
Access system for users of a refuse container and method for operating an access system
for refuse containers

Description

The present invention relates to a system for checking and controlling access for a user to a refuse container and to a method for checking and controlling access for a user to a refuse container.

5 Systems for checking and controlling access for a user to a refuse container for disposing of household refuse, for example, are known in the art. These often relate to large-scale refuse containers, which are provided and used by several households. Such refuse containers can belong to a household or community, for example. Only registered users are generally intended to obtain access to such refuse containers, it being possible to block access, for example if the disposal costs are not paid. Such access can be provided by a wide variety of
10 electronic systems. It is known in the art, for example, that an identification code is assigned to a user. This identification code is entered using a numeric keypad arranged on the refuse container, for example. The corresponding authentication process is carried out either by a local control unit in the refuse container or via a central server, which is connected to the
15 local control unit of the refuse container. After the authentication process, the refuse container is then temporarily opened and the user can dispose of his/her refuse.

Another system is known from US 2015 / 0307273 A1, for example. Said document describes a refuse container comprising a remote-controlled locking mechanism, a control unit,
20 various sensors and a communication module. The fill level, the weight of the refuse that is disposed of or the movement of the lid can be detected using the various sensors, for exam-

ple. By means of corresponding communication interfaces, the refuse container and a server are integrated in a common network. A Smartphone can also be integrated in this network and used to request access to the refuse container or to retrieve information via the system.

- 5 One problem of such systems is that the communication between the refuse container and the server is energy-intensive and generates costs due to the use of network resources.

In particular in refuse containers that are not assigned to any households but are placed in public places, it is often problematic to supply energy since the energy supply has to be protected against access by unauthorised parties. In addition, energy suppliers require measuring apparatuses that measure how much energy is used for billing purposes. These measuring apparatuses often cost many times more than the energy costs, and therefore alternative solutions are desirable here. Former proposed solutions include, for example, the decentralised power supply by means of batteries, solar cells or generators (converting wind energy or mechanical energy introduced by the user). However, these solutions are also costly and increase the size of the refuse container while providing the same capacity, which is also undesirable in public places.

Additional costs are incurred from the use of mobile connections that is often provided for transferring data between a server and a refuse container. The refuse container must be equipped with corresponding and electricity-consuming transmission technology for such data transfer. Such refuse containers are therefore relatively expensive and require power in order to communicate via the mobile network, this communication also generating costs and administrative effort due to the fees charged by the mobile network operator.

25 Therefore, the object of the present invention is to provide a system that overcomes or at least minimises the above-mentioned disadvantages.

This object is achieved by the independent claims, in particular the system according to claim 1 and the method according to claim 9.

An essential aspect of the invention is a system for checking and controlling access for a user to a refuse container, comprising a refuse container having an electronic control unit, which comprises a first communication interface for sending and receiving data and a server that is arranged at a distance from the refuse container and comprises a second communication interface, an authentication manager and a database. In order to identify a user before using the refuse container, it is possible to initiate a transfer of data between the first communication interface and a third communication interface of a communication apparatus, which apparatus can be assigned to a user. The authentication manager assigns user data from the database to the data and said user can be given or denied access to said refuse container on the basis of this assignment. It is essential here that the first communication interface does not comprise any devices for directly transferring data to the second communication interface, but the communication apparatus that can be assigned to the user comprises an interface device, via which indirect data transfer can be initiated between the first communication interface and the second communication interface. The refuse container therefore does not comprise a powerful communication interface, by means of which direct communication (for example via a mobile network) with the server is possible. Instead, in order to exchange data between the refuse container and the server, communication channels are used that are provided by the communication apparatus that can be assigned to a user (for example his/her smartphone). Both the energy requirement for transferring the data to the server via a long-range (wireless at least in portions) network and the grid fees incurred thereby are therefore passed on to the user or his/her communication apparatus. Data therefore only needs to be transferred from the refuse container or the (first) communication interface thereof as far as the communication apparatus of the user. Since, in order to authenticate the user at the refuse container, the communication apparatus (also referred to as a smartphone in the following, even if this only represents a preferred embodiment of a communication apparatus) often also has to be located in the immediate vicinity of said refuse container, transmission technology having a small range and therefore low energy consumption can be used to transfer data between the refuse container and the communication apparatus.

In a particularly preferred embodiment, the transferred data includes identification data. "Data" and "identification data" are also used synonymously in the following, unless explicitly stated otherwise. The term "identification data" can therefore also include other data. For example, it is also conceivable for data to be transferred that is not related to the identification of the user that is currently within range of the first communication channel that can be

formed between the first communication interface and the third communication interface. For example, data relating to updates for software for controlling the refuse container could be transferred. For this purpose, it would be conceivable for individual packets of software to be transferred to a store of the refuse container. This could be carried out by a user either at the same time as, or independently of, the use of the refuse container, provided that any user is within range of the above-mentioned first communication channel. For example, such data packets could also be transferred to a second refuse container while a user uses a first refuse container.

