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(71) Applicant: **Vestel Elektronik Sanayi ve Ticaret A.S.**
45030 Manisa (TR)

(72) Inventor: **KARATAS, Mustafa**
45030 Manisa (TR)

(74) Representative: **Ascherl, Andreas et al**
KEHL, ASCHERL, LIEBHOFF & ETTMAYR
Patentanwälte - Partnerschaft
Emil-Riedel-Strasse 18
80538 München (DE)

(54) SYSTEM FOR LIGHTING AN ENVIRONMENT

(57) A lighting system (1) for lighting an environment comprising more than one lighting source (2) adapted to generate light rays, and a change module (3) adapted to at least change direction of the light rays or move the lighting source (2), or a combination thereof, by individually actuating each of the lighting source (2) independently.

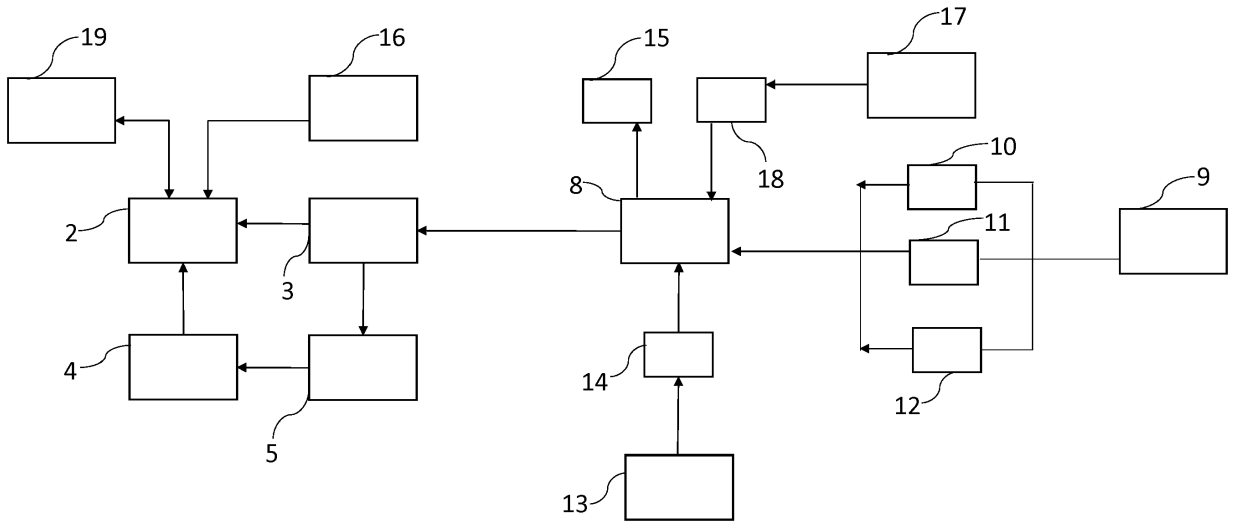

Fig. 1

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Description

[0001] This invention refers to a lighting system for lighting an environment according to claim 1.

Background of the Invention

[0002] In traditional manners, street lighting is done by generally lighting modules in a constant fashion without considering the respective need of an environment. Hence, only a limited area is illuminated. To illuminate a larger area, more and more lighting modules are required. This is neither cost-effective nor an energy efficient approach for street lighting.

[0003] Prior art document US Patent No. US2013148340 discloses a LED street lamp, which consists of power source box at front section, lamp holder at middle section and end cap at end section. The above-mentioned lamp holder is composed of turnable framework, frame fixing unit connected with frame to limit frame rotation and several LED lighting modules installed side by side in the frame. A LED lighting module can be turned to connect with frame on which module positioning unit is set to limit the rotation of LED lighting module. For LED street lamp base of the invention, the major design part contains two bilateral symmetrical frames each of which is set with several LED lighting modules side by side. Both angles of frame and LED lighting module are adjustable.

[0004] Japanese Patent Publication No. JP2016001543 discloses a light-emitting device capable of changing light distribution with a simple structure. The light-emitting device 1 includes a module support that has in a side surface part an attachment surface (a first attachment surface, a second attachment surface and a third attachment surface) to which plural light source modules are attached. The attachment surface includes the plural first attachment surfaces, and the plural second attachment surfaces whose angle to a device central axis is different from that of the first attachment surface.

[0005] Japanese Patent Publication No. JP2015099751 discloses a lamp capable of changing light distribution without greatly changing an external dimension of the lamp. The lamp includes a plurality of light source units, a lamp body, and a light source unit support body for supporting the light source units with respect to the lamp body. The plurality of light source units is arranged around a lamp center axis, and between the adjacent light source units, there is a gap for air to pass through. The light source unit support body has a rotary part for rotating the light source units around a rotational axis vertical to the lamp center axis, and the rotational axis of the rotary part is located between an end part close to a lamp tip of the light source unit and an end part close to a lamp base end of the light source unit.

