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(54) LIGHTING SYSTEM AND A METHOD FOR PROVIDING LIGHT TO AN AREA

BELEUCHTUNGSSYSTEM UND VERFAHREN ZUR BELEUCHTUNG EINER FLÄCHE

SYSTÈME D'ÉCLAIRAGE ET PROCÉDÉ DE FOURNITURE DE LUMIÈRE SUR UNE ZONE

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Description

[0001] The present invention relates to a lighting system and a method for providing light to an area.

[0002] According to an embodiment of the invention, the lighting system corresponds to a luminaire. According to a further embodiment of the invention, the lighting system comprises two or more luminaires.

[0003] In the prior art, LED light sources (LED-LS, light emitting diode light sources) comprising one or more LEDs (light emitting diodes), such as one or more of organic LEDs, inorganic LEDs, LEDs with secondary emission etc., are well known. LED light sources are more and more used instead of more traditional light sources comprising or corresponding to filament lamps and/or gas-discharge lamps. The use of LEDs for providing light has many advantages such as reduced energy consumption, longer lifetime, lighting of variable color etc.

[0004] In particular, LED light sources configured to emit white light are used for lighting purposes. Such LED light sources may emit light of a spectrum that causes more blinding (of persons) compared to more traditional light sources in case of humid air, because the white light emitted by the LED light sources is more reflected by the humid air compared to the light emitted by a traditional light source, such as a gas discharge lamp. For example in the field of street lighting before the use of LED light sources sodium vapor lamps, such as low pressure sodium lamps, were used as light sources. A light source emitting white light (e.g. of correlated color temperature (CCT) of 6500 K) causes more blinding in case of rain or fog compared to a sodium vapor lamp. This is due to an increased light-reflection of the light emitted by the LED light source on water drops, present due to the rain or fog, compared to the light-reflection om water drops of the light emitted by a sodium vapor lamp in such a case. The terms "dazzle" and "glare" may be used as synonyms for the term "blinding".

[0005] Publication US10405399B1 shows a lighting system according to the preamble of claim 1.

[0006] Therefore, it is an object of the present invention to provide an improved lighting system using an LED light source for providing light to an area, e.g. a street area, both in dry and wet conditions. In particular, it is an object to provide a lighting system using an LED light source for providing light to an area, for which the above described drawbacks in case of moisture (e.g. humid air and/or wet ground) are reduced, in particular overcome.

[0007] These and other objects, which become apparent upon reading the following description, are solved by the subject-matter of the independent claim. The dependent claims refer to preferred embodiments of the invention.

[0008] The terms "preferably", "in particular" and "optionally" are used herein for introducing optional features of the present invention.

[0009] According to a first aspect of the invention a lighting system for providing light to an area is provided. The system comprises at least one LED light source (LED-LS) configured to emit white light, and a control unit configured to control a light emission of the at least one LED-LS. The control unit is configured to control the light emission of the at least one LED-LS based on moisture information on a moisture in the area such that, in case the moisture information fulfills a condition regarding the moisture in the area, the control unit controls the at least one LED-LS to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than a probability threshold. The at least one LED-LS comprises a first LED unit configured to emit the white light. Further, the at least one LED-LS comprises a second LED unit configured to emit light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold. The control unit is configured to control the light emission of the at least one LED-LS such that: the first LED unit emits light, in case the moisture information does not fulfill the condition, and only the second LED unit emits light, in case the moisture information fulfills the condition. The second LED unit is configured to emit light of a spectrum comprising a relative emission intensity greater than 20% between a wavelength of 580 nm and a wavelength of 605 nm. Alternatively or additionally, the second LED unit is configured to emit light of a spectrum comprising a relative emission intensity greater than 20% between a wavelength of 542 nm and a wavelength of 670 nm. Alternatively or additionally, the second LED unit is configured to emit light of a spectrum between a wavelength of 565 nm and a wavelength of 620 nm. Alternatively or additionally, the second LED unit is configured to emit light of a spectrum between a wavelength of 527 nm and a wavelength of 685 nm.

[0010] In other words, in case the moisture information fulfills the condition regarding the moisture in the area, the control unit is configured to control the light emission of white light of the at least one LED-LS such that, when the at least one LED-LS emits light (light emitting state of the at least one LED-LS), the at least one LED-LS stops emitting light of a spectrum comprising a reflection probability of light-reflection on water drops greater than or equal to the probability threshold. That is, in case the moisture information fulfills the condition, the control unit is configured to control the light emission of the at least one LED-LS such that the control unit controls the at least one LED-LS to emit light of one or more wavelengths for which the reflection probability of light-reflection on water drops is smaller than the probability threshold.

[0011] As outlined above, according to an alternative, the second LED unit may be configured to emit light of a spectrum comprising a relative emission intensity greater than 20% between a wavelength of 580 nm and a wavelength of 605 nm. In other words, the spectrum of the light that may be emitted by the second LED unit may comprise a relative emission intensity greater than 20% only in a wavelength range between a wavelength of 580 nm and a wavelength of 605 nm. Thus, the relative emis-

sion intensity equaling 100% of the spectrum of the light emittable by the second LED unit may be in the wavelength range between 580 nm and 605 nm. According to another alternative, the second LED unit may be configured to emit light of a spectrum comprising a relative emission intensity greater than 20% between a wavelength of 542 nm and a wavelength of 670 nm. In other words, the spectrum of the light that may be emitted by the second LED unit may comprise a relative emission intensity greater than 20% only in a wavelength range between a wavelength of 542 nm and a wavelength of 670 nm. Thus, the relative emission intensity equaling to 100% of the spectrum of the light emittable by the second LED unit may be in the wavelength range between 542 nm and 670 nm.

[0012] Therefore, the lighting system may provide white light to the area in case the moisture information does not fulfill the condition. This is advantageous, because an LED-LS providing white light for illumination has a good efficiency factor with regard to the electrical energy needed for providing the lighting in the area. On the other side, in case the moisture information fulfills the condition, e.g. the air in the area comprises a certain humidity level, the lighting system may switch from providing white light to only providing light of the spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold, for providing the lighting in the area. This is advantageous, because this reduces the blinding (of a person in the area) caused by the light emission compared to a case, in which the light emission is not changed and, thus, emission of white light is continued. Reducing the blinding increases the visibility for a person present in the area.

[0013] Emitting only light of the spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold may decrease the efficiency factor of the light emission by the lighting system. Therefore, the control unit is configured to change the light emission of white light to light of the spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold only in case the condition is fulfilled. Thus, in case the condition is not fulfilled, the white light with the good efficiency factor is emitted.

[0014] In the light of the above, the lighting system according to the first aspect is advantageous, because it allows reducing blinding caused by light emission of the LED-LS of the system in case the condition regarding the moisture in the area, e.g. a certain moisture level or presence of rain or fog, is fulfilled. At the same time, the lighting system allows to improve the efficiency of the light emission by allowing white light emission, in case the condition is not fulfilled (e.g. good weather, no rain, no fog).

[0015] The moisture in the area comprises the moisture of the ground in the area and the moisture of the air in the area. The term humidity is used for referring to the moisture in the air of the area. The term "moisture" is to be understood as referring to water in the form of drops (i.e. water drops) either in the air, in a substance or on a surface (e.g. the ground in the area).

[0016] In particular, the smaller the wavelength of the emitted light the higher the reflection probability of light-reflection on water drops of the emitted light.

[0017] The area may be an outdoor area, e.g. a street area, a harbor/port area, airport area, forest area etc. Alternatively, the area may be an indoor area, e.g. indoor skiing hall, indoor pool, thermal bath etc. In particular, the area may be a combination of an outdoor and indoor area, such as a sports stadium or swimming hall, optionally with a movable roof.

[0018] The LED-LS may comprise a plurality of LEDs (light emitting diodes), such as at least one of organic LEDs, inorganic LEDs, LEDs with secondary emission etc.

[0019] The control unit may comprise or correspond to a processor, a microprocessor, a controller, a microcontroller, a field programmable gate array (FPGA), an application specific integrated circuit (ASIC) or any combination of them.

