmed to execute some or all of the applications in a sequence selected by the consumer. Some applications ("background applications") may be arranged to execute in succession until a consumer requests execution of a particular application ("foreground application") such as a game. The user may also customise their experience within applications by selecting one display ("card") and also selecting the particular information displayed on a card.

The CAD is preferably programmed to inform the consumer of the data that will be shared with a particular application before download to ensure that consumer privacy obligations are not breached. In respect of certain applications, the consumer may select the extent to which data is shared or even customise the accuracy of the data shared. Where the consumer limits data sharing to lower accuracy data, this may impact the quality or responsiveness of the application. The provider of the application may specify a minimum level of data accuracy.

According to another embodiment there is provided a home area network comprising at least one smart meter, a consumer access device according to an earlier embodiment and a user device, the at least one smart meter arranged to transmit data representing utility usage to the consumer access device in encrypted form, and the consumer access device and the user device being arranged to interact via a server.

According to an embodiment there is provided a method of operating a consumer access device in accordance with the earlier embodiment, the method comprising:

sending a request, by the processor under control of one of the plurality of applications, for secure data representing utility usage stored in the second memory,

receiving the request, by the processor under control of secure software, for secure data,

verifying the request, by the processor under control of secure software, to ensure that the one of the plurality of applications is entitled to the requested secure data,

sending, by the processor under control of secure software, the requested secure data to the one of the plurality of applications.

The step of sending the requested secure data preferably comprises storing the secure data in a container in the first memory, which container is unique to the one of the plurality of applications.

The method preferably further comprises abstracting the secure data representing utility usage before sending the data to the one of the plurality of applications.

By arranging for the processor to have two separate roles (i.e. application execution and secure data management) confidentiality of user consumption data is preserved.

According to another embodiment there is provided a method of pairing a consumer access device according to an earlier embodiment with a user device according to an earlier embodiment, the method comprising:

sending a message, from the user device to a server, requesting that the user device be paired with the consumer access device,

receiving, at the user device, a reply from the server, the reply instructing user activation of the consumer access device,

sending, by the consumer access device, at least one message to the user device,

sending, by the user device, at least one message to the consumer access device,

receiving, at the user device, the at least one message from the consumer access device,

receiving, at the consumer access device, the at least one message from the user device,

storing, at the consumer access device, pairing information received from the user device, and

storing, at the user device, pairing information from the consumer access device.

By pairing a consumer access device with a user device, the consumer may use the sophisticated user interface provided, for example, on a smartphone to control the CAD. This permits the CAD to be a simpler device and allows for cost savings relative to a CAD with a full interface (for example a touch screen).

The method of pairing may alternatively comprise:

receiving, at a server, a message from the user device, the message requesting that the user device be paired with an identified consumer access device,

confirming, at the server, that the user device is associated with the same consumer as the consumer access device, and

storing, at the server, pairing information for the user device and the identified consumer access device.

This variation on the method has the advantage of requiring less sophisticated hardware at the consumer access device.

According to another embodiment, there is provided a method of downloading an application to a consumer access device according to an earlier embodiment, the method comprising:

requesting, by a message from a user device to a server, an application to be downloaded,

receiving, at the consumer access device, the application software from a server,

installing, at the consumer access device, the application software, and

receiving, at the user device, confirmation of the installation.

By controlling the download of CAD applications from a user device, the CAD may be provided with only a rudimentary user interface (UI) which reduces cost and complexity.

DESCRIPTION OF THE FIGURES

The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

CLAIMS

1. A consumer access device for a smart energy system, the consumer access device comprising:

a processor,

first memory for storing at least one application,

second memory for secure storage of data representing utility usage,

a first transceiver configured to communicate with a domestic smart meter or Current Transformer (CT) clamp to receive secure utility data representing utility usage from the domestic smart meter or CT clamp, and

a second transceiver configured to communicate with at least one server,

the processor being programmed to store the secure utility data representing the utility usage received via the first transceiver in the second memory,

the processor also being programmed to execute at least one application stored in the first memory,

the processor further being programmed to request that the server establish a link with another consumer access device,

the processor additionally being programmed to respond to a request from a server to establish a link with at least one further consumer access device, to accept the request.

2. The consumer access device of claim 1, further comprising a display.

3. The consumer access device of either claim 1 or claim 2, wherein the processor is further programmed to obtain confirmation from a consumer prior to accepting the request from the server.

4. The consumer access device of claim 1, claim 2 or claim 3, wherein the processor is further programmed to download applications to the first memory.

5. The consumer access device of any one of claims 1 to 4, wherein the processor is further programmed to pair with at least one user device to provide a user interface.

6. The consumer access device of any one of the claims 1 to 5, further comprising a third transceiver comprising a short range wireless transceiver.

7. The consumer access device of claim 6 wherein the third transceiver comprises a Bluetooth™ transceiver.

8. The consumer access device of any one of the claims 1 to 7, wherein the first transceiver comprises a ZigBee™ transceiver, and/or wherein the second communication means comprises a WiFi™ transceiver.

9. The consumer access device of any one of the claims 1 to 8, wherein the processor is further programmed to receive utility data representing consumption of more than one utility.