Object of the Invention

[0006] It is therefore the object of the present invention is to realize a system for providing a lighting system which is cost-effective and efficient.

Description of the Invention

[0007] The before mentioned object is solved by a lighting system for lighting an environment according to claim 1.

[0008] The lighting system for lighting an environment according to the invention comprises more than one lighting source adapted to generate light rays, and a change module adapted to at least change direction of the light rays or move the lighting source, or a combination thereof, by individually actuating each of the lighting source independently.

[0009] This provides a mechanism for lighting the environment with minimal possible lighting sources. Changing the direction of the lighting rays in a required direction or moving the lighting source helps to change the illumination area to illuminate a specific area of the lighting environment which requires illumination at a particular point of time. This takes away the requirement of a huge amount of lighting sources to light the environment. Sometimes, it happens even using multiple lighting sources not to illuminate all the areas in the environment. However, according to the invention the movement of the light rays in the desired direction or movement of lighting source helps to light all areas of the enironment whenever required, and hence provides a cost-effective as well as efficient technique for lighting the environment.

[0010] Further preferred embodiments are subject-matter of dependent claims and/or of the following specification parts.

[0011] According to a preferred embodiment of the invention, the lighting system comprises one or more holders, such that each of the holder is holding one of the lighting sources, wherein the change module is in coupling movement to each of the holders and is adapted to actuate movement of each of the holders independently, such that each of the lighting sources moves independent to each other.

[0012] This embodiment is beneficial as it helps to provide an easy implimentation for changing the area being illuminated by the light source, as desired at the particular time frame.

[0013] According to a further embodiment of the lighting system, the change module is adapted to rotate the holder for tilting the lighting source from a first position to a second position.

[0014] This embodiment is helpful, as rotating the lighting source provides an easy and efficient mechanism for changing the direction of the light rays, which helps in changing the illumination area.

[0015] According to another embodiment of the lighting system, the change module comprises motors for each

of the light sources or each of the holders of the lighting sources, such that the motors move each of the holder independently.

[0016] This embodiment is helpful, as it provides an easy and efficient mechanism for implimentation to change an illumination area being illuminated by each of the lighting source independently by moving either the light source directly or by moving the holder either tranlationally or rotationally.

[0017] According to a further embodiment of the invention, at least one of the motors is located in proximity to a center of the holder or the lighting source.

[0018] This embodiment is helpful, as it provides an easy placement of the motor, which shall provide efficient movement of the holder or the light source. Specially, when the holder is to be rotated, the holder can directly be connected to the rotating rod, so as to lessen mechanical components used for rotation. In case that the motors are arranged at sides of the lighting sources or holders, there may be requirements of more mechnaical components or motors for proper and stable functioning of the movement of the holders. More mechanical components increases the chances of frequent breakdown of the system and may result in frequent maintenance.

[0019] According to another embodiment of the lighting system, at least one of the motors is a stepper motor or a servomotor.

[0020] This embodiment is beneficial, as it provides to achieve precision in the movement of the holder or the light source, which further helps in achieving desired area of illumination.

[0021] According to a further preferred embodiment of the invention, the lighting system comprises four or more lighting sources.

[0022] This embodiment is beneficial, as it divides the whole lighting system in smaller fractions which can be independently managed, which helps in achieving the desired illumination of the area in the environment with more precision.

[0023] According to another embodiment of the invention, the lighting system comprises a microcontroller adapted to control the change module for at least changing direction of the light rays or moving the lighting source, or a combination thereof by individually actuating each of the lighting source independently.

[0024] The embodiment is beneficial, as it provides a controlling of the change module with minimum human intervention, so as to achieve the change in illumination area being illuminated by the lighting source.

[0025] According to a further embodiment of the invention, the lighting system comprises a human detection module is adapted to detect presence of a human being in the environment where the lighting system is places, and is adapted to generate a human detection data, wherein the microcontroller is adapted to receive and process the human detection data, and to control the change module based on processing.

[0026] The embodiment is beneficial, as it further enables to control the change module in a completely automatic fashion by identifying presence of human being and wherever the human being is identified in a particular area of the environment, the change module is actuated to either change direction of the light rays or move the lighting source, so as to change the illumination area to the one with the human presence.

[0027] According to a further embodiment of the invention, the human detection module is adapted to detect at least a direction of the movement of the human or speed of movement of the human, or a combination thereof, and to generate at least one of a direction data or a speed data, or a combination thereof, and wherein the microcontroller is adapted to receive and process at least one of the direction data or the speed data, or a combination thereof, and to control the change module based on processing.

[0028] This embodiment is helpful, as identifying direction, or movement speed of a human or both helps in efficient controlling of the change module, without regular tracking of presence of the human. Once the speed or direction of the movement of the human is identified, the microcontroller shall use it as a basis for changing the illumination area continuously as the human is moving, without tracking the presence, movement or speed for some time interval. Thereafter, the human detection module can be again activated to track the presence of human, movement of human, or speed of human. This provides in particular a cost effective and energy efficient lighting system.

