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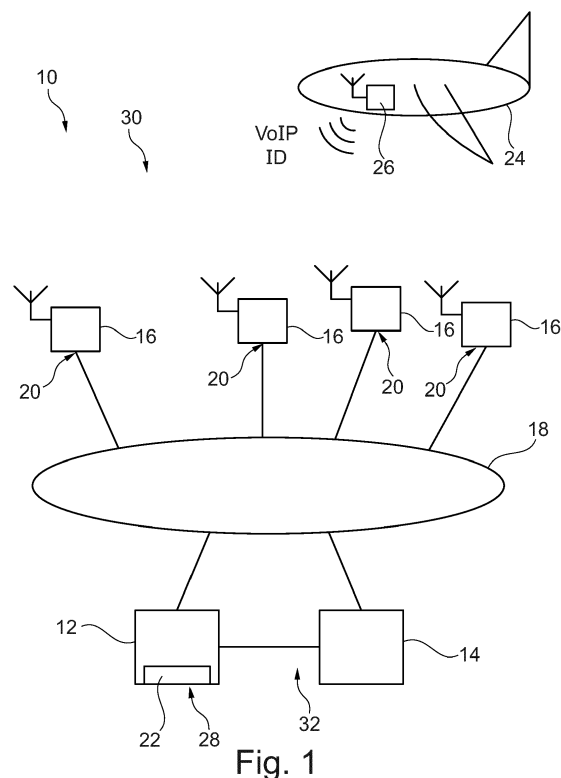
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(54) **COMMUNICATION SYSTEM FOR AIR TRAFFIC CONTROL AND METHOD OF CONTROLLING AIR TRAFFIC**

(57) A communication system for air traffic control of an airspace comprises at least one voice communication system (14), at least one air traffic management system (12) and at least one radio ground station (16) configured to communicate with a radio (26) having a voice over internet protocol identification. The radio ground station (16) has an internet protocol interface (20) via which the radio ground station (16) is connected with the voice communication system (14). The voice communication system (14) and the air traffic management system (12) are interconnected with each other. The air traffic management system (12) comprises a display (22) that is configured to display information obtained via the radio ground station (16). Further, a method of controlling air traffic of an airspace is described.



Description

[0001] The invention relates to a communication system for air traffic control of an airspace. Further, the invention relates to a method of controlling air traffic of an airspace.

[0002] Air navigation service providers (ANSPs) have the operational scenario that a controller of an airspace is responsible for all aircrafts in at least one sector that is defined by a certain frequency for radio communication. In order to establish a radio communication with different aircrafts, an amplitude modulation broadcast is provided that ensures communication of all aircrafts in the respective sector with the controller and/or between each other.

[0003] Nowadays, the air navigation service providers are investigating how to improve the efficiency of the entire communication. Therefore, a so-called sectorless flying is under investigation, according to which one controller is taking care for one or more aircrafts in the entire airspace rather than only a certain sector. In fact, an aircraft is assigned in the entire controlled area to a particular air traffic controller. This shall improve the efficiency of a respective controller as time-consuming and complicated handovers between different sectors (and controllers) are not required anymore. So far, using amplitude modulation radios and direction finders are under investigation for implementing the sectorless flying. However, the current investigations do not solve all problems associated with the sectorless flying.

[0004] Accordingly, there is a need for a system as well as method that enable sectorless flying in an efficient manner.

[0005] The invention provides a communication system for air traffic control of an airspace. The communication system comprises at least one voice communication system (VCS), at least one air traffic management (ATM) system and at least one radio ground station that is configured to communicate with a radio having a voice over internet protocol (VoIP) identification. The radio ground station has an internet protocol (IP) interface via which the radio ground station is connected with the voice communication system. The voice communication system and the air traffic management system are interconnected with each other. The air traffic management system comprises a display that is configured to display information obtained via the radio ground station.

[0006] Further, the invention provides a method of controlling air traffic of an airspace, comprising the steps of:

- Receiving information from at least one radio having a voice over internet protocol (VoIP) identification by means of at least one radio ground station that is connected with a voice communication system via an internet protocol (IP) interface,
- Forwarding the information to an air traffic management system, and

- Displaying the information on a display of the air traffic management system.