As mentioned above, the communication apparatus is particularly preferably a smartphone. However, a large selection of other communication apparatuses is also possible. In principle, it is possible to use any device as the communication apparatus that is suitable for establishing communication with the refuse container on the one hand and with the server on the other hand. The communication apparatus is preferably a portable data processing apparatus, preferably comprising a display device. Data processing apparatuses are particularly preferably selected from a group comprising a mobile phone, a smartphone, a tablet and a laptop. In particular, the communication apparatus is preferably a smartphone since they are widely used and comprise a plurality of communication interfaces, which can be used to form a data connection to the refuse container on the one hand and/or the server on the other hand. In addition, a smartphone comprises a display device, by means of which information could be sent to the user.

In a preferred embodiment of the system, data is transferred between the first and the third communication interface via a first communication channel, which is different from the second communication channel that is set up for communication between the second and the third communication interface. This therefore allows for the respective communication channels to have different ranges and/or transmitting powers. As a result, asymmetric communication can be formed, whereby the ranges and/or transmitting power of the first communication channel is/are preferably considerably smaller than those of the second communication channel. As a result, for communication between the first and the third communication interface via the first communication channel, the energy requirement is drastically reduced in comparison with that of direct communication between the first and the second communication interface. By integrating the communication apparatus, communication between the first and the second communication interface is still ensured, the increased energy requirement for communication to and from the second communication interface via the second commu-

nication channel being covered by the communication apparatus and/or other network users (for example LAN or WLAN router, internet providers, network infrastructure of a mobile network provider).

Both the first communication interface and the third communication interface are preferably formed such that communication therebetween can be initiated independently. "Independently" means in this case that communication is established when a user is using the refuse container, without the user doing anything. It is still possible for the user or an engineer to establish communication as a one-off. Establishing one-off communication could be "pairing", for example, as it is provided for apparatuses that communicate via Bluetooth. One-time coupling of the interfaces is required for communication via WLAN, too. When the refuse container is subsequently (regularly) used, the interfaces can, however, independently establish this previously established communication connection between the first communication interface and the third communication interface within the context of the above definition.

The communication apparatus is preferably a portable data processing apparatus comprising a display device such as a mobile phone, a smartphone, a tablet or a laptop. Of course, the present invention is not limited to this list and the application of other similar data processing apparatuses can also be considered. The use of mobile phones or smartphones is so common that the vast majority of the members of a corresponding household or community own such a smartphone. The communication apparatus, which is generally nearly always ready to hand, is therefore used as the authentication means for using the refuse container and simultaneously as the communication apparatus for transferring data between the refuse container and the server. Software is preferably installed on the communication apparatus by means of which the transfer of data between the refuse container and the server can be initiated.

In addition, the above-mentioned software could also be used to display information messages, for example in the form of push notifications, on the communication apparatus. Such information messages could be selected from a group comprising information relating to the fill level, when the container will next be emptied, the next refuse container that has free capacity, etc., for example. Push notifications are messages that appear on the communication apparatus without the particular software/app being opened. Such information messages can advantageously contain information relating to the GPS data and/or data from a sensor device integrated in the refuse container. Information relating to the imminent inaccessibility of the refuse container due to the weather, floodings, etc. would also be conceivable. Lastly, the

information provided could also contain information relating to opening times of the next disposal site or civic amenity site. Such (additional) information messages, for example regarding the disposal of refuse, can ensure optimum disposal of the refuse or optimum use of the refuse container on the one hand, and can increase the acceptance of the use of this system (and therefore also enabling the communication channel between the second and third communication interface) on the other hand.

It would also be conceivable to provide the user with information relating to the refuse that he has disposed of. This could be statistics relating to the amount, type, time and location of the refuse disposal, for example. The weight and/or the volume of the refuse disposed of could possibly be used to advise the user of the refuse container of the costs incurred. It would also be conceivable to present positive feedback, for example relating to the user's recycling behaviour. This could be in the form of a bonus program or a game (gamification), for example.

If a refuse container is full, the user (as mentioned above) could be shown the location of the next refuse container that has spare capacity and to which the user has authorised access. If this refuse container is integrated in the same system, access to this alternative refuse container can also be controlled centrally and the user can be granted access. Billing could then also be done by measuring the amount of refuse centrally. The location of the alternative refuse container could be provided in the form of a corresponding map, which is displayed on the communication apparatus.

However, the information provided does not have to be limited to the refuse container or the disposal of refuse. Instead, software installed on the communication apparatus could preferably contain official information and/or personalised information for advertising purposes. Such official information could contain information that relates to the community, such as building work or the like. Reminders for referendums, votes or events could also be displayed by the software by means of the information message.