[0020] In particular, the moisture information fulfills the condition in case the moisture information informs on a humidity level greater than a humidity threshold. Alternatively or additionally, the moisture information may fulfill the condition in case the moisture information informs on precipitation and/or fog. In particular, the moisture information may fulfill the condition in case the moisture information informs on a precipitation intensity greater than an intensity threshold, i.e. on an amount of precipitation greater than a threshold amount. Alternatively or additionally, the moisture information may fulfill the condition in case the moisture information informs on a moisture level of the ground in the area greater than a moisture threshold.

[0021] Thus, the moisture information may inform on at least one of a presence of a weather condition comprising or corresponding to precipitation and/or fog; a degree of a weather condition comprising or corresponding to precipitation and/or fog; a humidity level; and a moisture level of the ground.

[0022] The humidity level may correspond to the absolute humidity in the area, i.e. the total mass of water vapor present in a given volume or mass of air. The humidity level may correspond to a relative humidity. Precipitation may comprise or correspond to rain, snow, sleet, hail etc. The moisture level may correspond to an absolute moisture level or a relative moisture level.

[0023] In particular, the lighting system comprises a weather condition sensor unit configured to detect precipitation and/or fog in the area and provide the detection result as the moisture information to the control unit. The weather condition sensor unit may comprise or correspond to a precipitation and/or fog sensor unit. Additionally or alternatively, the lighting system may comprise a humidity sensor unit configured to detect a humidity level of the humidity in the area and provide the detection result

as the moisture information to the control unit. Additionally or alternatively, the lighting system may comprise a moisture sensor unit configured to detect a moisture level of the ground in the area and provide the detection result as the moisture information to the control unit. Additionally or alternatively, the lighting system may comprise a communication unit configured to receive the moisture information, e.g. from a weather forecast station, and provide the moisture information to the control unit. The weather forecast station may be a station for providing information on the weather in the future and/or information on the present weather. The term "weather station" may preferably be used for the "weather forecast station in case that only information on actual information is used but no forecast.

[0024] The weather condition unit may be configured to detect the presence of precipitation and/or fog in the area and optionally the degree of precipitation (i.e. amount/intensity of precipitation) and/or fog (density of fog). For implementing a weather condition sensor unit, a precipitation and/or fog sensor unit, a humidity sensor unit and a moisture sensor unit any sensors known in the art may be used.

[0025] The communication unit may be configured to communicate wirelessly and/or wire-bound for receiving the moisture information. In particular, the communication unit may be configured to communicate with a weather forecast station for receiving information on the weather condition in the area as the moisture information. The communication unit may be a part of the control unit. In particular, the wireless communication unit may be configured to communicate wirelessly using radio waves. The communication unit may be implemented by any means known in the art.

[0026] Thus, the lighting system may generate the moisture information regarding the moisture in the area by itself using at least one of a weather condition unit, precipitation and/or fog sensor unit, a humidity sensor unit and a moisture sensor unit. In this case, the control unit may be configured to determine based on the generated moisture information that the condition regarding the moisture in the area is fulfilled, e.g. presence of precipitation, the humidity level in the area is greater than a humidity threshold and/or the moisture level of the ground is greater than a moisture threshold. The control unit may react thereto, by controlling the light emission of the at least one LED light source such that the light emission is changed from a first emission state to a second emission state. In the first emission state, the at least one LED-LS emits white light, when the control unit controls the at least one LED-LS to emit light. In the second emission state, the at least one LED-LS emits only light of the spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0027] For example, in case the moisture information informs on a moisture level of the ground in the area greater than a moisture threshold (e.g. wet street due to rainfall), the control unit may determine that that the condition is fulfilled.

[0028] In addition or alternatively, the system may receive the moisture information regarding the moisture in the area from a weather forecast station. Thus, the control unit may already react to a received moisture information fulfilling the condition before the condition is actually fulfilled in the area. For example, in case, the communication unit receives from the weather forecast station information informing on heavy rain fall for a certain time and optionally date, e.g. on 12.05.2020 at 12.00 o'clock, and the condition corresponds to such heavy rain fall, then the control unit may determine based on the received information from the weather forecast station that at that time and optionally date (e.g. 12.05.2020 at 12.00 o'clock), the condition regarding the moisture in the area will be fulfilled. The control unit may be configured to control the at least one LED-LS such that at that time and optionally date (12.05.2020 at 12.00 o'clock) the at least one LED-LS emits only light of the spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0029] Optionally, the control unit may be configured to control the at least one LED-LS such that already a time period (e.g. 30 minutes) before that time and optionally date (12.05.2020 at 12.00 o'clock) the at least one LED-LS emits only light of the spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold. Thus, the communication unit allows the control unit to react to the condition already before the condition is fulfilled.

[0030] Optionally, the control unit may be configured to control, based on moisture information for a certain time received from the weather forecast station, the at least one LED-LS at the certain time. In other words, the moisture information from the weather forecast station may comprise or may be current information or live information on the moisture in the area. In this case, the weather forecast station may function or may be used by the light system as a central sensor unit (not part of the lighting system) for obtaining moisture information on the moisture in the area. For this, the lighting system may be configured to receive the moisture information from the weather forecast station. In particular, in the aforementioned case (i.e. the weather forecast station providing present moisture information or current moisture information) the weather forecast station may be a weather station.

[0031] For example, in case the control unit controls the at least one LED-LS based on current moisture information on the moisture in the area at a point in time (e.g. at 12.00 o'clock), the lighting system may receive the current moisture information on the moisture in the area for the point in time (e.g. at 12.00 o'clock) from the weather forecast station. The lighting system may be configured to receive the current moisture information on the moisture in the area for the point in time directly at the point in time. The control unit may be configured to

control, at the point in time, the at least one LED-LS based on the moisture information for the point in time. The control unit may control, at the point in time, the at least one LED-LS based on the moisture information for the point in time in addition to moisture information for the point in time obtained from one or more sensor units of the lighting system, such as at least one of the optional weather condition sensor unit, optional humidity sensor unit and optional moisture sensor unit.

[0032] For example, the weather forecast station may comprise or use a precipitation radar (e.g. rain radar) and the lighting system may be configured to receive, as the moisture information, information on the current precipitation (e.g. no precipitation, type of precipitation (snow, rain etc.) and/or degree of precipitation) in the area from the precipitation radar of the weather forecast station. The control unit may be configured to control the at least one LED-LS based on the information on the current precipitation, i.e. based on the current moisture information received from the weather forecast station.

[0033] Therefore, the control unit may use the moisture information obtained from the weather forecast station for proactively reacting or reacting in advanced to a future moisture situation in the area and/or reacting to a current moisture situation in the area on which the moisture information from the weather forecast station informs.

[0034] For evaluating the moisture information received from one or more sensors of the lighting system, such as the aforementioned sensors, and/or the information received from a weather forecast station, the control unit may use one or more look-up tables and/or one or more algorithms.

[0035] The reflection probability of light-reflection on water drops may correspond to a relative scattering coefficient and the probability threshold may correspond to a threshold for the relative scattering coefficient.

[0036] In particular, the reflection probability of light-reflection on water drops may correspond to a relative Rayleigh scattering coefficient and the probability threshold may correspond to a threshold for the relative Rayleigh scattering coefficient. In other words, the relative scattering coefficient may be a relative Rayleigh scattering coefficient.

[0037] In particular, the higher the relative scattering coefficient the higher the reflection probability of light-reflection on water drops.

[0038] As already described above, the at least one LED-LS comprises a first LED unit configured to emit the white light, and a second LED unit configured to emit light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold. The control unit may be configured to control the light emission of the at least one LED-LS such that the first LED unit emits light, in case the moisture information does not fulfill the condition, and only the second LED unit emits light, in case the moisture information fulfills the condition.

[0039] In particular, the control unit may be configured to control the light emission of the at least one LED-LS such that only the first LED unit emits light, in case the moisture information does not fulfill the condition.

[0040] The first LED unit and the second LED unit each may correspond to an LED chip.