[0029] According to another embodiment of the invention, the human detection module comprises at least one of a camera, a thermal sensor, or a proximity sensor, or a combination thereof.

[0030] This embodiment is helpful, as it provides an easy implementation of the embodiments of the claims 9 or 10.

[0031] According to a further preferred embodiment of the invention, the lighting system comprises an environment light density detection module adapted to detect a density of the environment in which the lighting system is places, and to generate a light density data, wherein the microcontroller is adapted to receive and process the light density data and to generate a density control trigger, and a light density module is adapted to receive the density control trigger and is adapted to change a lighting level of the lighting source.

[0032] This embodiment is helpful as it provides for changing intensity of illumination as required sufficiently to light an area of environment. It should be noted that when there is another natural lighting source like the sun or the moon, the lighting may not be required, and the light density module shall switch off the lighting source. In case of insufficient light from the natural lighting sources, the light density module shall switch on the lighting source, and shall further increase level of lighting level of the lighting source, so as to provide optimal lighting in a desired area of the environment. Additionally, there

may be other secondary sources like, headlight of the moving vehicles, lights from a building or a torch light from a user, etc., which can also be taken in consideration to optimize the lighting level. Additionally, there is a possibility of a presence of multiple lighting systems to be present in the environment, which may be placed at a certain distance to each other, and each of the lighting system shall detect presence and/or movement of the human, and shall illuminate the area where the user is present. However, in such a scenario, the area of the human presence may be illuminated more than required, hence, each of the microcontroller of each of the lighting system takes in consideration the light density due to other lighting system, and triggers the light density module to optimize the lighting level of their lighting source.

[0033] According to a further embodiment of the invention, the lighting system comprises a memory storing a set of predefined rules for at least changing direction or the light rays or changing the light level of the lighting source, or a combination thereof, wherein the microcontroller is adapted to receive and process the predefined rules, and is adapted to control the change module, or generate the density control trigger, or combination thereof.

[0034] This embodiment is beneficial, as it helps to further optimize the operation of the microcontroller, and thus the lighting system, as desired by a user or manager of the lighting system.

[0035] According to another embodiment of the invention, the lighting source is Light Emitting Diode.

[0036] This embodiment is beneficial, as it provides an energy efficient mechanism for lighting the environment, as the LEDs are energy efficient. Also, the LEDs are flexible, which helps in arranging the lighting source onto the holder, or moving the lighting source as desired.

[0037] According to a further embodiment of the invention, the lighting system comprises one or more reflectors arranged or movable to be arranged in such a way that the light rays are reflected by the reflector to either focus the light rays to a particular area of the environment, or to reflect a part of light rays to another area of the environment which is not accessible by the light rays travelling in a particular direction.

[0038] This embodiment is beneficial, as it further optimizes light rays to be available for illumination to a broader area of the environment or focuses the light rays to a particular area. Reflection of light for broader area helps in reducing requirements for a number of lighting sources substantially. Thus concentrating or focusing of light rays is also helpful in certain applications, which require a higher intensity of illumination.

[0039] Further benefits, goals and features of the present invention will be described by the following specification of the attached figures, in which components of the invention are exemplarily illustrated. Components of the devices and method according to the inventions, which match at least essentially with respect to their function, can be marked with the same reference sign, wherein such components do not have to be marked or described in all figures.

[0040] The invention is just exemplarily described with respect to the attached figure in the following.

Brief Description of the Drawings

[0041]

Fig. 1 illustrates a schematic diagram of a lighting system for lighting an environment, according to an embodiment of the invention.

Fig. 2a illustrates placement of lighting sources in a street lighting system, according to an embodiment of the invention.

Fig. 2b illustrates the lighting sources of Fig. 2a in different positions for lighting the environment as desired, according to an embodiment of the invention.

Detailed Description of the Drawings

[0042] The present invention focuses on providing an energy efficient and cost effective mechanism for lighting an environment. In traditional manner, at every shorter distance the lighting sources are required to be placed to optimally light environment. However, even placement of multiple lighting sources at regular distance intervals, there are many parts of the environments which are not properly illuminated, resulting in visibility issues in those specific parts of the environment. In the present invention, the mechanism is provided to change direction of light rays, or change illumination area of the environment, as needed. In some of the embodiment, presence of human, movement of human, and various other factors are taken in consideration to change direction of the light rays or to change the area of illumination.

