(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
22 October 2020 (22.10.2020)

WIPO | PCT

(10) International Publication Number
WO 2020/212884 A1

(51) International Patent Classification:
G07C 9/00 (2020.01) *G07C 9/10* (2020.01)

(21) International Application Number:
PCT/IB2020/053581

(22) International Filing Date:
16 April 2020 (16.04.2020)

(25) Filing Language: Italian

(26) Publication Language: English

(30) Priority Data:
102019000006024 18 April 2019 (18.04.2019) IT

(71) Applicant: **BLUETICKETING SRL** [IT/IT]; Corso Giuseppe Garibaldi, 12, 20121 Milano (IT).

(72) Inventor: **COLOMBO, Gianluca**; Via Bellaria, 16, 21018 Sesto Calende (IT).

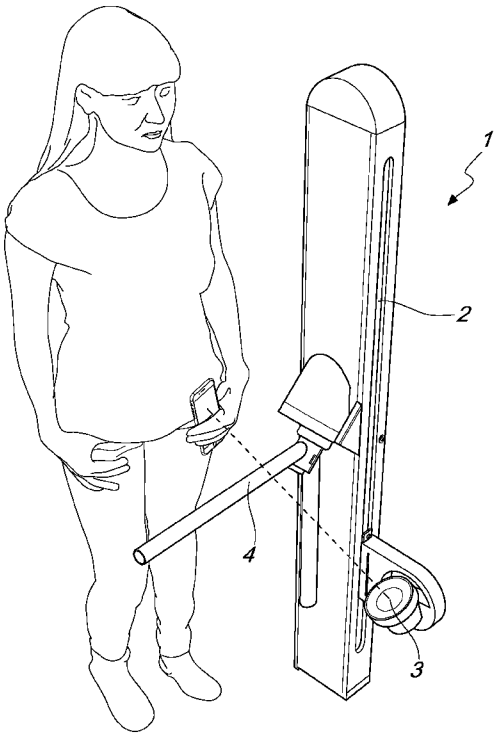
(74) Agent: **MODIANO, Micaela**; Modiano & Partners, Via Meravigli, 16, 20123 Milano (IT).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*

(54) Title: ACCESS CONTROL DEVICE



(57) Abstract: An access control device (1), comprising a barrier (2), the peculiarity of which consists in that it comprises a single receiver (3) which is adapted to detect the angle of arrival of a Bluetooth signal emitted by a mobile Bluetooth device carried by a person who has to pass through the barrier (2), the single receiver (3) being arranged downstream of the barrier.

WO 2020/212884 A1

ACCESS CONTROL DEVICE

The present invention relates to an access control device. More specifically, the invention relates to an access control device based on Bluetooth technology.

As is known, the most widespread access control systems are mainly based on RFID technologies and bar codes.

Systems that use Bluetooth are a very recent development, but they present numerous drawbacks with regard to the problem of precisely controlling heavy flows of persons. In fact, systems based on Bluetooth use only the signal intensity (RSSI), which by its nature is an approximate indicator of location.

In fact, if it is necessary to control large numbers of persons who come to a barrier, perhaps arranged in parallel lines, it is essential that only the person who is right in front of the checkpoint is identified, and not someone else who is behind or beside that person, who would therefore be accidentally identified.

Ultimately, in order to perform an access control that is genuinely effective and meaningful, it is necessary to distinguish one person from the next even when the persons are side by side and arranged in parallel lines.

The Bluetooth technology, from version 5.1 onward, supports the signal direction detection feature, and therefore makes it possible to detect, with a certain level of precision and under determined conditions, the angle of origin of the signal emitted by a device, for example, but not limited to, a smartphone provided with an adapted application.

The angle of arrival of the signal is normally expressed in polar coordinates with respect to the receiving antenna of the access control device, and it cannot distinguish between an arrival in front of or behind the signal that arrives from the device held by the person.

Currently, only by intersecting the data coming from multiple antennae in different locations (i.e. by triangulation) one can achieve a good

approximation of the position in (X, Y) coordinates projected on an imaginary plane at a hypothetical (i.e. not real) fixed height, or the (X, Y, Z) coordinates of the device that emits the signal.

However, in order to achieve this result, it is necessary to use multiple receiving antennae located apart from each other and arranged indicatively at the same height in order to determine (X, Y), or multiple receiving antennae arranged at different heights so as to determine the complete group of three coordinates (X, Y, Z), with considerable costs for infrastructure, supports, wiring and installation, in addition to problems of possible malfunctions since the number of antennae has to be multiplied.

Determination of the coordinates is one way of determining the position of the user with respect to a control barrier, such as for example a turnstile, a bar or a flap.

The aim of the present invention is to provide an access control device that enables the use of Bluetooth technology, thus making it possible to discriminate between one person and another with precision so as to effectively determine access control.

Within this aim, an object of the present invention is to provide an access control device that makes it possible to accurately determine the angle of arrival of the signal emitted by a device held by the person for whom to control access.