[0007] Accordingly, voice over internet protocol (VoIP) technology and mechanism are used to provide sectorless flying. The VoIP technology ensures individual addressing of a radio, for instance a radio on an aircraft, due to the voice over internet protocol (VoIP) identification provided by the respective radio. The VoIP identification used by the radio ensures an unambiguous identification. For instance, the VoIP identification is provided by an IPv6 address and/or a session initiation protocol uniform resource identifier (SIP URI).

[0008] In fact, VoIP communication streams can be used to establish the respective communication with the aircraft having the radio with the voice over internet protocol identification. Generally, the VoIP communication ensures signaling as well as addressing of individual radios within the communication system. Consequently, an easy and straightforward way is provided to implement the sectorless flying since new frequencies and complex integration of different technologies are not required to establish the sectorless flying.

[0009] The voice over internet protocol technology may relate to telecommunication standards like Long Term Evolution (LTE), 5G or 5G NR (New Radio).

[0010] In general, the communication system may also comprise the radio that has the voice over internet protocol identification. For instance, the radio is on an aircraft within the airspace to be controlled by the air traffic control.

[0011] According to an aspect, the information obtained corresponds to information concerning the at least one radio within the airspace, wherein the radio has the voice over internet protocol identification. Particularly, the voice communication system is configured to gather the voice over internet protocol identification from the radio. In other words, the information received corresponds to information concerning the radio within the airspace. For instance, a representation of the VoIP identification is displayed on the display. Particularly, the information is received, processed and displayed when the radio enters (or is located in) the airspace. Accordingly, the information is received when the aircraft with the radio on board is entering (or is already located in) the airspace that is monitored by the air traffic control comprising the communication system.

[0012] Generally, a controller using the communication system receives the respective information of the aircraft within the airspace monitored by means of the air traffic management system, namely via the display in an optical manner. Particularly, the controller is informed about any aircraft having a respective radio with VoIP identification that enters the airspace or is located in the airspace.

[0013] The information displayed on the display of the air traffic management system may relate to the respective VoIP identification that is received via the voice communication system that is interconnected with the air traf-

fic management system in a signal-transmitting manner. The VoIP identification or a representative thereof is displayed as soon as the radio, namely the aircraft with the radio rather the aircraft with the radio, enters the airspace monitored.

[0014] Another aspect provides that the air traffic management system comprises a selection module via which a controller is enabled to select a certain radio within the airspace. The controller may select a respective radio in order to establish a VoIP communication with the respective radio via the voice communication system (and the at last one radio ground station). The selection module may relate to an electronic flight progress strip system. Particularly, a controller working position (CWP) provides the selection module in an integrated manner.

[0015] For instance, the display is a touch-sensitive display which provides the selection module. The controller is enabled to interact with a display of the air traffic management system in order to select the respective radio. The radio may be labeled by means of its VoIP identification or a representative thereof on the display. Hence, the controller has a unique and unambiguous representation for the respective radio, particularly the aircraft comprising the respective radio.

[0016] Further, the voice communication system may be configured to automatically set up a voice over internet protocol connection with a radio selected via the selection module. Particularly, the voice over internet protocol connection is accepted automatically by the respective radio selected. Accordingly, the communication system automatically establishes the VoIP connection with the radio, namely the radio on the aircraft. By selecting the respective radio or rather aircraft comprising the radio via the selection module, particularly the touch-sensitive display, the VoIP connection is set up and automatically accepted by the radio in the aircraft.

[0017] In fact, a radio is selected by the controller wherein the voice communication system, namely the radio ground station, shall establish the VoIP connection with the radio selected. The VoIP connection is established automatically, as the VoIP connection is set up automatically when selecting the respective radio and the VoIP connection set up is accepted automatically by the radio, resulting in the automatically established VoIP connection. Put differently, the VoIP connection with the radio selected is set up automatically, wherein the VoIP connection set up is automatically accepted by the radio selected. Therefore, the VoIP connection is established automatically once the controller has selected the radio on the display of the air traffic management system.

[0018] Once the VoIP connection is established, the controller can speak with a pilot of the aircraft having the radio and vice versa.

[0019] According to another aspect, several radio ground stations are provided that are each configured to communicate with a radio having the voice over internet protocol identification. Depending on the respective position of the radio, namely the aircraft having the radio,

a certain radio ground station of the communication system is used for establishing the VoIP connection.