It would also be conceivable to be able to display personalised information to the user for advertising purposes. Personalised adverts are very attractive for several companies, as the adverts, that are adapted accordingly, can be supplied to a specific clientele. This therefore avoids large numbers of useless adverts. The user data supplied to the content provider can contain the age and/or sex of the user, for example. Corresponding companies can then use

this data to send the user adverts that are suited to him. Furthermore, the user data transmitted can also contain the location of the user (at the refuse container). Adverts limited to the local area can therefore be supplied to the user. Such adverts could contain information relating to the opening of a shop in the surrounding area or a nearby special sale, for example.

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According to another preferred embodiment, the information provider belongs to the server or is an external device. As a result, the information can be supplied to the communication apparatus via the server. The server therefore also comprises a store, in which corresponding information messages can be stored. Alternatively or in addition, the information provider can be independent of the server. The server then advantageously provides the information provider with the corresponding user data.

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It is preferable to use the described system for providing messages to a user of a recyclable materials bank, such as a paper, bottle or plastics banks.

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According to a preferred embodiment, data is transferred between the first and the third communication interface via a first communication channel. At least portions of the first communication channel advantageously use wireless technology. Particularly preferred wireless technology is NFC (near-field communication) technology or RFID (radio-frequency identification) technology. However, it would also be conceivable to use additional wireless technologies such as Bluetooth or wireless LAN. Bluetooth and wireless LAN connections (WLAN) are, however, disadvantageous in comparison to NFC and RFID (as described above) in that the (first-time) connection of two apparatuses has to be done manually by the user.

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The first communication channel for communication between the first and the third communication interface is preferably based on wireless technology that has a low energy consumption and a range of less than 300 m. More preferably, the range of the wireless technology used for the first communication channel is less than 100 m, preferably less than 50 m, preferably less than 30 m, preferably less than 10 m, preferably less than 5 m, preferably less than 3 m, preferably less than 1 m, particularly preferably less than 50 cm. In particular, the wireless technology used for the first communication channel is preferably selected from a group comprising NFC technology, RFID technology and optical transmission technology.

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A “communication channel” shall be understood to mean a transmission path, in this case for the (identification) data. Such a transmission path connects a transmitter and a receiver. This transmitter or receiver is advantageously part of the particular (first/second/third) communication interface. As a result, it is advantageous for the communication apparatus and the refuse container to be provided with a corresponding transmitter or receiver of the particular technology. Complementary transmitter-receiver pairs are preferably provided in the refuse container and the communication apparatus and the communication apparatus and the server. A complementary transmitter-receiver pair is not required in the refuse container and the server and is preferably not provided either.

NFC allows for “connection-affected” or active transmission. This “active-active” transmission, also referred to as “Peer-to-Peer” transmission, represents a preferred embodiment. The initiator and the receiver preferably generate a high-frequency magnetic field and a so-called “handshake” is first carried out, in which authentication is performed and in which various settings are selected, such as the optimum transmission speed. Data is preferably only exchanged thereafter. Due to the mutual authentication, this active transmission is substantially more secure than “passive” transmission (in which at least one communication partner does not actively send the high-frequency magnetic field).

According to another preferred embodiment, at least portions of the second communication channel for communication between the second and the third communication interface is based on wireless technology having a maximum range of more than 30 m. More preferably, the range of the wireless technology used for the second communication channel is more than 100 m, preferably more than 500 m, preferably more than 1 km, particularly preferably several km. The wireless technology used for the second communication channel is particularly preferably wireless technology selected from a group comprising a WLAN connection, mobile connection, GSM connection, UMTS connection, GPRS connection or LTE connection. Of course, other connections such as radio links, for example in the ISM band, are also possible. The second communication channel shall also be understood to mean a transmission path for the (identification) data.

In a preferred embodiment, additional data can be transferred between the second and the first communication interface via the interface device, which data is preferably selected from a group comprising time data, (software) updates, system information, usage behaviour, (unsuccessful) attempted uses, (unsuccessful) attempted logins, fill level of the refuse container

and location of the refuse container. In this embodiment, the interface device of the communication apparatus, which apparatus can be assigned to the user, can be used as an interface for transferring data between the second and first communication interface. A change in the data by a communication apparatus, which can be assigned to the user, is not necessary in this case. For system data and software updates in particular, it is advantageous to forward data unchanged. Of course, it is still possible to modulate the data, which may prove necessary, by means of the communication apparatus in order to adapt it to the transmission technology used in each case.