[0041] As already described above, the second LED unit may be configured to emit light of a spectrum comprising a relative emission intensity greater than 20% between a wavelength of 580 nm and a wavelength of 605 nm. In other words, the second LED unit may be configured to emit light of a spectrum comprising, between the wavelength of 580 nm and the wavelength of 605 nm, a relative emission intensity between 20% and 100%. That is, the relative emission intensity of the spectrum may be equal to 100% at a wavelength between the wavelength of 580 nm and the wavelength of 605 nm. Thus, the second LED unit may be configured to emit light of a spectrum comprising its main part (i.e. the main part of the spectrum) between the wavelength of 580 nm and the wavelength of 605 nm. The second LED unit may be configured to emit light of a spectrum comprising 20% relative emission intensity at the wavelength of 580 nm and the wavelength of 605 nm. Alternatively, the second LED unit may be configured to emit light of a spectrum comprising a relative emission intensity greater than 20% between a wavelength of 542 nm and a wavelength of 670 nm. In other words, the second LED unit may be configured to emit light of a spectrum comprising, between the wavelength of 542 nm and the wavelength of 670 nm, a relative emission intensity between 20% and 100%. That is, the relative emission intensity of the spectrum may be equal to 100% at a wavelength between the wavelength of 542 nm and the wavelength of 670 nm. Thus, the second LED unit may be configured to emit light of a spectrum comprising its main part (i.e. the main part of the spectrum) between the wavelength of 542 nm and the wavelength of 670 nm. The second LED unit may be configured to emit light of a spectrum comprising 20% relative emission intensity at the wavelength of 542 nm and the wavelength of 670 nm. The second LED unit may be configured to emit light of a spectrum between a wavelength of 565 nm and a wavelength of 620 nm or a wavelength of 527 nm and a wavelength of 685 nm.

[0042] In particular, the spectrum comprises a Gaussian spectral shape. The spectrum may be a symmetrical spectrum.

[0043] The second LED unit may be a monochromatic amber LED unit configured to emit amber light. The second LED unit may be a phosphor converted LED unit configured to emit amber light.

[0044] In particular, the first LED unit is configured to emit white light with a variable correlated color temperature (CCT) and the control unit is configured to vary the CCT of the white light.

[0045] The first LED unit may be configured to emit white light with a variable CCT between 2700 and 4000 K. Optionally, the first LED unit may be configured to emit white light with a CCT of 6500 K.

[0046] In particular, the lighting system comprises a lens unit arranged to modulate the light emitted by the second LED unit. The lens unit comprises an improved beam geometry reducing the reflection probability of light-reflection on water drops of the light emitted by the second LED unit.

[0047] For implementing the lens unit any lens known in the art may be used. The lens unit may correspond to a lens arrangement comprising a plurality of lenses.

[0048] In particular, the lens unit is arranged to reduce reflectivity of light, emitted by the second LED unit, on a wet ground in the area. That is, the lens unit may be arranged to reduce reflectivity of light, emitted by the second LED unit, on a ground in the area, wherein the moisture level of the ground is above a moisture threshold (e.g. a water level or water amount above a threshold value is present on the ground).

[0049] Optionally, the lens unit may be arranged with regard to the first LED unit and the second LED unit such that the lens unit comprises an improved beam geometry reducing the reflection probability of light-reflection on water drops of the light emitted by the second LED unit. For example, the lens unit may be arranged with regard to the first LED unit and the second LED unit such that the lens unit comprises a specifically adapted beam geometry for the white light emitted by the first LED unit and a specifically adapted beam geometry for the light emitted by the second LED unit, reducing the reflection probability of light-reflection on water drops of the light emitted by the second LED unit. That is, the lens unit may be arranged with regard to the first LED unit and the second LED unit such that the lens unit is improved with regard to the white light emitted by the first LED unit and improved with regard to reducing the reflection probability of light-reflection on water drops of the light emitted by the second LED unit.

[0050] Optionally, the lens unit may be arranged with regard to the second LED unit or may be associated with the second LED unit such that the lens unit comprises an improved beam geometry reducing the reflection probability of light-reflection on water drops of the light emitted by the second LED unit. The lighting system may comprise a further lens unit arranged to modulate the white light emitted by the first LED unit. The further lens unit comprises an improved beam geometry for the white light emitted by the first LED unit.

[0051] For implementing the further lens unit, any lens known in the art may be used. The further lens unit may correspond to a lens arrangement comprising a plurality of lenses.

[0052] For example, the lens unit may comprise an improved beam geometry by directing the light emitted from the second LED unit not to the ground or by reducing the light emitted from the second LED unit that is directed directly to the ground. This may be advantageous in case the ground is covered by at least one of water (e.g. after raining), snow and ice. Namely, when the light emitted from the second LED unit falls onto the ground, the light may be reflected by the water, snow and/or ice, which may cause a blinding of a person (e.g. a driver of a car or pedestrian). This may be especially advantageous in the case of street lighting; in which light emitted from the second LED unit may be reflected by water, snow and/or ice covering the street and/or the pathway for pedestrians.

[0053] According to an embodiment, the lighting system is a luminaire.

[0054] The lighting system may be an outdoor luminaire, such as a street lighting luminaire, a harbor lighting luminaire, a floodlight luminaire (e.g. for a sports stadium), a spotlight luminaire (e.g. for a sports stadium), a car headlights luminaire etc.

[0055] The at least one LED-LS may correspond to at least one LED module, the luminaire may comprise a driver module for driving the at least one LED module, and the driver module may comprise the control unit. Alternatively, the control unit may be extern to the driver module (i.e. not a part of the driver module).

[0056] In particular, the luminaire may comprise a housing and the at least one LED-LS (LED module), the driver module and the control unit may be arranged inside the housing. In this case, the at least one LED-LS (LED module) is arranged in the housing such that the at least one LED-LS (LED module) is configured to emit light from inside the housing via an opening and/or a transparent section of the housing to the outside of the housing.

[0057] The driver module is configured to provide the at least one LED-LS (LED module) with electrical energy. For this, the driver module may comprise an optional power factor correction (PFC) circuit, a power conversion circuit (AC/DC and/or DC/DC power conversions circuit) and/or an optional filter circuit. The power conversion circuit may comprise one or more actively switched power converters (in particular at least one actively switched DC/DC power converter and/or at least one actively switched AC/DC power converter). The control unit is configured to control the light emission of the at least one LED-LS (LED module) by controlling the electrically energy supplied by the driver module to the at least one LED-LS (LED module). In particular, in case the driver module comprises an actively switched power converter (may be referred to as active power converter), such as at least one boost converter, buck converter, flyback converter and/or resonant converter, the control unit may be configured to control switching of the actively switched power converter for controlling the electrical energy supplied to the at least one LED-LS (LED module) and, thus, the light emission by the at least one LED-LS (LED module). The higher the electrical energy (e.g. time-averaged electrical energy over a time period), in particular current (e.g. time-averaged current over a time period), supplied to the at least one LED-LS (LED module), the higher the amount of light respectively the higher the light intensity of the light emitted by the at least one LED-LS (LED module).

[0058] According to a further embodiment, the lighting

system comprises two or more LED-LS and each LED-LS is a luminaire.

[0059] Each LED-LS may be an outdoor luminaire, such as a street lighting luminaire, a harbor lighting luminaire, a floodlight luminaire, a spotlight luminaire, e.g. for a sports stadium, car headlights luminaire etc.

[0060] The above description of the lighting system may be valid for each luminaire of the lighting system, in case the lighting system comprises two or more LED-LS and each LED-LS is a luminaire.

[0061] At least one of the two or more LED-LS comprises a local control unit configured to control the light emission of the respective LED-LS based on moisture information on the moisture in the area such that in case the moisture information fulfills the condition regarding the moisture in the area, the local control unit controls the respective LED-LS to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold. In particular, each of the two or more LED-LS comprises a local control unit configured to control the light emission of the respective LED-LS based on moisture information on the moisture in the area such that in case the moisture information fulfills the condition regarding the moisture in the area, the local control unit controls the respective LED-LS to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold. In addition or alternatively, the control unit may be part of one of the two or more LED-LS and may be configured to control the light emission of the two or more LED-LS.

[0062] In the following, the two or more LED-LS of the lighting system according to the further embodiment may be referred to two or more luminaires, because each LED-LS of the lighting system according to the further embodiment is a luminaire.