[0020] Particularly, the air traffic management system is configured to exchange an exact position of the radio in the airspace with the voice communication system, wherein the voice communication system is configured to route a voice over internet protocol connection established to one of the several radio ground stations which provides best communication properties. Hence, the one of the several radio ground stations which provides the best receive/transmission properties is selected in order to maintain the VoIP connection with the radio. This might happen several times within a respective area of the airspace or rather the entire airspace such that the VoIP connection is maintained while ensuring best communication properties.

[0021] As the VoIP connection is maintained among these several radio ground stations, the same controller is responsible for the aircraft with the radio irrespective of any sector. Accordingly, the sectorless flying is implemented within the entire airspace.

[0022] Generally, the voice communication system may select the one of the several radio ground stations which provides the best receive/transmission properties in order to establish the VoIP connection with the radio due to the exact position of the radio when setting up the VoIP connection.

[0023] In fact, the communication system may be configured to perform an automatic handover scenario of a voice over internet protocol connection established. The handover scenario relates to maintaining the VoIP connection while selecting another radio ground station of the several radio ground stations for communicating with the respective radio. Particularly, the radio ground station providing the best communication properties is selected when performing the automatic handover scenario.

[0024] In other words, an exact position of the radio in the airspace may be exchanged with the voice communication system, wherein the voice communication system routes the VoIP connection established to one of the several radio ground stations which provides best communication properties.

[0025] Generally, the automatic handover scenario enables a continuous communication between the (same) controller and the aircraft having the radio, particularly the pilot of the aircraft.

[0026] The automatic handover scenario of the voice over internet protocol connection established may be performed among several radio ground stations when the radio is moving. The radio may be located on the aircraft that moves within the airspace. Hence, the respective distance from the radio to one of the several radio ground stations may change while the aircraft moves, namely the radio on board (airborne radio), such that the respective communication properties vary. The automatic handover scenario is performed in order to ensure best communication properties between the radio and the radio ground stations, namely a certain one hav-

ing the best communication properties with respect to the actual position of the radio within the airspace.

[0027] The automatic handover scenario may take place within the entire airspace monitored by a single air navigation service provider (ANSP), for instance a national airspace. Hence, the VoIP connection with the single controller is maintained due to the automatic handover scenario, particularly the controller responsible for the entire airspace.

[0028] Alternatively, the airspace automatic handover scenario may take place within an airspace monitored by several air navigation service providers (ANSPs), for instance several national airspaces. Accordingly, the VoIP connection is handed over from a first controller responsible of a first (national) airspace to a second controller responsible of a second (national) airspace.

[0029] An aspect provides that the voice communication system is connected with a wide area network (WAN). For instance, the several ground stations are connected with the wide area network. The wide area network ensures that the VoIP connection established can be routed from one radio ground station to another radio ground station while maintaining the respective VoIP connection. The different radio ground stations may be located over a large distance, particularly an area monitored by a respective air navigation service provider (ANSP), wherein maintaining of the VoIP connection is ensured by means of the wide area network connected with the voice communication system.

[0030] The wide area network may be associated with a single national airspace or with several airspaces.

[0031] In general, a wide area network (WAN) is a telecommunications network that extends over a large geographical area for the primary purpose of computer networking. The wide area network (WAN) ensures that data or information can be distributed across the large geographical area.

[0032] In contrast to the wide area network (WAN), similar types of networks like personal area networks (PANs), local area networks (LANs), campus area networks (CANs), or metropolitan area networks (MANs) are usually limited to a room, building, campus or specific metropolitan area, respectively.

[0033] Typically, a personal area network (PAN), a local area network (LAN), a campus area network (CAN), or a metropolitan area network may be connected with a wide area network (WAN).

[0034] In fact, a wide area network (WAN) relates to computer networking technologies used to transmit data or information over long distances, and between different LANs, MANs and other localized computer networking architectures. Hence, WANs are used to connect LANs and other types of networks together so that users and computers in one location can communicate with users and computers in other locations. Many WANs are built for one particular organization and are private. Others, built by Internet service providers, provide connections from an organization's LAN to the Internet.