[0043] Fig. 1 illustrates a schematic diagram of a lighting system 1 for lighting an environment, according to an embodiment of the invention. The lighting system 1 includes more than one lighting sources 2 and a change module 3. The lighting sources 2 are placed in proximity to each other, and generates light rays for illuminating the environment. The change module 3 at least changes direction of the lights rays or moves the lighting source 2. Each of these activities are carried by individually activating each of the lighting sources 2. By changing the direction of the light rays, or moving the lighting source 2, the illumination area can be changed. This helps in covering a wider area for illuminating, however, a part of the wider area at a time while using minimal lighting sources 2. It is to be noted, the lighting sources 2 can be moved translationally or angularly to achieve the change in illumination area. By angularly moving of the lighting source 2, changing of the direction of the light rays are achieved. Direction of the light rays can also be changed by providing any other mechanisms, like optical arrange-

ment inside the lighting source 2 or any electrically induced mechanism so that the direction or focus of lighting rays can be changed by activation of the change module 3.

[0044] The lighting system 1 also includes one or more holders 4. Each of the holders 4 holds one of the lighting sources 2. The holders 4 are in coupling movement with the change module 3. The change module 3 actuates movement of each of the holders 4 independently, so as to move the lighting source 2 independent to each other. In one embodiment, the holders 4 are not required or at least not required to be moved, and the lighting source 2 can directly be moved or the direction of the light rays can be changed even without moving the holders 4 or the lighting sources 2.

[0045] The holders 4 can be either rotated or moved translationally to achieve movement of the lighting source 2, and to change the area of the illumination.

[0046] To move the holders 4, the change module 3 includes a motor 5 for each of the holders 4 so that the motors 5 can move the holder 4 independently. In one embodiment, where the holders 4 are not provided, the motors 5 directly move the lighting source 2 to achieve the movement of the lighting source 2. In another embodiment, as an alternative to a motor any other movement mechanism can be provided to move the holder 4 or the lighting source 2. In another embodiment, where the direction of the light rays is changed without moving the lighting source 2, the motor 5 is not required. In one embodiment, the motors 5 can be a stepper motor or servo motor, which helps in moving the holder 4 or the lighting source 2 precisely. In one embodiment, the motor 5 is placed in proximity to a center of the holder 4 or the lighting source 2. Keeping the motor 5 near to the center, helps in easy movement of the lighting source 2 or the holder 4, and also provides stability and low maintenance due to reductions of mechanical parts and fixtures.

[0047] For controlling the change module 3 efficiently, the lighting system 1 also includes a microcontroller 8 which controls the change module 3 to function as desired for either changing direction of the light rays or moving the lighting source 2, or both. In another embodiment, the microcontroller 8 is not required, however, the change module 3 can be manually handled to change the direction of the light rays, or to move the lighting source 2.

[0048] The lighting system 1 also includes a human detection module 9 which detects the presence of a human being in the environment where the lighting system 1 is placed. On detection of the presence of human, the human detection module 9 generates a human detection data 10. The human detection module 9 is also capable of detecting movement of the human, more specifically direction of the human movement, and the speed of the human movement. On detecting the direction of the human movement, the human detection module 9 generates a direction data 11, and on detecting the speed of human movement a speed data 12 is generated by the human detection module 9.

[0049] The microcontroller 8 receives the human detection data 10, the direction data 11, and the speed data 12, and controls the change module 3 according to the data 10, 11, and 12. In one embodiment, the human detection module 9 is enabled to detect for speed of the human movement, and direction of the human movement, only when the presence of the human is identified. In another embodiment, only the presence of the human is taken in consideration, and the human detection module 9 is not enabled to detect the speed of the human movement or the direction of the human movement. In yet another embodiment, the human detection module 9 is only enabled to detect either the speed of the human movement or the direction of the human movement. In another embodiment, the human detection module 9 is enabled to first detect speed of the human movement, and thereafter the corresponding direction of the human movement, or vice-versa. It is to be noted that detection of the speed of the human movement or direction of the movement enables the change module 3 to control and define the rate movement of the holders 4 or lighting source 2, or rate of movement of the direction of the light rays respectively.

[0050] The human detection module 10 includes any one of a camera, a thermal sensor, or a proximity sensor, or any combination of them. Based on the types of human detection module 10, the lighting system 1 may require appropriate processing capabilities, like image processing techniques, or thermal data processing techniques, etc.

[0051] In another embodiment, the human detection module 10 is not provided, and the microcontroller 8 can be programmed on various other criteria for controlling the change module 3.

[0052] Additionally, the lighting system 1 includes an environment light density detection module 13 and a light density module 16. The environment light density detection module 13 detects a lighting density of the environment in which the lighting system 1 is placed. On detecting the density of lighting, the environment light density detection module 13 generates a light density data 14. The light density data 14 is received and processed by the microcontroller 8, which generates a density control trigger 15 based on the processing. The light density module 16 receives the density control trigger 15 and changes a lighting level of the lighting source 2. In an environment, there can be multiple lighting system 1 present and there can be presence of natural lighting like the sun and the moon and/or secondary lighting sources like car headlights can be present. In such scenario, the part of the environment in which the lighting system 1 is present, need not require the lighting conditions to be at higher level, however, lower level of lighting can be good enough to produce the desired illumination, or brightness. The current embodiment supports the lighting system to be further efficient, and provides with lower running cost of the lighting system 1. In another embodiment, the lighting system 1 need not consider the illumination from

natural sources, or secondary sources, or from another lighting system 1 placed in proximity, and hence the environment light density detection module 13 and the light density module 16 are not required.