Another object of the present invention is to provide an access control device in which the discrimination of the signal originating from a mobile Bluetooth device is performed using the least possible number of receiving antennae.

Another object of the present invention is to provide an access control device that is highly reliable, easily and practically implemented and of low cost.

This aim and these and other objects which will become better apparent hereinafter are achieved by an access control device, comprising a barrier,

characterized in that it comprises a single receiver which is adapted to detect the angle of arrival of a Bluetooth signal emitted by a mobile Bluetooth device carried by a person who has to pass through the barrier, said single receiver being arranged downstream of said barrier.

Further characteristics and advantages of the invention will become better apparent from the description of a preferred, but not limiting, embodiment of the device according to the invention, illustrated by way of non-limiting example in the accompanying drawings, in which the single figure is a schematic a perspective view of the access control device according to the present invention.

With reference to the figure, the access control device according to the invention, generally designated by the reference numeral 1, comprises a barrier 2, such as for example a turnstile, and a receiver 3 which is arranged immediately after the barrier 2, i.e. downstream of the barrier, and is capable of detecting the angle of arrival of a signal emitted by a mobile Bluetooth device which must be located, so as to enable the control of access to the barrier 2 by the person who holds such mobile device.

Conveniently, the receiver 3 comprises an antenna capable of detecting the angle of arrival of the signal, which is substantially directed upward, substantially in the direction of the person for whom to control access.

The positioning of the receiver 3 (antenna) makes it possible to reliably determine the position of the person, without resorting to triangulation of the signal using supplementary antennae.

The position after the barrier 2 in fact makes it possible to ensure that there are no impediments to the propagation of the signal caused by the presence of other persons in the queue. The antenna 3 is in fact exposed only to the person who is passing through the barrier 2, who normally holds the mobile device either in a pocket or in the hand.

The position after the barrier (downstream of the barrier) further ensures that the signal is not tangential to the body of the person, causing

further problems of absorption and disturbance in the propagation of the signal in a straight line, which needs to pass through a significant portion of body.

The position in a lower region, after the barrier, under a movable part 4 of the barrier ensures that, with its determination of the angle of arrival of the signal, it can be determined substantially uniquely that the mobile device is in the lane being monitored and that it is being held by the person closest to the barrier 2.

In fact, determining the angle of arrival does not mean determining the distance of a person from a certain point, but rather means determining the angle of the straight line that runs from the receiving antenna 3 to the portable terminal that the person carries with him or her.

The position of the receiving antenna 3 in a lower region, below the movable part 4 of the barrier, makes it possible to obtain the desirable effect that the straight line that runs from the portable terminal to the receiving antenna 3 always falls in the lane where the terminal is present.

The only ambiguity relating to being in the correct lane can arise if the coordinate on the Z axis shifts to heights that are not physically compatible with the dimensions of persons who have to pass through the barrier, and this makes it possible to have the desired accuracy.

Being in the correct lane is determined by the presence of the signal within a boundary area expressed in polar coordinates.

Therefore the positioning of the receiving antenna 3 after the barrier 2, in a position directed upward, i.e. toward the person who is passing through the barrier, makes it possible to effectively and precisely discriminate the person who is effectively right in front of the barrier, without running the risk of detecting the signal from other persons beside him or her.

In practice it has been found that the device according to the invention fully achieves the set aim and objects, in that it makes it possible to accurately determine the angle of arrival of a Bluetooth signal emitted by a

mobile Bluetooth device, carried by a person who is about to pass through a barrier and whose transit needs to be authorized by an access control.

The device, thus conceived, is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

Moreover, all the details may be substituted by other, technically equivalent elements.

In practice, the materials used, as well as the contingent shapes and dimensions, may be any according to the requirements and to the state of the art.

The disclosures in Italian Patent Application No. 102019000006024 from which this application claims priority are incorporated herein by reference.

Where the technical features mentioned in any claim are followed by reference numerals and/or signs, those reference numerals and/or signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference numerals and/or signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference numerals and/or signs.

CLAIMS

1. An access control device (1), comprising a barrier (2), characterized in that it comprises a single receiver (3) which is adapted to detect the angle of arrival of a Bluetooth signal emitted by a mobile Bluetooth device carried by a person who has to pass through the barrier, said single receiver being arranged downstream of said barrier.