[0035] Accordingly, the wide area network may be part of a cloud solution for the communication system. The voice communication system is connected with the wide area network in order to distribute the respective data or information associated with the voice communication system (online) such that certain controllers, for instance the ones of different airspaces, may exchange their respective data or information via the cloud solution, namely the wide area network (WAN).

[0036] Particularly, a wide area network cloud exchange for certain data or information may be provided by means of the WAN.

[0037] For instance, the wide area network may comprise an interface for the respective cloud (service).

[0038] The cloud (service) may be associated with a respective network, server and/or data center with which the WAN is (directly) connected and, therefore, the voice communication system is (indirectly) connected.

[0039] In general, a so-called voice communication system (VCS) in the cloud can be provided by means of the wide area network that is connected to the voice communication system (VCS).

[0040] The voice communication system in the cloud can be used to provide a geographic redundancy, namely a redundancy distributed over a large geographic area, particularly a geographic area covered by the WAN.

[0041] Another aspect provides that the air traffic management system comprises a radar system and a flight management system, wherein the radar system is configured to obtain identification information of an aircraft in the airspace which has the radio with the voice over internet protocol identification and to forward this identification information to the flight management system. The flight management system may be configured to obtain position information of the aircraft in the airspace and the voice over internet protocol identification of the radio. The identification information of the aircraft may relate to radar information obtained, for instance by means of a transponder on the aircraft. Accordingly, the radar system may relate to a secondary surveillance radar that is used to exchange data for identification purposes.

[0042] The flight management system may be associated with the voice communication system. For instance, the flight management system comprises the voice communication system at least partly. In fact, the flight management system is configured to obtain/process the VoIP identification of the radio wherein which the voice communication system may communicate via the voice over internet protocol connection.

[0043] The foregoing aspects and many of the attendant advantages of the claimed subject matter will become more readily appreciated as the same become better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

- Figure 1 schematically shows a communication system for air traffic control of an airspace according to

the present invention, and

- Figure 2 shows a flow-chart illustrating a method of controlling air traffic of an airspace according to the present invention.

[0044] The detailed description set forth below in connection with the appended drawings, where like numerals reference like elements, is intended as a description of various embodiments of the disclosed subject matter and is not intended to represent the only embodiments. Each embodiment described in this disclosure is provided merely as an example or illustration and should not be construed as preferred or advantageous over other embodiments. The illustrative examples provided herein are not intended to be exhaustive or to limit the claimed subject matter to the precise forms disclosed. For the purposes of the present disclosure, the phrase "at least one of A, B, and C", for example, means (A), (B), (C), (A and B), (A and C), (B and C), or (A, B, and C), including all further possible permutations when greater than three elements are listed. In other words, the term "at least one of A and B" generally means "A and/or B", namely "A" alone, "B" alone or "A and B".

[0045] In Figure 1, a communication system 10 for air traffic control of an airspace is shown.

[0046] The communication system 10 comprises an air traffic management system 12 as well as a voice communication system 14 that are interconnected with each other. The communication system 10 also comprises several radio ground stations 16 that are each configured to communicate with a radio having a voice over internet protocol (VoIP) identification. The air traffic management system 12, the voice communication system 14 as well as the several radio ground stations 16 are located on the ground.

[0047] The respective radio ground stations 16 are each connected with a wide area network (WAN) 18 to which the air traffic management system 12 as well as the voice communication system 14 are also connected.

[0048] The WAN 18 may be connected with a cloud (service), for instance a respective network, a server and/or a data center. Thus, a so-called voice communication system (VCS) in the cloud can be provided wherein geographic redundancy is provided.

[0049] In general, each of the radio ground stations 16 has an internet protocol interface 20 via which the respective radio ground station 16 is connected with the voice communication system 14 (via the wide area network 18) such that internet protocol data can be exchanged between the respective radio ground stations 16 and the voice communication system 14.

[0050] Furthermore, the air traffic management system 12 comprises a display 22 that is configured to display information obtained via the radio ground station(s) 16 such that a controller using the communication system 10, particularly the air traffic management system 12, is enabled to gather the respective information displayed.

[0051] Generally, the air traffic management system

12 may be associated with a controller working position (CWP) that is used by the controller for air traffic control of the airspace to be monitored.

[0052] In Figure 1, an aircraft 24 is also shown that is within the airspace monitored by the air traffic control to which the communication system 10 is assigned.