[0053] The lighting system 1 also includes a memory 17 which stores a set of predefined rules 18 for either changing direction or the light rays, or changing the light level of the lighting source 2, or both. The microcontroller 8 fetches the predefined rules 18 and processes the predefined rules 18 and based on the predefined rules 18 either controls the change module 3 or generate the density control trigger 15, or both. The microcontroller 8 can also be connected to a remote server, which can update or replace the predefined rules 18 by sending the predefined rules 18 to the microcontroller 8, which further replaces the predefined rules 18 already stored in the memory 17. In one embodiment, the predefined rules 18 are received in real time from the remote server for taken in consideration and processing by the microcontroller 8, and in such scenario the memory 17 is not required. In yet another embodiment, the microcontroller 8 cannot be remotely instructed or provided with predefined rules 18 and it functions based on the data 10, 11, 12.

[0054] In one embodiment, the lighting source 2 is Light Emitting Diode (LED), which are having a lower energy consumption, and hence have a lower running cost.

[0055] The lighting system also includes one or more reflectors 19. The reflectors 19 are arranged in such a fashion that the light rays generated by the lighting source 2 are reflected by the reflector 19 to either focus the light rays to a particular area, or to reflect a part of light rays to another area of the environment which is not accessible by the light rays travelling in a particular direction. Focusing the light rays helps in increasing lighting density, and can be useful in a scenario where lighting density is required to be more for better visibility. Further, the reflection of light to other non-accessible parts by the light rays helps in covering a wider area for the illumination. In one embodiment, the reflectors 19 can be moved to change their arrangement, as desired for particular application or need, at a particular instance of time. In an alternate embodiment the reflectors 19 are not provided, and the lighting system 1 uses changing direction of light rays or movement of the light source to cover the area of the environment for illumination or focusing of the light rays for higher density levels.

[0056] Fig. 2a and Fig. 2b shows the lighting system 1 to be implemented as part of a street lighting scenario. In street lighting, the lighting sources 2 are raised to a particular height, and are further movably fixed to a frame 20. As shown in figures, the frame 20 encapsulates four lighting sources 2, which are movably affixed to the frame 20, such that they can move in an angular fashion. All the four lighting sources 2 are placed in proximity to each other in matrix fashion, and have a clearance between each other, so that the angular movement of the lighting sources 2 can efficiently take place. The lighting sources 2 provided are Light emitting diodes. For movement of the lighting sources 2, motors (not shown in the figure) are provided at a center 21 of each of the lighting source 2. The angular movement can be achieved along any of the axis passing through an imaginary plane which is in parallel to the plane of the frame 20. For a proper movement, the lighting sources 2 are affixed in a raised fashion, so as to keep a gap between the lighting sources, and affixing platform of the frame.

[0057] In Fig. 2a, the lighting sources 2 are in a first position, which is a first position 6, which is a resting position or initial position of the lighting sources 2. When the motor is effectuated, it moves the lighting sources 2 in a second position 7, which is an angular position of the lighting sources 2. It is to be noted that by using elements of the Fig. 1, the motors can be effectuated as desired, and in such a way that each motor are independently effectuated for moving each of the lighting sources 2.

[0058] In an alternate embodiment, the lighting sources 2 can move vertically too to increase lightning density in a particular area of the environment.

[0059] Thus, the present invention provides for a lighting system 1 for lighting an environment comprising more than one lighting source 2 which generates light rays, and a change module 3 which at least changes direction of the light rays or moves the lighting source 2, or a combination thereof, by individually actuating each of the lighting source 2 independently.

List of reference numbers

[0060]

1	lighting system
2	lighting source
3	change module
4	holder
5	motor
6	first position
7	second position
8	microcontroller
9	human detection module
10	human detection data
11	direction data
12	speed data
13	environment light density detection module
14	light density data
15	density control trigger
16	light density module
17	memory
18	predefined rules
19	reflector
20	frame
21	center

Claims

1. A lighting system (1) for lighting an environment comprising:

   - more than one lighting source (2) adapted to generate light rays; and
   - a change module (3) adapted to at least change direction of the light rays or move the lighting source (2), or a combination thereof, by individually actuating each of the lighting source (2) independently.

2. The lighting system (1) according to the claim 1 comprising:

   - one or more holders (4) such that each of the holders (4) is holding one of the lighting sources (2),

   wherein the change module (3) is in coupling movement to each of the holders (4), and is adapted to actuate movement of each of the holders (4) independently such that each of the lighting source (2) moves independent to each other.