According to a preferred embodiment, the refuse container comprises a locking device having an interlocking device. The authentication manager preferably authenticates the user using the user data. Following successful (positive) authentication, the authentication manager then advantageously sends a release signal to the first communication interface or the refuse container by means of the communication apparatus in order to unlock the interlocking device. The interlocking device is preferably an electrical closure mechanism. The information messages can advantageously be delivered to the user before or after the interlocking device has been unlocked. The locking device preferably has a limited capacity so that, for a single opening, only a limited amount of refuse can be disposed of in the container. One or more devices for establishing the amount of refuse that has been added and/or how much refuse there is can optionally be provided in the interlocking device and/or the receiving region of the refuse container. For example, these can be devices for establishing the weight and/or volume of the refuse. These devices are preferably a weighing device and/or a sonographic filling level establishing device.

The identification data transferred from the first communication interface to the first communication channel advantageously comprises data for identifying the refuse container, for example an identification code and/or any other data for identifying the corresponding refuse container, for example the location.

For example, the associated user data can contain information relating to the payment of fees, or the like. If the fees are not paid, a release signal would advantageously not be sent or a corresponding information message would be delivered to the user.

According to another preferred embodiment, the refuse container comprises a device for determining location data, such as a GPS device. The position (for example GPS) data can advantageously be used to determine the location of the refuse container. This location determination could be used to identify the individual refuse container. Furthermore, the refuse container would also be easy to retrieve if it were stolen or vandalised. For example, the position data can also be transferred from the first communication interface (of the refuse container) to the second communication interface (of the server) via the indirect communication channel together with the communication apparatus of the user.

The refuse container advantageously comprises a power supply. For example, said power supply can supply an electronic control apparatus and/or the interlocking device and/or the GPS device and/or other devices with electricity. Energy can also be provided in order to transfer data from the first to the third communication interface. The power supply is advantageously a battery. Alternatively or in addition, a solar cell or the like could also be provided.

In one variant, it is conceivable for the refuse container to comprise sensors, which detect if certain materials have been disposed of, such as metals. In a residual refuse container, it would therefore be possible to detect if the user has disposed of such materials without permission.

The sensor data from the at least one sensor device is preferably sent to a control unit of the server, which evaluates the data and potentially initiates additional steps, for example notifying the relevant competent bodies.

Another essential aspect of the invention is a method for controlling access to a refuse container for a user by means of an electronic control unit that is connected to the refuse container and comprises a first communication interface for sending and receiving data. Said method comprises the steps of:

- a) initiating a transfer of identification data from the first communication interface to a communication apparatus, which apparatus can be assigned to a user and comprises a third communication interface, before the refuse container is used;
- b) transferring the identification data relating to the refuse container and to the user from the communication apparatus, which comprises the third communication interface, to a server having a second communication interface;

- c) receiving the identification data by means of the second communication interface and supplying the identification data to an authentication manager of the server;
- d) assigning user data from a database of the server to the identification data by means of the authentication manager;
- 5 e) generating a signal in order to grant or deny access to said refuse container for said user;
- f) transmitting the signal from the second communication interface to the third communication interface and/or the communication apparatus and optionally converting the signal inside the communication apparatus,
- g) transmitting a signal from the third communication interface and/or the communication
- 10 apparatus to the first communication interface,
- h) granting or denying access to said refuse container for the user on the basis of the signal received at the first communication interface.

This method allows for communication between the refuse container and the server without
15 the refuse container having to comprise an energy-intensive and cost-intensive communication interface that allows for direct communication with the remote server. Instead, a data connection between the communication apparatus, which can be assigned to a user and comprises a third communication interface, and the server can be used for indirect communication between the refuse container and the server.

20 In a preferred variant of the method, said method is characterised in that at least one of steps a) and b) is carried out by the transmission of data, which transmission is wireless at least in portions. This simplifies the use by the user and therefore also the acceptance of this technology. Both steps a) and b) are preferably carried out by the transmission of data, which
25 transmission is wireless at least in portions, thereby further simplifying the use.

In another preferred variant of the method, different communication channels are used for steps a) and b). This allows for the range of the communication channels and the energy requirement of the communication interface used therefor to be adapted to the particular re-
30 quirements. This therefore allows for particularly energy-efficient and inexpensive (indirect) communication between the first and the second communication interface.

In another preferred variant of the method, wireless technology that has a low energy consumption and a range of less than 300 m is used for step a). This method variant is particularly preferred, since step a) has been identified as being especially critical with regard to the
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energy requirement of the refuse container and the costs of transferring data. Wireless technologies having a small range usually require a small amount of energy while still allowing for comparatively high data rates. Furthermore, such wireless technologies can usually be used free of charge and therefore, at least for this portion of the communication between the first and second communication interface, no costs are incurred. The range of the wireless technology used for step a) is preferably less than 100 m, preferably less than 50 m, preferably less than 30 m, preferably less than 10 m, preferably less than 5 m, preferably less than 3 m, preferably less than 1 m, particularly preferably less than 50 cm, since these low ranges can further decrease the energy requirement of the first communication interface. Transmission technology selected from a group comprising NFC technology, RFID technology and optical transmission technology is particularly preferable therefor. The advantages thereof have already been described above with regards to the device.