[0053] The aircraft 24 comprises a radio 26 that has a voice over internet protocol identification (VoIP ID) which is unique and unambiguous. The VoIP identification may be provided by an IPv6 address and/or a session initiation protocol uniform resource identifier (SIP URI).

[0054] The VoIP identification can be exchanged between the radio 26 of the aircraft 24 and at least one of the radio ground stations 16 as shown in Figure 1. Particularly, the information, namely the VoIP identification, is forwarded to the voice communication system 14.

[0055] Further, the information may be retrieved by the air traffic management system 12 that communicates with the voice communication system 14 such that the information, namely the VoIP identification, can be displayed on the display 22. Generally, the VoIP identification itself or rather a representative thereof, namely information associated with the VoIP identification, might be displayed on the display 22. Accordingly, the information displayed may relate to information concerning the radio 26 of the aircraft 24 while being in the airspace monitored.

[0056] Particularly, the respective information is forwarded to the air traffic management system 12 when the respective radio 26 enters the airspace.

[0057] Therefore, the controller obtains information concerning all aircrafts 24 or rather their respective radios 26 that are located in the airspace to be monitored by the controller. The airspace may relate to a national airspace that is monitored by a single air navigation service provider.

[0058] Furthermore, the communication system 10 may comprise a selection module 28 via which the controller is enabled to select a certain radio 26 or rather aircraft 24 in the airspace in order to establish a voice over internet protocol (VoIP) connection with the respective radio 26. Once the VoIP connection is established, the controller is enabled to speak with the pilot of the respective aircraft 24 having the radio 26 selected and vice versa.

[0059] The selection module 28 may be established by the display 22 itself that is a touch-sensitive one. Hence, the controller is enabled to interact with the display 22 in order to select the respective radio 26.

[0060] The air traffic management system 12 may comprise a radar system 30 that ensures to obtain identification information of the respective aircraft 24 in the airspace. The identification information of the aircraft 24 may relate to radar information obtained by the radar system 30, for instance by means of a transponder associated with the aircraft 24. Thus, the radar system 30 may relate to a secondary surveillance radar that is used to exchange data for identification purposes of the air-

crafts 24 in the airspace.

[0061] In addition, the air traffic management system 12 may comprise a flight management system 32 that provides (exact) position information of the aircraft 24 in the airspace. The flight management system 32 may be connected with the radar system 30 in order to receive data from the radar system 30 while enriching the data appropriately.

[0062] Accordingly, the air traffic management system 12 is generally enabled to gather the exact position of the radio 26 in the airspace, namely the aircraft 24 having the radio 26, wherein the exact position of the radio 26 may be exchanged with the voice communication system 14.

[0063] In general, the VoIP technology provided ensures an individual addressing of the respective radios 26 assigned to the aircrafts 24 due to the voice over internet protocol (VoIP) identification provided by the respective radio 26. Accordingly, an unambiguous identification is ensured.

[0064] Hereinafter the operation of the communication system 10 shown in Figure 1 is explained while also referring to Figure 2 illustrating a method of controlling the air traffic of the airspace.

[0065] In a first step S1, information from a radio 26 having the voice over internet protocol identification is received by means of at least one of the several radio ground stations 16 connected with the voice communication system 14 via the respective internet protocol interface 20.

[0066] In a second step S2, the information is forwarded to the air traffic management system 12 that is connected with the voice communication system 14 in a signal-transmitting manner.

[0067] In a third step S3, the information is displayed on the display 22 of the air traffic management system 12. The information displayed may relate to the VoIP ID itself or a representative thereof which ensures a unique and unambiguous identification of the respective radio 26.

[0068] Hence, the controller interacting with the air traffic management system 12, for instance the controller work position (CWP), obtains the information of all aircrafts 24 in the airspace to be monitored.

[0069] In a fourth step S4, the controller selects a respective radio 26 via the selection module 28, namely the touch-sensitive display 22. Then, the voice over internet protocol (VoIP) connection is set up automatically with the radio 26 selected. In turn, the respective radio 26 automatically accepts setting up the VoIP connection such that the VoIP connection is established in an entirely automatic manner. When the VoIP connection is established, the controller is enabled to speak with the pilot of the respective aircraft 24 having the radio 26 selected and vice versa.