3. The lighting system (1) according to the claim 2, wherein the change module (3) is adapted to rotate the holder (4) for tilting the lighting source from a first position (6) to a second position (7).

4. The lighting system (1) according to any of the claims 1 to 3, wherein the change module (3) comprises motors (5) for each of the light source (2) or holders (4) of the lighting source (2) such that the motors (5) move each of the holder (4) or the lighting source (2) independently.

5. The lighting system (1) according to the claim 4, wherein at least one of the motors (5) is located in proximity to a center (21) of the holder (4) or the lighting source (2).

6. The lighting system (1) according to any of the claims 4 or 5, wherein at least one of the motors (5) is a stepper motor or a servomotor.

7. The lighting system (1) according to any of the claims 1 to 6 comprising four or more lighting sources (2).

8. The lighting system (1) according to any of the claims 1 to 7 comprising:

   - a microcontroller (8) adapted to control the change module (3) for at least changing direction of the light rays or moving the lighting source (2), or a combination thereof by individually actuating each of the lighting sources (2) independently.

9. The lighting system (1) according to the claim 8 comprising:

   - a human detection module (9) adapted to detect the presence of a human being in the environment where the lighting system (1) is placed, and adapted to generate a human detection data (10),

   wherein the microcontroller (8) is adapted to receive and process the human detection data (10) and to control the change module (3) based on processing.

10. The lighting system (1) according to the claim 9, wherein the human detection module (9) is adapted to detect at least a direction of movement of the human or a speed of the movement of the human, or a combination thereof, and to generate at least one of a direction data (11) or a speed data (12), or a combination thereof, and wherein the microcontroller (8) is adapted to receive and process at least one of the direction data (11) or the speed data (12), or a combination thereof, and to control the change module (3) based on processing of the direction data (11) or the speed data (12), or a combination thereof.

11. The lighting system (1) according to any of the claims according to any of the claims 9 or 10, wherein the human detection module (10) comprises at least one of a camera, a thermal sensor, or a proximity sensor, or a combination thereof.

12. The lighting system (1) according to any of the claims 8 to 11 comprising:

   - an environment light density detection module (13) adapted to detect a lighting density of the environment in which the lighting system (1) is placed, and to generate a light density data (14); wherein the microcontroller (8) is adapted to receive and process the light density data (14) and generate a density control trigger (15); and
   - a light density module (16) adapted to receive the density control trigger (15), and adapted to change a lighting level of the lighting source (2).

13. The lighting system (1) according to any of the claims 8 to 12 comprising:

   - a memory (17) storing a set of predefined rules (18) for at least changing direction or the light rays or changing the light level of the lighting source (2), or a combination thereof,

   wherein the microcontroller (8) is adapted to receive and process the predefined rules (18) and is adapted

to control the change module (3) or to generate the density control trigger (15), or a combination thereof.

14. The lighting system (1) according to any of the claims 1 to 13, wherein the lighting source (2) is Light Emitting Diode.

15. The lighting system (1) according to any of the claims 1 to 14 comprising one or more reflectors (19) arranged or movable to be arranged in such a way so that the light rays are reflected by the reflector (19) to either focus the light rays to a particular area of the environment or to reflect a part of light rays to another area of the environment which is not accessible by the light rays travelling in a particular direction.