Furthermore, a method variant is preferred in which wireless technology having a maximum range of more than 30 m is used at least in portions for step b). In this context, a “maximum range” shall be understood to mean the range of the communication between two communication interfaces under normal conditions and without any obstacles arranged between the communication interfaces. Such a range usually allows for the (wireless) transfer of data from the communication apparatus at least as far as the closest transfer point that is used to feed the data (possibly via a local network (LAN)) into a wide area network (WAN) and to forward it to the second communication interface. The transfer point or access point can be a WLAN router or a radio mast of a mobile network provider, for example. A large range of the wireless technology used at least in portions for step b) therefore allows for a large movement radius of the user while maintaining the wireless connection and consequently also allows for a large degree of variability when selecting a location for the refuse container. For an even greater variability in the location and the vast independence of existing infrastructure, the range of the wireless technology used at least in portions for step b) is preferably more than 100 m, preferably more than 500 m, preferably more than 1 km, particularly preferably several km. The use of transmission technology selected from a group comprising a WLAN connection, mobile connection, GSM connection, UMTS connection, GPRS connection, LTE connection and DECT has proven to be particularly suitable.

In steps c)-e), the identification data relating to the refuse container and the user data are compared and a check is carried out to check whether the user is permitted to use said refuse container. If the result of the check is positive, a signal is generated that can grant the

authenticated (and now also authorised) user access to said refuse container. For this purpose, this signal is transmitted to the refuse container.

5 In one method variant, in step h), when a signal is received at the first communication interface (4), which encodes the allowability of access for the user to said refuse container (2), a control signal is generated that unlocks an interlocking device of the refuse container (2). By means of the reception of such an “access granting signal”, the interlocking device of the refuse container can therefore be unlocked and the user can be granted access to the refuse container, to the refuse bin or to a refuse interlocking device of the refuse container. This
10 simplifies the method for the user, who thus does not have to enter any other authentication data, such as a PIN.

With respect to the method, it is preferable for the signal transmitted from the third communication interface and/or the communication apparatus to the first communication interface in
15 step g) to comprise a one-time or rolling code. This is preferable with regards to preventing unauthorised parties from reading out the authentication data and using this data for unauthorised access to the refuse container. By using a one-time or rolling code, the current access granting data cannot be used for the next attempted access and unauthorised access at a later stage using this data is no longer possible.

20 In a preferred method variant, a portable data processing apparatus is used as the communication apparatus. Communication apparatuses comprising a display device, such as a mobile phone, a smartphone, a tablet or a laptop, have proven particularly suitable. The user can transport these devices easily and usually carries them with them in any case – in particular the mobile phone or smartphone. It is therefore particularly simple for the user to access the refuse container. The wireless technology used for step a) particularly preferably has a range that means the user does not have to hold the communication apparatus in his/her hand or does not have to place the apparatus in the direct vicinity of the refuse container, but can leave it in his/her pocket, for example. This is therefore particularly advantageous, since the user can therefore carry a refuse transporting bin with both hands and empty
25 it into the refuse container after successful authentication (also with both hands if necessary), without having to put it down for the authentication process.

Another advantage of using one of the above-mentioned apparatuses as the communication
35 apparatus is that it is possible to display information to the user on a display device of the

communication apparatus. This information can be information relating to the fill level and/or when the refuse container will next be emptied, for example. In addition or alternatively, advertises and/or information relating to refuse prevention or refuse separation could also be displayed. By means of such additional information, a user can increase the incentive to use this technology and the associated provision of a (second) communication channel, which is (usually) (co-)financed by said user.

It is optionally possible – if not preferable – for communication to take place via the two communication channels at different times. This could be necessary, for example, if communication between the third communication interface and the second communication interface is not possible. If such an “offline” state is detected by the communication apparatus, said apparatus could (re-)grant or (re-)deny access to the refuse container by itself on the basis of the last result of the authentication by the server. Access for an authorised user would therefore also be possible if the second communication channel did not exist.

In order to avoid misuse by actively disabling the second communication channel in this embodiment, access could be restricted to a specific maximum number (for example less than 10, less than 5, preferably less than 3, more preferably less than 2) by means of independent authentication by the communication apparatus.

If certain users are to be barred either completely or temporarily from using a refuse container, a list of unauthorised users could also be stored in the refuse container. If a user who is on this list and has a communication apparatus assigned to him attempts to establish communication via the communication channel between the first communication interface and the third communication interface, this attempt can be stopped by the third communication interface, or the access to this refuse container is denied for this user, provided a different signal is not transmitted between the second communication interface and the third communication interface via the communication channel. As a result, the user could be removed from the list of unauthorised users and accordingly granted access. It is also possible to remove a user from the list of unauthorised users when using any other type of data connection between the refuse container and the server, for example via the communication apparatus of another user whilst they are using the refuse container.