[0063] The light emission by each of the two or more luminaires of the lighting system of the further embodiment may be controlled according to different alternatives in dependence of the moisture in the area. According to a first alternative, the control unit of the system may be a single central control unit that is configured to control the light emission of the two or more luminaires based on moisture information on the moisture in the area such that, in case the moisture information fulfills the condition regarding the moisture in the area, the control unit controls the two or more luminaires to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than a probability threshold.

[0064] According to a second alternative, the control unit of the system may be part of one of the two or more luminaires and may be configured to control the light emission of the two or more luminaires based on moisture information on the moisture in the area such that, in case the moisture information fulfills the condition regarding the moisture in the area, the control unit controls the two or more luminaires to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than a probability threshold.

[0065] According to a third alternative, in addition to the first alternative at least one of the two or more luminaires may comprise a local control unit configured to control the light emission of the respective luminaires based on moisture information on the moisture in the area such that in case the moisture information fulfills the condition regarding the moisture in the area, the local control unit controls the respective luminaire to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0066] According to a fourth alternative, in addition to the first alternative each of the two or more luminaires may comprise a local control unit configured to control the light emission of the respective luminaire based on moisture information on the moisture in the area such that in case the moisture information fulfills the condition regarding the moisture in the area, the local control unit controls the respective luminaire to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0067] A fifth alternative corresponds to the third alternative, wherein the control unit of the system corresponds to the local control unit of the at least one luminaire of the two or more luminaires. A sixth alternative corresponds to the fourth alternative, wherein the control unit of the system corresponds to a local control unit of one of the two or more luminaires.

[0068] The above description with respect to the control unit of the lighting system may be valid for the local control unit of a respective luminaire.

[0069] According to an embodiment, the control unit may be a central control unit that is configured to receive the moisture information from a weather forecast station (weather station) and/or from at least one of the two or more LED-LS (luminaires). The control unit may be configured to control the light emission of the two or more LED-LS (luminaires) based on the moisture information such that: in case the moisture information fulfills the condition regarding the moisture in the area, the control unit controls the two or more LED-LS (luminaires) to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0070] In this case, at least one of the two or more LED-LS, optionally each of the two or more LED-LS, may comprise a local control unit configured to control the light emission of the respective LED-LS, as described above. For controlling the light emission of a respective LED-LS based on the moisture information the central control unit may transmit control information (e.g. an instruction) to the respective LED-LS, wherein the control information is configured to trigger the local control unit of the respective LED-LS to control the respective LED-LS to emit only light of a spectrum comprising a reflection probability of

light-reflection on water drops smaller than the probability threshold.

[0071] The at least one LED-LS of the two or more LED-LS, from which the central control unit may be configured to receive the moisture information, may comprise one or more sensor units for obtaining the moisture information. The one or more sensor units may comprise at least one of a weather condition sensor unit configured to detect precipitation and/or fog, a humidity sensor unit configured to detect a humidity level, a moisture sensor unit configured to detect a moisture level of the ground. The at least one LED-LS may be configured to provide the detection result of the one or more sensor units as moisture information to the central control unit.

[0072] The description above, with regard to one or more sensor units (e.g. weather condition sensor unit, humidity sensor unit, moisture sensor unit) and the weather forecast station (weather station), may be correspondingly valid for the embodiment, in which the control unit may be the central control unit. The central control unit may comprise a communication interface for receiving the moisture information (e.g. from the weather forecast station, one or more sensor units and/or the at least one LED-LS of the two or more LED-LS). The description above, with regard to controlling at least one LED-LS based on moisture information from one or more sensor units and/or from the weather forecast station may be correspondingly valid for the embodiment, in which the control unit may be the central control unit.

[0073] In addition or alternatively, the central control unit may be configured to receive the moisture information from one or more optional sensor units (e.g. one or more central sensor units) of the lighting system that are arranged in the area outside the two or more LED-LS. The one or more sensor units may be at least one of a weather condition sensor unit configured to detect precipitation and/or fog, a humidity sensor unit configured to detect a humidity level, a moisture sensor unit configured to detect a moisture level of the ground. For example, the one or more optional sensor units may be arranged at a center of the area. In addition or alternatively, the one or more senor units may be spread or arranged in the area at different locations. The description above, with regard to one or more sensor units (e.g. weather condition sensor unit, humidity sensor unit, moisture sensor unit), may be correspondingly valid for the one or more sensor units being one or more external entities with regard to the two or more LED-LS.

[0074] The central control unit may be configured to control the light emission of the two or more LED-LS (luminaires) based on the moisture information such that: in case the moisture information from at least one of the weather forecast station (weather station), the at least one LED-LS and/or the one or more optional sensor units fulfills the condition regarding the moisture in the area, the central control unit controls the two or more LED-LS (luminaires) to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0075] In case the central control unit may be configured to receive the moisture information from at least two of the two or more LED-LS, the central control unit may be configured to process the moisture information of each of the at least two LED-LS and control the light emission of the two or more LED-LS based on the processed moisture information. That is, the central control unit may be configured to control the light emission of the two or more LED-LS such that: in case the processed moisture information fulfills the condition regarding the moisture in the area, the central control unit controls the two or more LED-LS (luminaires) to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0076] For example, in case each LED-LS is configured to provide a moisture level at its location to the central control unit, the central control unit may be configured to compute based on the moisture levels received from the two or more LED-LS an average moisture level of the area of the lighting system. The central control unit may be configured to control the two or more LED-LS based on the computed average moisture level. That is, the central control unit may be configured to control the light emission of the two or more LED-LS such that: in case the computed average moisture level is above a threshold for the moisture level, the central control unit controls the two or more LED-LS (luminaires) to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0077] In case the central control unit may be configured to receive the moisture information from at least two of the two or more LED-LS, the central control unit may be configured to control the light emission of the two or more LED-LS such that: in case the moisture information received from at least one LED-LS fulfills the condition regarding the moisture in the area, the control unit controls the two or more LED-LS (luminaires) to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0078] Alternatively or additionally, the control unit (central control unit) may be configured to control the light emission of the two or more LED-LS based on the moisture information such that:

the control unit controls a group of one or more LED-LS of the two or more LED-LS to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold, in case the moisture information fulfills the condition regarding the moisture in an area associated with the group of one or more LED-LS

[0079] In other words, according to a further embodiment, the control unit may be a central control unit that is configured to receive the moisture information from a weather forecast station (weather station) and/or from at least one of the two or more LED-LS (luminaires), and

the control unit may be configured to control the light emission of the two or more LED-LS (luminaires) based on the moisture information such that: the control unit controls a group of one or more LED-LS of the two or more LED-LS to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold, in case the moisture information fulfills the condition regarding the moisture in an area associated with the group of one or more LED-LS.

[0080] According to an embodiment, the control unit may part of one of the two or more LED-LS (luminaires). The control unit may be configured to control the light emission of the two or more LED-LS. The control unit may be configured to receive the moisture information from a central control unit, from a weather forecast station (weather station) and/or from at least one of the two or more LED-LS. The control unit may be configured to control the light emission of the two or more LED-LS based on the moisture information such that: in case the moisture information fulfills the condition regarding the moisture in the area, the control unit controls the two or more LED-LS to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0081] The central control unit may be as outlined above. The above description with regard to the one or more sensor units arranged outside the LED-LS may be valid for the central control unit. That is, the central control unit may comprise such one or more sensor units. Optionally, the central control unit may be configured to receive moisture information from the weather forecast station (weather station) and/or at least one of the two or more LED-LS (e.g. one or more sensor units of the at least one LED-LS). The central control unit may be referred to as central moisture information unit.

[0082] The at least one LED-LS of the two or more LED-LS, from which the control unit may be configured to receive the moisture information, may comprise one or more sensor units for obtaining the moisture information. The one or more sensor units may comprise at least one of a weather condition sensor unit configured to detect precipitation and/or fog, a humidity sensor unit configured to detect a humidity level, a moisture sensor unit configured to detect a moisture level of the ground. The at least one LED-LS may be configured to provide the detection result of the one or more sensor units as moisture information to the control unit. The LED-LS, comprising the control unit, may itself comprise one or more sensor units for obtaining the moisture information.