10. A method of linking at least first and second consumer access devices located at separate premises in a smart energy system so that, after linking, their respective consumers can interact via their respective consumer access devices, each of the first and second consumer access devices comprising a processor, first memory for storing at least one application, second memory for secure storage of secure utility data representing utility usage, a first transceiver configured to connect to a respective smart energy meter or Current Transformer (CT) clamp to receive the secure utility data from the domestic smart meter or CT clamp, and a second transceiver configured to communicate with at least one server, the processor being programmed to store the secure utility data received via the first transceiver in the second memory, the processor also being programmed to execute at least one application stored in the first memory, the processor further being programmed to request that the at least one server establish a link with another consumer access device, the processor additionally being programmed to respond to a request from the server to establish a link with the another consumer access device, to accept the request, the method performed by the server and comprising:

receiving, from the first consumer access device or a first user device associated with the first consumer access device, an indication of the identity of another consumer,

confirming that the another consumer has the second consumer access device,

sending an invitation to the second consumer access device or to a second user device associated with the second consumer access device, the invitation identifying the consumer associated with the first consumer access device, and

in response to a positive reply from the second consumer access device or from the second user device associated with the second consumer access device, storing data identifying that the first and second consumer access devices are linked and communicating link data to the first and second consumer access devices to enable the first and second consumer access devices to link to each other and to interact with each other after linking.

11. The method of claim 10, wherein the link data communicated to the first and second consumer access devices comprises address data for a peer-to-peer connection between the first and second consumer devices.

12. The method of claim 11 or claim 12, wherein the indication of the identity of the another consumer comprises at least one of street address, customer number, customer name, postal code and property number, and unique consumer access device identity.

13. A method of communicating first data to both a first consumer access device and a second consumer access device, , each of the first and second consumer access devices comprising a processor, first memory for storing at least one application, second memory for secure storage of data representing utility usage, a first transceiver configured to communicate with a domestic smart meter or CT clamp to receive second data comprising secure utility data representing utility usage from the domestic smart meter or Current Transformer (CT) clamp, and a second transceiver configured to communicate with at least one server, the processor being programmed to store the second data received via the first transceiver in the second memory, the processor also being programmed to execute at least one application stored in the first memory, the processor further being programmed to request that the server establish a link with another consumer access device, the processor additionally being programmed to respond to a request from a server to establish a link with at least one further consumer access device, to accept the request the method performed by a server and comprising:

receiving, at a server, a request from first consumer access device or a first user device associated with the first consumer access device to communicate first data to the first and second consumer access devices,

confirming that the first and second consumer access devices comprise linked consumer access devices, and

communicating the first data to the first and second consumer access devices.

14. A method of claim 13, further comprising:

receiving, at the server, a request from a second consumer access device or a second user device associated with the second consumer access device to communicate first data to the first and second consumer access devices, and

communicating the first data to the first and second consumer access devices.

15. A method of claim 13 or claim 14, wherein the server is further programmed to periodically transmit the same first data to the first and second consumer access devices.

16. A method of communicating between a first consumer access device and a second consumer access device , each of the first and second consumer access devices comprising a processor, first memory for storing at least one application, second memory for secure storage of second data

comprising secure utility data representing utility usage, a first transceiver configured to communicate with a domestic smart meter or Current Transformer (CT) clamp to receive the second data from the domestic smart meter or CT clamp, and a second transceiver configured to communicate with at least one server, the processor being programmed to store the second data received via the first transceiver in the second memory, the processor also being programmed to execute at least one application stored in the first memory, the processor further being programmed to request that the server establish a link with another consumer access device, the processor additionally being programmed to respond to a request from a server to establish a link with at least one further consumer access device, to accept the request, the method performed at a server and comprising:

receiving, at a server, a request from the first consumer access device to communicate first data to the second consumer access device,

confirming that the first and second consumer access devices comprise linked consumer access devices, and

sending the first data to the second consumer access device.

17. The method of claim 16, wherein the first data communicated to the second consumer device is alarm data in response to uncharacteristic energy consumption detected by the first consumer access device.

18. The method of claim 16 or claim 17, further comprising

sending the first data to at least one user device associated with the second consumer access device.

19. A method of sharing energy usage data between at least a first consumer access device and a second consumer access device, each of the first and second consumer access devices comprising a processor, first memory for storing at least one application, second memory for secure storage of data comprising secure utility data representing utility usage, a first transceiver configured to communicate with a domestic smart meter or Current Transformer (CT) clamp to receive the secure utility data from the domestic smart meter or CT clamp, and a second transceiver configured to communicate with at least one server, the processor being programmed to store the secure utility data received via the first transceiver in the second memory, the processor also being programmed to execute at least one application stored in the first memory, the processor further being programmed to request that the server establish a link with another consumer access device, the processor additionally being programmed to respond to a request from a server to establish a link with at least one further consumer access device, to accept the request, the method comprising:

receiving energy usage data from the first consumer access device, and

sending energy usage data to the second consumer access device.

20. The method of claim 19 wherein the sending of energy usage data occurs over a peer-to-peer connection or via a server.