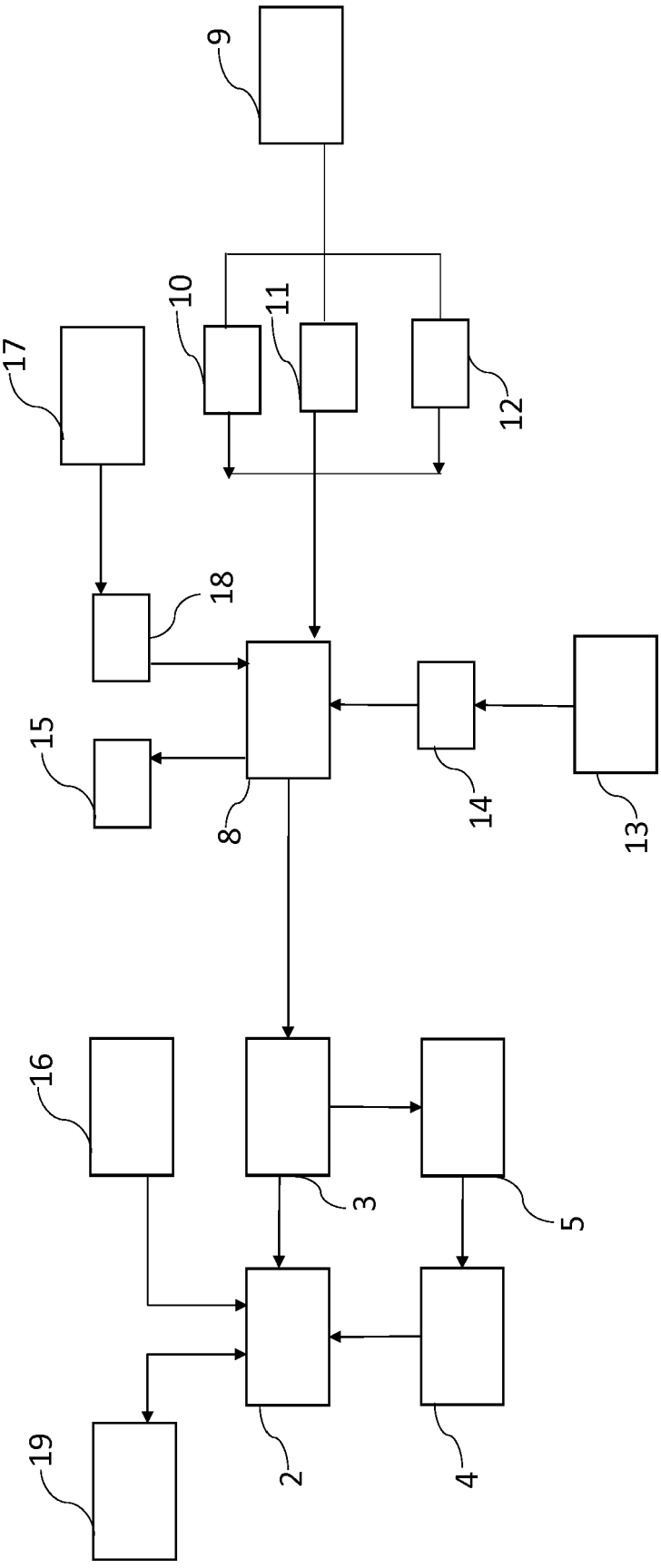

Fig. 1

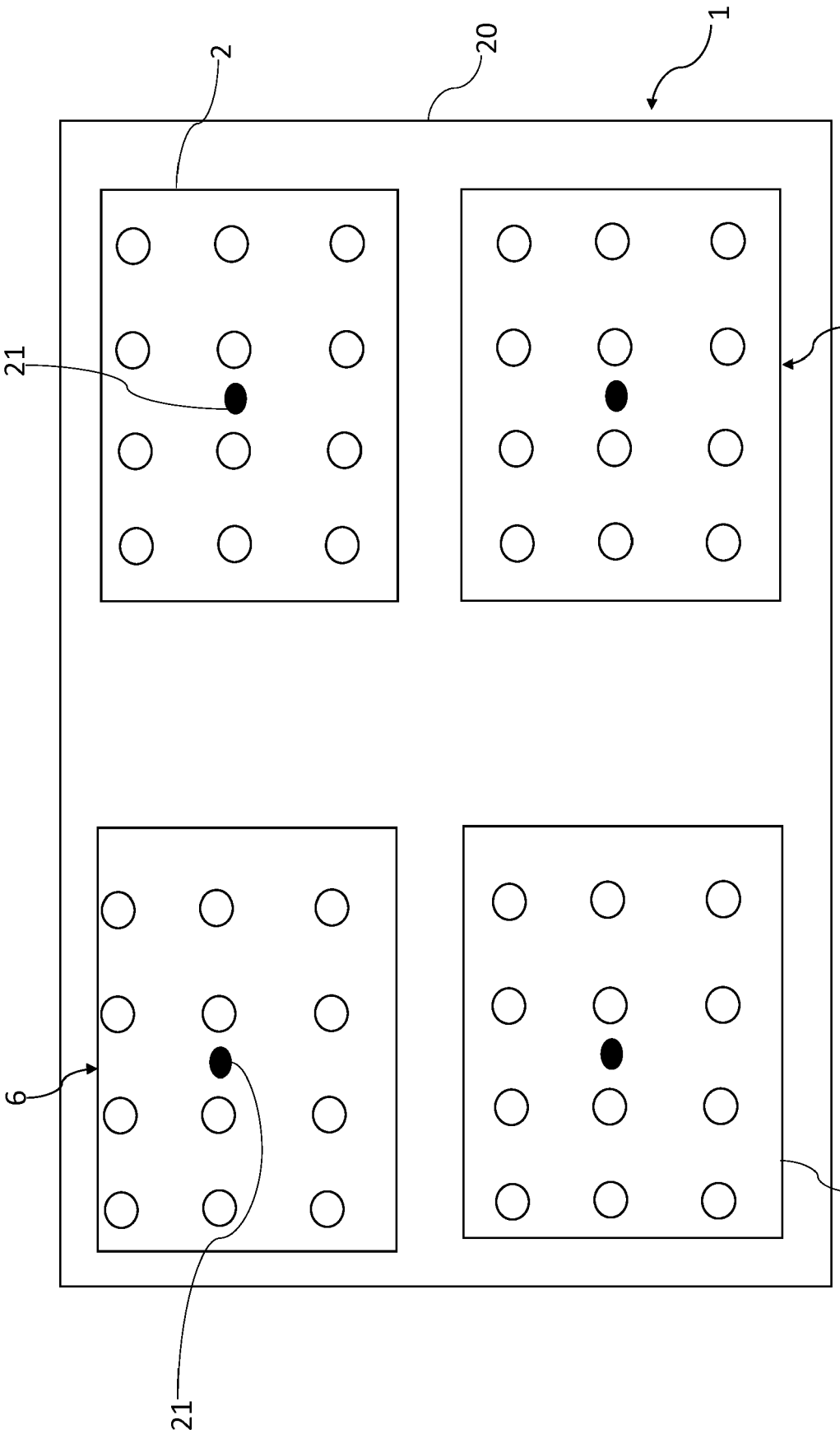

Fig. 2a

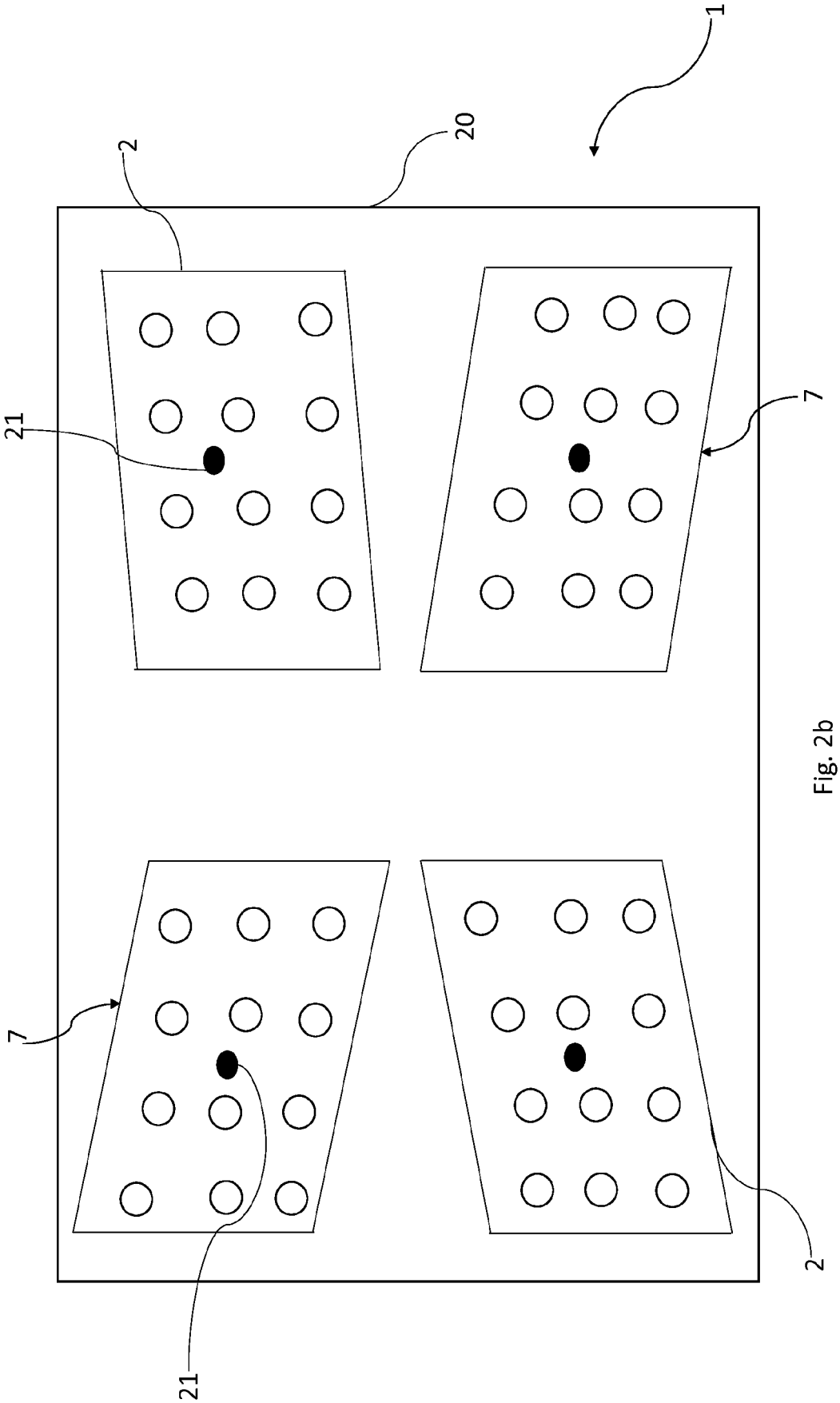

Fig. 2b

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 17 19 9928

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	US 2015/035437 A1 (PANOPOULOS PETER J [US] ET AL) 5 February 2015 (2015-02-05) * the whole document *	1-15	INV. F21S2/00 F21V14/02
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