[0083] The description above, with regard to one or more sensor units (e.g. weather condition sensor unit, humidity sensor unit, moisture sensor unit) and the weather forecast station (weather station), may be correspondingly valid for the embodiment, in which the control unit may be part of one of the two or more LED-LS. The description above, with regard to controlling at least one LED-LS based on moisture information from one or more sensor units and/or from the weather forecast station may be correspondingly valid for the embodiment, in which the control unit may be part of one of the two or more LED-LS.

[0084] In case the control unit may be configured to obtain the moisture information from at least two of the two or more LED-LS (optionally including the LED-LS comprising the control unit), the control unit may be configured to process the moisture information of each of the at least two LED-LS and control the light emission of the two or more LED-LS based on the processed moisture information. That is, the control unit may be configured to control the light emission of the two or more LED-LS such that: in case the processed moisture information fulfills the condition regarding the moisture in the area, the control unit controls the two or more LED-LS (luminaires) to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0085] For example, in case each LED-LS is configured to provide a moisture level at its location to the control unit, the control unit may be configured to compute based on the moisture levels obtained from the two or more LED-LS an average moisture level of the area of the lighting system. The control unit (i.e. the LED-LS comprising the control unit) may be configured to control the two or more LED-LS based on the computed average moisture level. That is, the control unit may be configured to control the light emission of the two or more LED-LS such that: in case the computed average moisture level is above a threshold for the moisture level, the control unit controls the two or more LED-LS (luminaires) to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0086] In case the control unit may be configured to receive the moisture information from at least two of the two or more LED-LS (optionally including the LED-LS comprising the control unit), the control unit may be configured to control the light emission of the two or more LED-LS such that: in case the moisture information received from at least one LED-LS fulfills the condition regarding the moisture in the area, the control unit controls the two or more LED-LS (luminaires) to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0087] Alternatively or additionally, the control unit may be configured to control the light emission of the two or more LED-LS based on the moisture information such that: the control unit controls a group of one or more LED-LS of the two or more LED-LS to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold, in case the moisture information fulfills the condition regarding the moisture in an area associated with the group of one or more LED-LS

In other words, according to a further embodiment, the

control unit may be a part of one of the two or more LED-LS (luminaires). The control unit may be configured to control the light emission of the two or more LED-LS (luminaires) and receive the moisture information from a central control unit, from a weather forecast station (weather station) and/or from at least one of the two or more LED-LS. The control unit may be configured to control the light emission of the two or more LED-LS based on the moisture information such that: the control unit controls a group of one or more LED-LS of the two or more LED-LS to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold, in case the moisture information fulfills the condition regarding the moisture in an area associated with the group of one or more LED-LS.

[0088] Each LED-LS (luminaire) may comprise a communication unit for communicating, in particular wirelessly, with other devices. The other devices may comprise or correspond to the other LED-LS of the lighting system. Additionally or alternatively, other devices may correspond to mobile end devices, such as mobile phones, vehicles, local weather stations, weather forecast stations (weather stations) etc. For example, in case the lighting system is used for providing illumination to a street area, the communication unit of each LED-LS (luminaire) may be configured to communicate with vehicles driving on a street at the street area, mobile end devices carried by persons walking on a pedestrian at the street area and a local weather station that may be present at the street area for monitoring the weather condition at the street area. In particular, the local weather station may be configured to detect the humidity level in the street area, the moisture level of the ground in the street area (e.g. moisture level of the street) and/or the presence and optionally amount of precipitation and/or fog in the street area. Thus, the communication unit of each LED-LS (luminaire) may be configured to receive moisture information regarding the moisture at the street area from the vehicles, mobile end devices and the local weather station. The communication between each of the LED-LS (luminaires) and other devices may be wireless. The wireless communication may be based on radio waves.

[0089] The above is also valid with respect to a different outdoor area, such as a harbor, airport etc. For example, in case of the harbor the communication unit may be configured to communicate with ships and, thus, the communication unit of each LED-LS (luminaire) may be configured to receive moisture information regarding the moisture at the harbor area from the ships.

[0090] In particular, the first LED unit and the second LED unit form an LED module.

[0091] As described above, according to an embodiment the lighting system may be a luminaire. In this case, the at least one LED-LS corresponds to the lighting means of that luminaire. According to a further embodiment, the lighting system may comprise at least two LED-LS, wherein each LED-LS corresponds to a luminaire. In this case, each luminaire comprises lighting means. The description of the lighting system being a luminaire according to the above-mentioned embodiment is correspondingly valid for describing each luminaire of the system according to the further embodiment.

[0092] In order to achieve the lighting system according to the present invention, some or all of the above described optional features may be combined with each other.

[0093] According to a second aspect of the invention, a method for providing light to an area is provided, wherein the method comprises the step of emitting, by at least one LED light source, LED-LS, white light. The method further comprises the step of controlling, by a control unit, a light emission of the at least one LED-LS based on moisture information on a moisture in the area such that in case the moisture information fulfills a condition regarding the moisture in the area, the control unit controls the at least one LED-LS to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than a probability threshold. The at least one LED-LS comprises a first LED unit configured to emit the white light. Further, the at least one LED-LS comprises a second LED unit configured to emit light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold. The second LED unit is configured to emit light of a spectrum comprising a relative emission intensity greater than 20% between a wavelength of 580 nm and a wavelength of 605 nm. In addition or alternatively, the second LED unit is configured to emit light of a spectrum comprising a relative emission intensity greater than 20% between a wavelength of 542 nm and a wavelength of 670 nm. In addition or alternatively, the second LED unit is configured to emit light of a spectrum between a wavelength of 565 nm and a wavelength of 620 nm. In addition or alternatively, the second LED unit is configured to emit light of a spectrum between a wavelength of 527 nm and a wavelength of 685 nm. The method comprises controlling, by the control unit, the light emission of the at least one LED-LS such that: the first LED unit emits light, in case the moisture information does not fulfill the condition, and only the second LED unit emits light, in case the moisture information fulfills the condition.

[0094] The method according to the second aspect of the present invention achieves the same advantages as the lighting system according to the first aspect of the invention.

[0095] The above description with regard to the lighting system according to the first aspect of the present invention is correspondingly valid for the method according to the second aspect of the present invention.

[0096] In particular, the above description of the LED-LS and control unit of the lighting system according to the first aspect of the present invention is correspondingly valid for the LED-LS and control unit used for performing the method according to the second aspect of the present

invention.

[0097] In the following, the invention is described exemplarily with reference to the enclosed figures, wherein

Figure 1 (a) schematically shows a lighting system according to the first aspect of the present invention;

Figure 1 (b) schematically shows a lighting system according to an embodiment of the present invention;

Figure 2 schematically shows a lighting system according to an embodiment of the present invention;

Figure 3 schematically shows a lighting system according to an embodiment of the present invention;

Figure 4 shows the spectrum of light that is emitted by different light sources comprising an LED light source for emitting white light at correlated color temperature (CCT) of 6500 K, a low pressure sodium lamp, a monochromatic amber LED light unit configured to emit amber light and a phosphor converted LED light unit configured to emit amber light;

Figure 5 shows an example of a relationship between a reflection probability of light-reflection on water drops and wavelength of light according to an embodiment of the invention;

Figure 6 schematically shows a lighting system according to an embodiment of the present invention; and

Figure 7 shows the CIE chromaticity diagram with two examples of the color range of white light, examples of a color of amber light of a phosphor converted LED light unit configured to emit amber light (i.e. phosphor converted amber LED light unit) and an example of a color of amber light of a monochromatic amber LED light unit configured to emit amber light.

[0098] In the Figures, corresponding elements have the same reference signs. The proportions and dimensions of the elements shown in the figures do not represent the luminaire to scale, but are merely chosen to describe the structure and function of the luminaire.

[0099] **Figure 1 (a)** schematically shows a lighting system according to the first aspect of the present invention.