[0070] In a fifth step S5, an automatic handover scenario is performed by the communication system 10. The automatic handover scenario might be necessary to

maintain the VoIP connected while the aircraft 24 is moving within the airspace.

[0071] In fact, the automatic handover scenario relates to routing the VoIP connection established to one of the several radio ground stations 16 which provides best communication properties. This might depend on the exact position of the aircraft 24, namely the radio 26 associated therewith. With respect to the different radio ground stations 16.

[0072] In other words, the automatic handover scenario of the voice over internet protocol connection established can be performed by the communication system 10 while taking the exact position of the radio 26 in the airspace into account. The exact position of the radio 26 is provided by the air traffic management system 12 that exchanges the respective information with the voice communication system 14 that controls the radio ground stations 16 appropriately.

[0073] The several radio ground stations 16 may generally relate to a national airspace that is controlled by a single controller. Hence, it is ensured that the same controller is responsible for the respective aircraft 24 irrespective of the position of the aircraft 24 in the airspace. Hence, the so-called sectorless flying can be ensured appropriately.

[0074] However, the several radio ground stations 16 may also relate to different national airspaces such that responsibility for the respective aircraft 24 might be handed over to another controller (of another air navigation service provider) when the aircraft 24 having the radio 26 leaves a first national airspace associated with the first controller while entering a second national airspace associated with a second controller.

[0075] Accordingly, the communication system 10 is enabled to provide automatic handover scenarios within a national airspace as well as between different national airspaces.

[0076] In general, the so-called sectorless flying is ensured by means of the communication system 10 and the method in a simple and cost-efficient manner.

Claims

1. A communication system for air traffic control of an airspace, wherein the communication system (10) comprises at least one voice communication system (14), at least one air traffic management system (12) and at least one radio ground station (16) configured to communicate with a radio (26) having a voice over internet protocol identification, wherein the radio ground station (16) has an internet protocol interface (20) via which the radio ground station (16) is connected with the voice communication system (14), wherein the voice communication system (14) and the air traffic management system (12) are interconnected with each other, and wherein the air traffic management system (12) comprises a display (22)

that is configured to display information obtained via the radio ground station (16).

2. The communication system according to claim 1, wherein the information obtained corresponds to information concerning the at least one radio (26) within the airspace, wherein the radio (26) has the voice over internet protocol identification, in particular wherein the voice communication system (14) is configured to gather the voice over internet protocol identification from the radio (26). 5
3. The communication system according to any of the preceding claims, wherein the air traffic management system (12) comprises a selection module (28) via which a controller is enabled to select a certain radio (26) within the airspace. 10
4. The communication system according to claim 3, wherein the display (22) is a touch-sensitive display which provides the selection module (28). 15
5. The communication system according to claim 3 or 4, wherein the voice communication system (14) is configured to automatically set up a voice over internet protocol connection with the radio (26) selected via the selection module (28), in particular wherein the voice over internet protocol connection is accepted automatically by the respective radio (26) selected. 20
6. The communication system according to any of the preceding claims, wherein several radio ground stations (16) are provided that are each configured to communicate with the radio having the voice over internet protocol identification. 25
7. The communication system according to claim 6, wherein the air traffic management system (12) is configured to exchange an exact position of the radio (26) in the airspace with the voice communication system (14), and wherein the voice communication system (14) is configured to route a voice over internet protocol connection established to one of the several radio ground stations (16) which provides best communication properties. 30
8. The communication system according to claim 6 or 7, wherein the communication system (14) is configured to perform an automatic handover scenario of a voice over internet protocol connection established. 35
9. The communication system according to any of the preceding claims, wherein the voice communication system (14) is connected with a wide area network (18), in particular wherein the several radio ground stations (16) are connected with the wide area net- 40

work (18).