Additional advantages, aims and properties of the present invention will be explained on the basis of the following description of the accompanying figures. Similar components may have the same reference numerals in the different embodiments.

In the figures:

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Fig. 1 is a schematic diagram of the system for providing messages for a user of a refuse container according to one embodiment;

Fig. 1 shows a system (1) for checking and controlling access for a user to a refuse container (2), comprising a refuse container (2) and a server (5) that is arranged at a distance from the refuse container. The refuse container (2) comprises an electronic control unit (3) having a first communication interface (4) for sending and receiving data. The server (5) that is arranged at a distance from the refuse container comprises a second communication interface (6), an authentication manager (7) and a database (8). In order to identify a user before the refuse container (2) is used, a transfer of data (11) can be initiated between the first communication interface (4) and a third communication interface (10) of a communication apparatus (9), which apparatus can be assigned to a user (not shown). Furthermore, a transfer of data (11) can be initiated between the third communication interface (10) and the second communication interface (6). The first communication interface (4) therefore does not comprise any devices for directly transferring data (11) to the second communication interface (6), but the communication apparatus (9) that can be assigned to the user comprises an interface device, via which indirect data transfer can be initiated between the first communication interface (4) and the second communication interface (6). This takes place, for example, via two different communication channels (15 and 16). The authentication manager (7) assigns user data from the database (8) to the data (11) and gives or denies access for said user to said refuse container (2) on the basis of this assignment.

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In this example, the communication apparatus (9) is a smartphone, for example, which comprises a display device (9a). Additional information can be displayed to the user on this display device. This information can be provided by the server (5) via the communication channel (16). In the representation, however, parameters can also be taken into account that originate from the refuse container (2) and have been transmitted to the communication apparatus (9) via the communication channel (15). This data can optionally also be forwarded to the server (5) via the communication channel (16), where it can be further processed before being displayed on the display device (9a). For example, it would therefore be possible to

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display the current fill level of the refuse container (2) and statistics relating to the previous use of said refuse container (2) by the user.

The communication apparatus (9) is a portable data processing device, for example, such as a mobile phone, a smartphone, a tablet or a laptop, and comprises a display means (9a). It is essential for the communication apparatus (9) to comprise the third communication interface (10). This third communication interface (10) is shown twice in Fig. 1. This is intended to illustrate that these may be different communication interfaces (10). As described above, in particular the two communication channels (15, 16) for communication between the first communication interface (4) (of the refuse container (2)) and the third communication interface (10) (of the communication apparatus (9)) on the one hand and for communication between the third communication interface (10) (of the communication apparatus (9)) and the second communication interface (6) (of the server (5)) on the other hand preferably differ.

Unlike what is known in the art, communication between the first communication interface (4) (of the refuse container (2)) and the second communication interface (6) (of the server (5)) is therefore possible without the refuse container (or the first communication interface (4)) having to be designed for long-range communication. This allows for significant energy savings during operation. In addition, for short-distance communication between the first communication interface (4) (of the refuse container (2)) and the third communication interface (10) (of the communication apparatus (9)), it is possible to rely on communication channels (15) that can be used free of charge. The use of (usually chargeable) mobile connections, for example a GSM connection or a UMTS connection or a GPRS connection or an LTE connection, is not necessary. Instead, NFC technology can be used, for example.

However, the third communication interface (10) comprises another transmission and/or receiving device, which uses wireless technology at least in portions, which allows for data to be transferred over a large distance. As a result, data can be directly transferred to the server (as shown schematically in Fig. 1), but existing network infrastructure such as a WLAN or mobile network is preferably used therefor. In this case, the data can, of course, also be transferred via cables in portions.

The refuse container comprises a locking device (18) having an interlocking device (19). The refuse container also comprises the electronic control unit (3) that has the first communication interface (4). This first communication interface (4) comprises transmission and/or re-

ceiving devices, which use wireless technology, for example NFC technology. Furthermore, the first communication interface (4) can comprise additional transmission and/or receiving devices.

5 The server (5) comprises the authentication manager (7), the database (8) and the second communication interface (6). This second communication interface (6) comprises a long-range transmission and receiving device. This can use, for example, a mobile connection, for example a GSM connection or a UMTS connection or a GPRS connection or an LTE connection (at least in portions). It would therefore be conceivable, for example, for the communication apparatus (9) of the user to establish an internet connection to the server via a mobile network. The server itself does not need to establish its own mobile connection in this case and the second communication interface (6) does not need to be suitable for forming a mobile connection either. It is sufficient for the communication apparatus (9) of the user to be able to establish a connection, which is wireless in portions, to the server (for example via a mobile network).