[0100] As shown in Figure 1 (a), the lighting system 1 for providing light to an area comprises an LED light source (LED-LS) 2 and a control unit 3. The lighting system 1 may comprise more than one LED-LS 2. The at least one LED-LS 2 is configured to emit white light and the control unit 3 is configured to control a light emission of the at least one LED-LS 2. The control unit 3 is configured to control the light emission of the at least one LED-LS 2 based on moisture information on a moisture in the area such that, in case the moisture information fulfills a condition regarding the moisture in the area (e.g. rain present in the area), the control unit 3 controls the at least one LED-LS 2 to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than a probability threshold.

[0101] Therefore, the lighting system 1 of Figure 1 (a) may reduce blinding of persons present in the area that is caused by the light emission of the at least one LED-LS 2, in case the condition regarding the moisture in the area is fulfilled (e.g. rain present in the area). Namely, the light of the spectrum comprising a reflection probability of light-reflection on water drops smaller than a probability threshold is less reflected on water drops, such as rain drops, compared to light of wavelengths respectively a spectrum comprising a reflection probability of light-reflection on water drops greater than or equal to the probability threshold. Generally, the higher the reflection probability of light-reflection on water drops of a wavelength of light the more probable the light of said wavelength and, thus, the more often the light of said wavelength is reflected on water drops, such as rain drops. Reducing blinding increases the visibility of a person present in the area.

[0102] In particular, the smaller the wavelength of emitted light the higher the reflection probability of light-reflection on water drops of that emitted light.

[0103] For describing the system 1 of Figure 1 (a) in more detail, reference is made to the above description of the lighting system according to the first aspect of the present invention.

[0104] **Figure 1 (b)** schematically shows a lighting system according to an embodiment of the present invention. The lighting system of Figure 1 (b) corresponds to the lighting system of Figure 1 (a). Therefore, the above description of the system of Figure 1 (a) is also valid for the lighting system of Figure 1 (b) and in the following mainly additional features shown in Figure 1 (b) are described.

[0105] As shown in Figure 1 (b) the at least one LED-LS 2 may optionally comprise a first LED unit 4a configured to emit white light, and a second LED unit 4b configured to emit light of the spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold. The control unit 3 may be configured to control the light emission of the at least one LED-LS 2 such that the first LED unit 4a emits light, in case the moisture information does not fulfill the condition, and only the second LED unit 4b emits light, in case the moisture information fulfills the condition.

[0106] For a more detailed description of the first LED

unit 4a and the second LED unit 4b reference is made to the above description of the first LED unit and second LED unit of the lighting system according to the first aspect of the present invention.

[0107] **Figure 2** schematically shows a lighting system according to an embodiment of the present invention. The lighting system of Figure 2 corresponds to the lighting system of Figure 1 (b). Therefore, the above description of the lighting system of Figures 1 (a) and 1 (b) is also valid for the lighting system of Figure 2 and in the following mainly additional features shown in Figure 2 are described.

[0108] As shown in Figure 2 the lighting system 1 may comprise an optional weather condition sensor unit 5a configured to detect precipitation and/or fog in the area and provide the detection result as the moisture information to the control unit 3. The optional weather condition sensor unit 5a may be a precipitation and/or fog sensor unit. Additionally or alternatively, the lighting system 1 may comprise a humidity sensor unit 5b configured to detect a humidity level of the humidity in the area and provide the detection result as the moisture information to the control unit 3. Additionally or alternatively, the lighting system 1 may comprise a moisture sensor unit 5c configured to detect a moisture level of the ground of the area and provide the detection result as the moisture information to the control unit 3. Additionally or alternatively, the lighting system 1 may comprise a communication unit 6 configured to receive the moisture information, e.g. from a weather forecast station (weather station), and provide the moisture information to the control unit 3. The communication unit 6 may be configured for a wireless and/or wire-bound communication with outside the lighting system 1, e.g. with a weather forecast station (weather station). The wireless communication may be based on radio waves.

[0109] The lighting system 1 may comprise an optional bus (not shown in Figure 2), such as a DALI (Digital Addressable Lighting Interface) bus or DALI-2 bus, to which the control unit 3, the optional weather condition sensor unit 5a, the optional humidity sensor unit 5b, the optional moisture sensor unit 5c and the optional communication unit 6 are electrically connected allowing communication between the electrical components connected to the bus. Thus, the optional sensor units 5a, 5b, 5c and the optional communication unit 6 may provide information respectively data via the bus to the control unit 3. The control unit 3 may be configured to control electrical components, which are connected to the bus, via the bus. DALI (DALI Version 1) and DALI-2 (DALI Version 2) are industry standards that are well known in the field of lighting. Preferably, the at least one LED-LS 2 may be electrically connected to the bus. This may be in particular the case, when the lighting system 1 is a luminaire.

[0110] The lighting system 1 may comprise additional sensor units, such as a temperature sensor unit, light sensor unit, ambient light sensor unit, presence and/or movement detector unit etc., that are configured to provide information to the control unit 3 for controlling the light emission of the at least one LED-LS 2. Such additional sensor units may be connected to the optional bus of the lighting system 1.

[0111] In case the lighting system 1 is a luminaire, the control unit 3 may be part of a driver module 7 for driving the at least one LED-LS 2, as indicated in Figure 2 by a dashed box. The driver module 7 may be connected to the optional bus of the luminaire 1. The control unit 3 may alternatively be an electrical component separate to the driver module 7 that is electrically connected with the driver module 7, optionally via the optional bus. In case the lighting system 1 is a luminaire, the at least one LED-LS 2 is the lighting means of the luminaire 1 and the at least one LED-LS 2 may correspond to at least one LED module. The optional weather condition sensor unit 5a, the optional humidity sensor unit 5b, the optional moisture sensor unit 5c, the optional communication unit 6 and/or optional additional sensor units may be connected, in particular detachably connected, to the driver module 7 for providing information respectively data to the control unit 3 for the control of the light emission of the LED-LS 2 by the control unit 3. For this, the driver module 7 may comprise one or more Zhaga interfaces (e.g. Zhaga sockets) and/or NEMA interfaces (e.g. NEMA sockets) that are well known in the art.

[0112] For a more detailed description of the optional weather condition sensor unit 5a, the optional humidity sensor unit 5b, the optional moisture sensor unit 5c and the optional communication unit 6 of the system according to Figure 2, reference is made to the above description of the optional weather condition sensor unit, the optional humidity sensor unit, the optional moisture sensor unit and the optional communication unit of the lighting system according to the first aspect of the present invention. For a more detailed description of the optional driver module 7 reference is made to the above description of the optional driver module of the lighting system according to the first aspect of the present invention.

[0113] **Figure 3** schematically shows a lighting system according to an embodiment of the present invention.

[0114] The lighting system 1 of Figure 3 comprises a control unit 3 and two luminaires 2. The lighting system may comprise more than two luminaires 2. The following description with respect to two luminaires is thus only by way of example and correspondingly valid in case the lighting system comprises more than two luminaires. Each of the luminaires 2 comprises lighting means 2a, a local control unit 8, an optional weather condition sensor unit 5a, optional humidity sensor unit 5b and/or optional moisture sensor unit 5c and an optional communication unit 6. As shown in Figure 3, the lighting means 2a of each luminaire 1 may optionally comprise a first LED unit 4a configured to emit white light, and a second LED unit 4b configured to emit light of the spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0115] The above description of the lighting system of

Figures 1 (a), 1 (b) and 2 is also valid for describing each of the two luminaires 2 of the system of Figure 3. In particular, the description with regard to the at least one LED-LS 2 of the system of Figures 1 (a), 1 (b) and 2 is valid for describing the lighting means 2a of each of the two luminaires 2. The above description with regard to the control unit 3 of the system of Figures 1 (a), 1 (b) and 2 is correspondingly valid for describing the local control unit 8 of each of the two luminaires 2. The description of the optional local control unit of the lighting system according to the first aspect is valid for describing the local control unit 8 of each luminaire 2.

[0116] The above description of the control unit 3 of the system of Figures 1 (a), 1 (b) and 3 is correspondingly valid for describing the control unit 3 of the system 1 of Figure 3. The control unit 3 of the system 1 of Figure 3 may be referred to as central control unit. The above description of the system of Figures 1 (a), 1(b) and 2 is correspondingly valid for the system of Figure 3.