10. The communication system according to any of the preceding claims, wherein the air traffic management system (12) comprises a radar system (30) and a flight management system (32), wherein the radar system (30) is configured to obtain identification information of an aircraft (24) in the airspace which has the radio (26) with the voice over internet protocol identification and to forward this identification information to the flight management system (32), in particular wherein the flight management system (32) is configured to obtain position information of the aircraft (24) in the airspace and the voice over internet protocol identification of the radio (26). 45
11. A method of controlling air traffic of an airspace, comprising the steps of:
 - Receiving information from at least one radio (26) having a voice over internet protocol identification by means of at least one radio ground station (16) that is connected with a voice communication system (14) via an internet protocol interface (20),
 - Forwarding the information to an air traffic management system (12), and
 - Displaying the information on a display (28) of the air traffic management system (12).
12. The method according to claim 11, wherein the information received corresponds to information concerning the radio (26) within the airspace and/or wherein the information is received when the radio (26) enters the airspace. 50
13. The method according to claim 11 or 12, wherein a radio (26) is selected by a controller in order to establish a voice over internet protocol connection with the radio (26) via the voice communication system (14), in particular wherein the voice over internet protocol connection with the radio (26) selected is set up automatically, wherein the voice over internet protocol connection set up is accepted automatically by the respective radio (26) selected. 55
14. The method according to any of claims 11 to 13, wherein an exact position of the radio (26) in the airspace is exchanged with the voice communication system (14), and wherein the voice communication system (14) routes a voice over internet protocol connection established to one of the several radio ground stations (16) which provides best communication properties.
15. The method according to any of claims 11 to 14, wherein an automatic handover scenario of a voice over internet protocol connection established is per-

formed among several radio ground stations (16)
when the radio (26) is moving.

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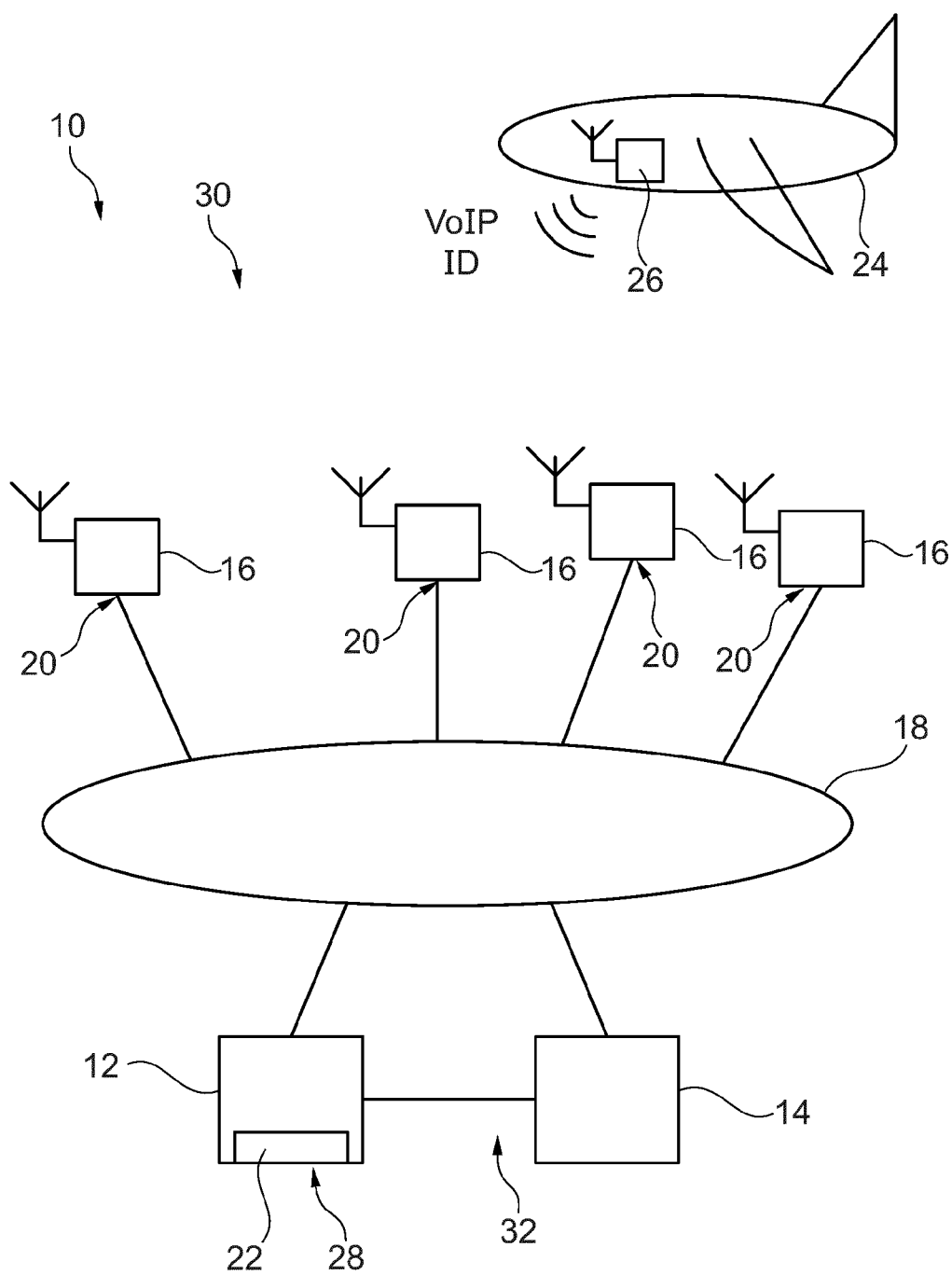