This transferred (identification) data (11) can comprise both identification data relating to the user and identification data relating to the refuse container. In the server, the data obtained via the communication channel (16) is supplied to the authentication manager (7) of the server (5). The authentication manager (7) then assigns the identification data (11) received to user data (12) from the database (10). Following successful authentication, a release signal is transmitted to the refuse container (2) in order to unlock the interlocking device (19). This is carried out via the two communication channels (15 and 16). Both communication channels (15 and 16) are preferably bidirectional communication channels (as shown by the double-headed arrows).

The refuse container (2) can optionally be provided with a GPS device for determining the location of said refuse container, or at least one sensor device (22). The sensor device (22) can comprise sensors for monitoring the temperature inside the refuse container (2), for detecting movements inside the refuse container (2), for detecting movements of the refuse container (2) itself, for displaying the fill level, for determining the weight of the refuse that is disposed of or for detecting certain materials in the refuse that is disposed of.

This GPS/sensor data is preferably transferred from the first communication interface (4) of the refuse container (2) to the second communication interface (6) or the server (5) via the same communication channels (15 and 16) either together with the above-described data or separately therefrom.

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The GPS/sensor data received by the second communication interface (6) is preferably supplied to a control unit of the server, which evaluates the data and may initiate additional steps, such as notifying the relevant competent bodies. Corresponding contact data can be stored in the store (25).

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All of the features disclosed in the application documents are claimed to be essential to the invention, either on their own or in combination with one another, provided that they are novel over the prior art.

List of reference numerals

5	1	system
	2	refuse container
	3	electronic control unit
	4	first communication interface
	5	server
10	6	second communication interface
	7	authentication manager
	8	database
	9	communication apparatus
	9a	display device
15	10	third communication interface
	11	(identification) data
	12	user data
	13	information provider
	15	first communication channel
20	16	second communication channel
	18	locking device
	19	interlocking device
	22	GPS and/or sensor device
	23	power supply
	25	store
25		

Claims

1. System (1) for checking and controlling access for a user to a refuse container (2), comprising a refuse container (2) having an electronic control unit (3), which
5 comprises a first communication interface (4) for sending and receiving data and a server (5) that is arranged at a distance from the refuse container and comprises a second communication interface (6), an authentication manager (7) and a database (8), it being possible to initiate a transfer of data (11) between the first communication interface (4) and a third communication interface (10) of a
10 communication apparatus (9), which apparatus can be assigned to a user, in order to identify a user before using the refuse container (2), and it being possible to initiate a transfer of data (11) between the third communication interface (10) and the second communication interface (6),
the first communication interface (4) does not comprise any devices for directly
15 transferring data to the second communication interface (6), the communication apparatus (9) that can be assigned to the user comprising an interface device, via which indirect data transfer can be initiated between the first communication interface (4) and the second communication interface (6), the authentication manager (7) assigning user data from the database (8) to the data (11) and giving
20 or denying said user access to said refuse container (2) on the basis of this assignment
characterised in that
the communication takes place via a first communication channel (15) and a second communication channel (16), which is different from the first communication
25 channel (15), at different times, wherein an offline state, in which the communication between the third communication interface (10) and the second communication interface (6) is not possible, is detected by the communication apparatus (9), wherein the communication apparatus (9) can give or deny access to the refuse container (2) in the offline state by itself on the basis of the
30 last result of the authentication by the server (5).
2. System according to claim 1,
characterised in that

the communication apparatus (9) is a portable data processing apparatus, preferably comprising a display device (9a), for example a mobile phone, a smartphone, a tablet or a laptop.

- 5 3. System according to either claim 1 or claim 2,
characterised in that
data (11) is transferred between the first (4) and the third (10) communication in-
terface via the first communication channel (15), which is different from the sec-
ond communication channel (16) that is set up for communication between the
10 second (6) and the third (10) communication interface.
4. System according to any of the preceding claims,
characterised in that
at least portions of at least one, preferably both, of the communication channels
15 (15, 16) use wireless technology for communication between the first (4) and the
second (6) communication interface or between the second (6) and the third (10)
communication interface.
5. System according to any of the preceding claims,
20 characterised in that
the first communication channel (15) for communication between the first (4) and
the third (6) communication interface is based on wireless technology having a
low energy consumption and a range of less than 300 m.
- 25 6. System according to any of the preceding claims,
characterised in that
at least portions of the second communication channel (16) for communication
between the second (6) and the third (10) communication interface are based on
wireless technology having a maximum range of more than 30 m.
30
7. System according to any of the preceding claims,
characterised in that

additional data can be transferred between the second (6) and the first (4) communication interface via the interface device, which data is preferably selected from a group comprising time data, updates, system information, usage behaviour, (unsuccessful) attempted uses, (unsuccessful) attempted logins, fill level of the refuse container and location of the refuse container.