[0117] The communication unit 6 of each luminaire 2 may be configured to communicate with other devices. For example, the communication unit 6 of one luminaire 2 may be configured to communicate with the communication unit 6 of another luminaire 2. The communication unit 6 of each luminaire 2 may be configured to communicate with the central control unit 3. The communication unit 6 of each luminaire 2 may be configured for a wireless communication. The wireless communication may be based on radio waves.

[0118] The system 1 may comprise an optional weather condition sensor unit, an optional humidity sensor unit, an optional moisture sensor unit and/or an optional communication unit arranged outside the luminaires 2 (not shown in Figure 3), which are configured to provide information to the control unit 3. This information is in particular moisture information regarding the moisture of the area for which the system 1 comprising the two luminaires 2 provides light. In addition or alternatively, the control unit 3 may receive the moisture information from at least one, in particular each, of the two luminaires 2 (in particular optional sensor units 5a, 5b, 5c of the respective luminaire 2). The communication unit (arranged outside the luminaires 2) may be configured to receive information from outside the system 1, in particular from a weather forecast station (weather station), and provide the received information to the control unit 3. The communication unit may be part of the control unit 3. In this case, the control unit 3 may use the communication unit for communicating, in particular wirelessly, with the two luminaires 2. The control unit 3 is configured to control the light emission of the two luminaires 2 based on the information received from the optional weather condition sensor unit, the optional humidity sensor unit, the optional moisture sensor unit and/or the optional communication unit that are arranged outside the luminaires 2. In this case, at least one luminaire 2, in particular each luminaire 2, may optionally not comprise the optional sensor units 5a, 5b, 5c. The communication unit 6 of at least one luminaire 2, in particular of each luminaire, may optionally be configured for only communicating with the control unit 3 (central control unit).

[0119] The control unit 3 may be configured to receive moisture information from at least one of the following:

- the weather forecast station (weather station),
- the at least one luminaire 2 (optionally each luminaire 2), and
- the optional weather condition sensor unit, the optional humidity sensor unit, the optional moisture sensor unit and/or the optional communication unit arranged outside the luminaires 2.

[0120] The control unit 3 may be configured to control the light emission of the two luminaires 2 based on the aforementioned received moisture information such that: in case the moisture information fulfills the condition regarding the moisture in the area, the control unit 3 controls the two luminaires to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0121] For controlling the light emission of a respective luminaire 2 based on the moisture information, the control unit 3 may transmit control information (e.g. an instruction) to the respective luminaire 2. The control information is configured to trigger the local control unit 8 of the respective luminaire 2 to control the respective luminaire 2 to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0122] In case the moisture information received from at least one of the weather forecast station (weather station), the at least one luminaire 2 (optionally each luminaire 2), the optional weather condition sensor unit, the optional humidity sensor unit, the optional moisture sensor unit and the optional communication unit fulfills the condition regarding the moisture in the area, the control unit 3 may be configured to control the two luminaires 2 to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0123] In case the control unit 3 may be configured to receive the moisture information from each of the two luminaires 2, the control unit 3 may be configured to process the moisture information of each of the two luminaires 2 and control the light emission of the two luminaires 2 based on the processed moisture information. That is, in case the processed moisture information fulfills the condition regarding the moisture in the area, the control unit 3 may be configured to control the two luminaires 2 to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold. For example, in case each luminaire 2 is configured to provide a moisture level at its location to the control unit 3, the control unit 3 may be configured to compute based on the moisture levels received from the two luminaires 2 an average moisture

level of the area of the lighting system. The control unit 3 may be configured to control the two luminaires 2 based on the computed average moisture level. That is, in case the computed average moisture level is above a threshold for the moisture level, the control unit 3 may be configured to control the two luminaires 2 to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0124] In case the control unit 3 may be configured to receive the moisture information from the two luminaires 2, the control unit 3 may be configured to control the light emission of the two luminaires 2 such that: in case the moisture information received from at least one luminaire 2 fulfills the condition regarding the moisture in the area, the control unit 3 controls the two luminaires 2 to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0125] The control unit 3 may be configured to control the light emission of the two luminaires 2 based on the moisture information such that: the control unit controls a group of one or more luminaires of the two luminaires 2 to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold, in case the moisture information fulfills the condition regarding the moisture in an area associated with the group of one or more luminaires 2. The aforementioned may be particularly valid, in case the system comprise more than two luminaires 2, e.g. more than three luminaires 2.

[0126] Optionally, the system 3 may not comprise the central control unit 3 or the central control unit 3 may correspond to the local control unit 8 of one of the luminaires 2.

[0127] In other words, optionally the local control unit 8 of one of the two luminaires 2 may control the light emission by the two luminaires 2. For this, the aforementioned description with regard to a central control unit 3 controlling the two luminaires 2 is correspondingly valid.

[0128] Therefore, the control unit 3 (being a central control unit as shown in Figure 3 or corresponding to a local control unit 8 of one of the luminaires 2) may be configured to control the light emission of the two luminaires 2 based on moisture information on a moisture in the area (that is illuminated by the lighting system 1 of Figure 3) such that, in case the moisture information fulfills a condition regarding the moisture in the area, the control unit controls the two luminaires 2 to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than a probability threshold. The control unit 3 may receive the moisture information from at least one, in particular each, of the two luminaires 2 (in particular optional sensor units 5a, 5b, 5c of the respective luminaire 2) and/or one or more additional sensor units and/or an additional communication unit 6 that are arranged outside the luminaires, as described above. In addition or alternatively, the control unit 3 may receive the moisture information from electrical devices, such as mobile end devices of a person walking in the area. In addition or alternatively, the control unit 3 may receive the moisture information from a weather forecast station (weather station).

[0129] Alternatively or additionally, the local control unit 8 of at least one, in particular of each, of the two luminaires 2 is configured to control the light emission of the respective luminaire 2 based on moisture information on the moisture in the area (that is illuminated by the lighting system 1 of Figure 3) such that in case the moisture information fulfills the condition regarding the moisture in the area, the local control unit 8 controls the respective luminaire 2 to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold. The local control unit 8 may receive the moisture information from at least one of

- one or more own optional sensor units 5a, 5b, 5c and/or a own optional communication unit 6;
- at least one other luminaire 2;
- one or more optional additional sensor units and/or an optional additional communication unit 6 that are arranged outside the luminaires, as described above; and
- electrical devices, such as mobile end devices of a person walking in the area.

In addition or alternatively, the local control unit 8 may receive the moisture information from a weather forecast station (weather station).

[0130] The local control unit 8 of at least one luminaire 2 may be configured to control the light emission of the two luminaires 2 based on the aforementioned received moisture information such that: in case the moisture information fulfills the condition regarding the moisture in the area, the local control unit 8 controls the two luminaires 2 to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0131] For controlling the light emission of another luminaire 2 based on the moisture information, the local control unit 8 may transmit control information (e.g. an instruction) to the other luminaire 2. The control information is configured to trigger the local control unit 8 of the other luminaire 2 to control the other luminaire 2 to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0132] In case the moisture information from at least one of

- one or more own optional sensor units 5a, 5b, 5c and/or a own optional communication unit 6;
- at least one other luminaire 2;
- one or more optional additional sensor units and/or an optional additional communication unit 6 that are

arranged outside the luminaires, as described above;
- electrical devices, such as mobile end devices of a person walking in the area; and
- the weather forecast station (weather station),

fulfills the condition regarding the moisture in the area, the local control unit 8 may be configured to control the two luminaires 2 to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0133] In case the local control unit 8 may be configured to obtain the moisture information from each other luminaires 2 (in addition to the moisture information from the own luminaire 2), the local control unit 8 may be configured to process the moisture information of the two luminaires 2 and control the light emission of the two luminaires 2 based on the processed moisture information. That is, in case the processed moisture information fulfills the condition regarding the moisture in the area, the local control unit 8 may be configured to control the two luminaires 2 (i.e. its own luminaire 2 and one other luminaire 2 in the example of Figure 3) to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold. For example, in case each luminaire 2 is configured to provide a moisture level at its location to the local control unit 8, the local control unit 8 may be configured to compute based on the moisture levels received from the two luminaires 2 an average moisture level of the area of the lighting system. The local control unit 8 may be configured to control the two luminaires 2 based on the computed average moisture level. That is, in case the computed average moisture level is above a threshold for the moisture level, the local control unit 8 may be configured to control the two luminaires 2 to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0134] In case the moisture information received from at least one luminaire 2 (e.g. the own luminaire 2 or another luminaire 2) fulfills the condition regarding the moisture in the area, the local control unit 8 may be configured to control the two luminaires 2 to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

[0135] The local control unit 8 may be configured to control the light emission of the two luminaires 2 based on the moisture information such that: the local control unit 8 controls a group of one or more luminaires of the two luminaires 2 to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold, in case the moisture information fulfills the condition regarding the moisture in an area associated with the group of one or more luminaires 2. The aforementioned may be particularly valid, in case the system comprise more than two luminaires 2, e.g. more than three luminaires 2.