Fig. 1

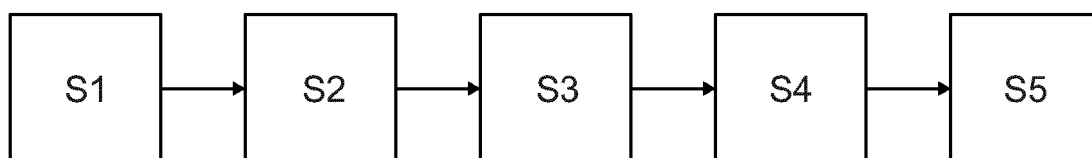


Fig. 2



EUROPEAN SEARCH REPORT

 Application Number
EP 20 16 3644

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	Anonymous: "Air traffic management research & innovation 2018 highlights", 15 March 2019 (2019-03-15), XP055728203, Luxembourg DOI: 10.2829/40375 ISBN: 978-92-9-216125-5 Retrieved from the Internet: URL:https://www.sesarju.eu/sites/default/files/documents/reports/SESAR%20Innovation%20pipeline%202018.PDF [retrieved on 2020-09-07]	1-5, 10-13	INV. G08G5/00
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A	----- US 2006/046715 A1 (BURGEMEISTER ALVIN H [US]) 2 March 2006 (2006-03-02) * paragraphs [0010], [0058], [0062] *	1-15	
A	----- US 2010/198489 A1 (ROZOVSKI DAVID [US] ET AL) 5 August 2010 (2010-08-05) * paragraph [0026] * * figure 3 *	1-15	TECHNICAL FIELDS SEARCHED (IPC) G08G
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Y	----- US 7 313 143 B1 (BRUNO RONALD [US]) 25 December 2007 (2007-12-25) * column 12, line 48 - column 13, line 52 * * figures 1, 4, 13 * ----- -/--	6-9,14, 15	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 19 November 2020	Examiner Van den Bosch, I
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
EP 20 16 3644

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 8 219 799 B1 (LUCCHESI FRANK A [US] ET AL) 10 July 2012 (2012-07-10) * column 16, line 58 - line 64 * * column 23, line 37 - column 24, line 39 * * figure 1 * -----	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 19 November 2020	Examiner Van den Bosch, I
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	



Application Number

EP 20 16 3644

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



LACK OF UNITY OF INVENTION
SHEET B

Application Number

EP 20 16 3644

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 2-5, 10, 12, 13(completely); 1, 11(partially)

Communication system for air traffic control of an airspace comprising at least one air traffic management system and at least one radio ground station configured to communicate with a radio using a voice over internet protocol, wherein the air traffic management system comprises a selection module via which a controller is enabled to select a certain radio within the airspace.

2. claims: 6-9, 14, 15(completely); 1, 11(partially)

Communication system for air traffic control of an airspace comprising at least one air traffic management system and at least one radio ground station configured to communicate with a radio using a voice over internet protocol, wherein the voice communication system is configured to route a voice over internet protocol connection established to one of the several radio ground stations which provides best communication properties.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 20 16 3644

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

19-11-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006046715 A1	02-03-2006	NONE	
US 2010198489 A1	05-08-2010	NONE	
EP 3444791 A2	20-02-2019	NONE	
US 7313143 B1	25-12-2007	NONE	
US 8219799 B1	10-07-2012	NONE	