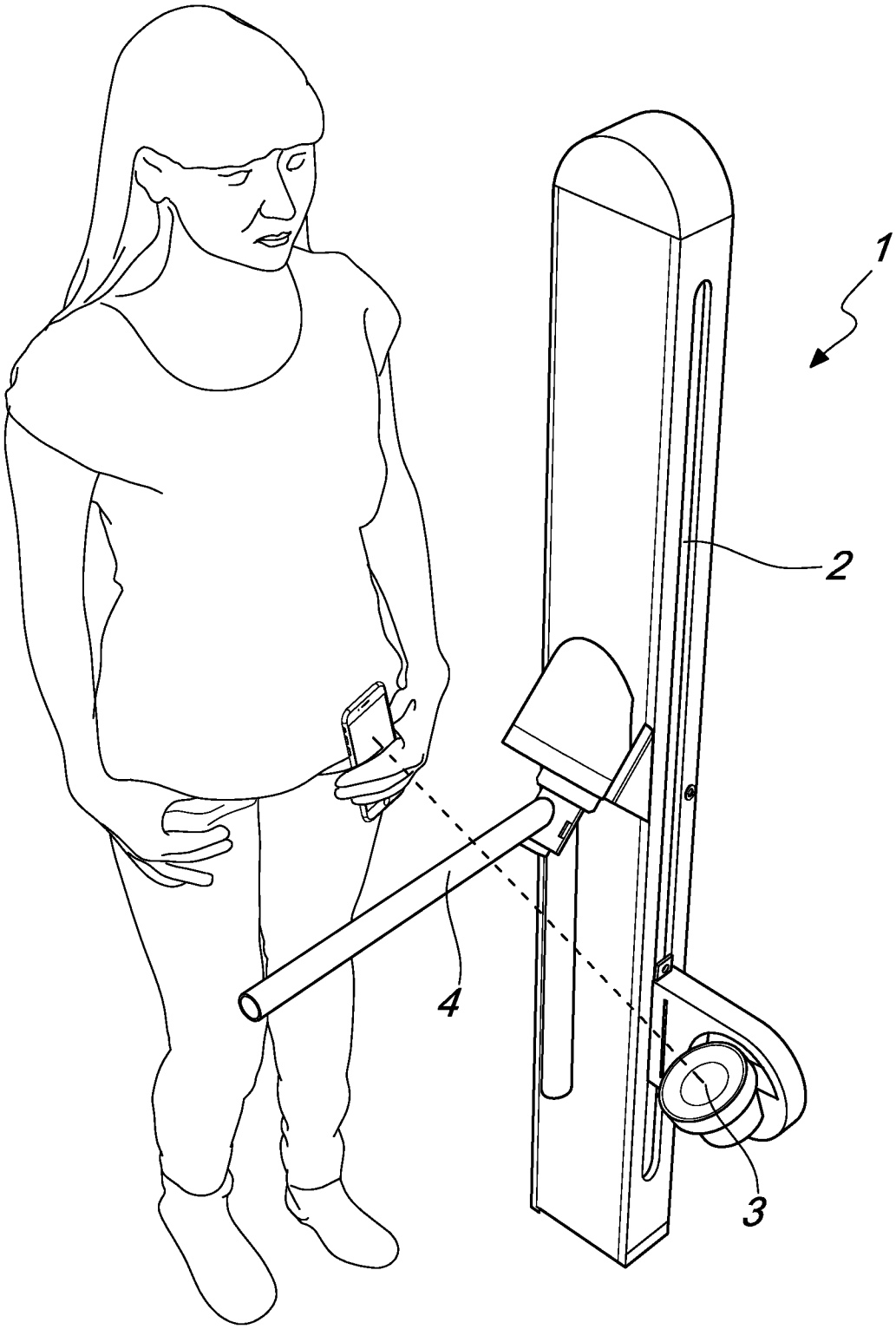
2. The device according to claim 1, characterized in that said single receiver (3) is arranged in a lower position with respect to a movable part (4) of said barrier (2).

3. The device according to claim 1, characterized in that said single receiver (3) is oriented upward, in the direction of the person who is in front of the barrier (2) that he or she has to pass through.

4. The device according to one or more of the preceding claims, characterized in that said receiver (3) is arranged downstream of the barrier (2), in a lower region, so that the straight line that runs from the portable terminal that the person carries with him or her to the receiver (3) always falls in the lane where the person who has to pass through the barrier is present.

5. The device according to one or more of the preceding claims, characterized in that said single receiver (3) is an antenna.

6. The device according to one or more of the preceding claims, characterized in that the presence of the person in a lane is determined by the presence of the signal within a boundary area expressed in polar coordinates.


1
2
3
4

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2020/053581

A. CLASSIFICATION OF SUBJECT MATTER
INV. G07C9/00 G07C9/10
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G07C E06B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/314833 A1 (RUIZ JORDI AGUD [JP]) 24 December 2009 (2009-12-24) paragraphs [0030], [0033], [0038], [0070] -----	1-6
A	WO 2018/116119 A1 (ALFI SRL [IT]) 28 June 2018 (2018-06-28) claim 2; figure 2 -----	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 June 2020	26/06/2020

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Verhoof, Paul

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2020/053581

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009314833 A1	24-12-2009	EP 2138981 A2	30-12-2009
		JP 2010003271 A	07-01-2010
		US 2009314833 A1	24-12-2009
WO 2018116119 A1	28-06-2018	EP 3555867 A1	23-10-2019
		US 2020045537 A1	06-02-2020
		WO 2018116119 A1	28-06-2018