8. System according to any of the preceding claims, characterised in that the interface device of the communication apparatus (9), which apparatus can be assigned to the user, comprises a data processing device, which is designed to modulate data in order to transfer it to different communication channels (15, 16) and/or to encode and/or decode the data received by a first or second communication interface (4, 6) before it is forwarded to the other communication interface in each case, either the first or second communication interface (4, 6).
9. System according to any of the preceding claims, characterised in that the first communication channel (15) for communication between the first (4) and the third (6) communication interface is based on wireless technology selected from a group comprising NFC technology, RFID technology and optical transmission technology.
10. System according to any of the preceding claims, characterised in that at least portions of the second communication channel (16) for communication between the second (6) and the third (10) communication interface are based on wireless technology selected from a group comprising a WLAN connection, mobile connection, GSM connection, UMTS connection, GPRS connection or LTE connection.
11. System according to any of the preceding claims, characterised in that

the first communication channel (15) for communication between the first (4) and the third (6) communication interface is based on wireless technology having a low energy consumption and a range of less than 50 cm.

- 5 12. System according to any of the preceding claims,
 characterised in that
 at least portions of the second communication channel (16) for communication
 between the second (6) and the third (10) communication interface are based on
 wireless technology having a maximum range of more than 1 km.
- 10 13. Method for controlling access to a refuse container (2) for a user by means of an
 electronic control unit (3) that is connected to the refuse container (2) and com-
 prises a first communication interface (4) for sending and receiving data, said
 method comprising the steps of:
- 15 a) initiating a transfer of identification data (11) from the first communication in-
 terface (4) to a communication apparatus (9), which apparatus can be assigned
 to a user and comprises a third communication interface (10), before the refuse
 container (2) is used;
- 20 b) transferring the identification data (11) relating to the refuse container (2) and
 to the user from the communication apparatus (9), which comprises the third
 communication interface (10), to a server (5) having a second communication in-
 terface (6);
- 25 c) receiving the identification data (11) by means of the second communication
 interface (6) and supplying the identification data (11) to an authentication man-
 ager (9) of the server (5);
- 30 d) assigning user data (12) from a database (8) of the server (5) to the identifica-
 tion data (11) by means of the authentication manager (9);
 e) generating a signal in order to grant or deny access to said refuse container
 (2) for said user;
- f) transmitting the signal from the second communication interface (6) to the third
 communication interface (10) and/or the communication apparatus (9) and op-
 tionally converting the signal inside the communication apparatus (9);

g) transmitting a signal from the third communication interface (10) and/or the communication apparatus (9) to the first communication interface (4);
h) granting or denying access to said refuse container (2) for the user on the basis of the signal received at the first communication interface (4),
5 wherein step a) takes place via a first communication channel (15), which is different to a second communication channel (16) used in step b), wherein the communication via the communication channels (15, 16) takes place at different times, when an offline state is detected by the communication apparatus (9), when the communication between the third communication interface (10) and
10 the second communication interface (6) is not possible, wherein the access to the refuse container (2) is granted or denied by the communication apparatus (9) in the offline state by itself on the basis of the last result of the authentication by the server (5).

- 15 14. Method according to claim 13,
characterised in that
at least one, preferably both, of steps a) and b) is/are carried out by the transmission of data, which transmission is wireless at least in portions.
- 20 15. Method according to either claim 13 or claim 14,
characterised in that
the access by means of independent authentication by the communication apparatus (9) is restricted to a specific maximum number less than 10.
- 25 16. Method according to any of claims 13 to 15,
characterised in that
wireless technology that has a low energy consumption and a range of less than 300 m is used for step a), and
wireless technology having a maximum range of more than 30 m is used at least
30 in portions for step b).
17. Method according to any of claims 13 to 16,
characterised in that,

in step h), when a signal is received at the first communication interface (4), which encodes the allowability of access for the user to said refuse container (2), a control signal is generated that unlocks an interlocking device of the refuse container (2).

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18. Method according to any of claims 13 to 17, characterised in that the signal transmitted from the third communication interface (10) and/or the communication apparatus (9) to the first communication interface (4) in step g) comprises a one-time or rolling code.

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19. Method according to any of claims 13 to 18, characterised in that a portable data processing apparatus, preferably having a display device (9a), for example a mobile phone, a smartphone, a tablet or a laptop, is used as the communication apparatus (9).

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20. Method according to any of claims 13 to 19, characterised in that wireless technology is used for step a) that is selected from a group comprising NFC technology, RFID technology and optical transmission technology, and wireless technology is used at least in portions for step b) that is selected from a group comprising a WLAN connection, mobile connection, GSM connection, UMTS connection, GPRS connection or LTE connection.

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