[0136] **Figure 4** shows the spectrum of light that is emitted by different light sources comprising an LED light source for emitting white light at correlated color temperature (CCT) of 6500 K, a low pressure sodium lamp, a monochromatic amber LED light unit configured to emit amber light and a phosphor converted LED light unit configured to emit amber light. The phosphor converted LED light unit configured to emit amber light may be referred to as phosphor converted amber LED light unit.

[0137] Curve C1 of Figure 4 shows the spectrum of light emitted by an LED light source for emitting white light at correlated color temperature (CCT) of 6500 K. Curve C2 of Figure 4 shows the spectrum of light emitted by a monochromatic amber LED light unit configured to emit amber light. Curve C3 of Figure 4 shows the spectrum of a phosphor converted LED light unit configured to emit amber light. Curve C4 of Figure 4 shows the spectrum of a low pressure sodium light unit, which is an example of a sodium vapor lamp light unit. Curve C5 of Figure 4 shows a luminosity function indicating the average spectral sensitivity of human visual perception of brightness for different wavelengths. The luminosity function may be referred to as luminous efficiency function or as V-Lambda-Curve. Curve C6 of Figure 4 shows the reflection probability of light-reflection on water drops of light for different wavelengths.

[0138] The horizontal axis (x-axis) of the graph of Figure 4 corresponds to the wavelength in nanometers (nm). For curves C1, C2, C3 and C4, the vertical axis (y-axis) of the graph of Figure 4 corresponds to the relative emission intensity. For curve C5, the vertical axis of the graph of Figure 4 corresponds to the average spectral sensitivity of human visual perception of brightness. For curve C6, the vertical axis of the graph of Figure 4 corresponds to the reflection probability of light-reflection on water drops respectively the scattering probability of light-scattering (normalized to a wavelength of 460 nm).

[0139] The reflection probability of light-reflection on water drops and the scattering probability of light-scattering on water drops are direct proportional. That is, the higher the reflection probability of light-reflection on water drops the higher the scattering probability of light-scattering on water drops and vice versa. Therefore, the embodiments of the present invention may alternatively use, instead of the reflection probability of light-reflection on water drops, the scattering probability of light-scattering on water drops as a value for controlling light emission of the at least one LED-LS by the control unit of the lighting system. In other words, the control unit may be configured to control the light emission of the at least one LED-LS based on moisture information on the moisture at an area such that, in case the moisture information fulfills a condition regarding the moisture in the area, the control unit controls the at least one LED-LS to emit only light of a spectrum comprising a scattering probability of light-scattering on water drops smaller than a probability threshold.

[0140] As indicated by Figure 4, the spectrum of the

LED light source for emitting white light (cf. curve C1) may comprise its 20% (0.2) relative emission intensity at about 430 nm (nanometers) and about 670 nm. The spectrum of the monochromatic amber LED light unit (cf. curve C2) may comprise its 20% (0.2) relative emission intensity at 580 nm and 605 nm. That is, the spectrum of the monochromatic amber LED light unit (cf. curve C2) may comprise a relative emission intensity greater than 20% between a wavelength of 580 nm and a wavelength of 605 nm. In other words, the spectrum of the monochromatic amber LED light unit (cf. curve C2) may comprise a relative emission intensity greater than 20% only between a wavelength of 580 nm and a wavelength of 605 nm. The spectrum of the phosphor converted LED light unit configured to emit amber light (cf. curve C3) may comprise its 20% (0.2) relative emission intensity at 542 nm and 670 nm. That is, the spectrum of the phosphor converted LED light unit configured to emit amber light (cf. curve C3) may comprise a relative emission intensity greater than 20% between a wavelength of 542 nm and a wavelength of 670 nm. In other words, the spectrum of the phosphor converted LED light unit configured to emit amber light (cf. curve C3) may comprise a relative emission intensity greater than 20% only between a wavelength of 542 nm and a wavelength of 670 nm.

[0141] As indicated by curve C6, the smaller the wavelength of the emitted light the higher the reflection probability of light-reflection on water drops of the emitted light. That is, when the wavelength of the emitted light is increased, the reflection probability of light-reflection on water drops of the emitted light decreases and vice versa. For example, the reflection probability of light-reflection is greater for the peak wavelength of the spectrum of the white light shown by curve C1 than for the peak wavelength of the spectrum of the monochromatic amber LED light unit shown by curve C2. The peak wavelength of a spectrum corresponds to the wavelength at which the relative emission intensity of the spectrum is 100% (1). The reflection probability of light-reflection is similar, in particular the same, for the peak wavelength of the spectrum of the monochromatic amber LED light unit shown by curve C2 and the peak wavelength of the spectrum of the phosphor converted LED light unit configured to emit amber light shown by curve C3.

[0142] As shown in Figure 4, the spectrum of the low pressure sodium light unit (cf. curve C4) is best with regard to the reflection-probability of light-reflection on water drops of the emitted light compared to the spectrum of the monochromatic amber LED light unit and the spectrum of the phosphor converted LED light unit configured to emit amber light. Namely, the width of the spectrum of the low pressure sodium light unit is smallest. Moreover, the spectrum of the monochromatic amber LED light unit is better with regard to the reflection-probability of light-reflection on water drops of the emitted light compared to the spectrum of the phosphor converted LED light unit configured to emit amber light. Namely, the width of the spectrum of the monochromatic amber LED light unit (cf. curve C2) is smaller than the width of the spectrum of the phosphor converted LED light unit (cf. curve C3). Nevertheless, as shown by curve C5, indicating the average spectral sensitivity of human visual perception of brightness for different wavelengths, although the spectrum of the phosphor converted LED light unit is wider than the spectrum of the monochromatic amber LED light unit and the low pressure sodium light unit, the phosphor converted amber LED light unit may be used for implementing the at least one LED-LS of the lighting system, in particular the second LED unit of the at least one LED-LS.

[0143] Therefore, the at least one LED-LS of the lighting system according to the present invention preferably comprises or corresponds to a monochromatic amber LED light unit configured to emit amber light or a phosphor converted LED light unit configured to emit amber light. In particular, the second LED unit of the at least one LED-LS of the lighting system may be a monochromatic amber LED light unit configured to emit amber light or a phosphor converted LED light unit configured to emit amber light.

[0144] **Figure 7** shows the CIE chromaticity diagram with two examples of the color range of white light, examples of a color of amber light of a phosphor converted LED light unit configured to emit amber light (i.e. phosphor converted amber LED light unit) and an example of a color of amber light of a monochromatic amber LED light unit configured to emit amber light. The term "CIE color space" may be used as a synonym for the term "CIE chromaticity diagram".

[0145] In Figure 7, the curve 71 indicates the black-body curve. The term "black-body radiation curve" may be used as a synonym for the term "black-body curve". It may also be referred to as "Planckian locus" or "black-body locus". The dots 72 indicate two examples of an amber color of amber light that may be emitted by a phosphor converted LED light unit. The dot 73 indicates an example of an amber color of amber light that may be emitted by a monochromatic amber LED light unit.

[0146] Further, in Figure 7, the color range along the black-body curve 71 indicated by the bold enclosure A1 corresponds to a color range of white light that may be emitted by light sources according to an EU regulation for eco-design requirements. The color range along the black-body curve 71 indicated by the stripped enclosure A2 corresponds to a color range of ANSI white light.

[0147] **Figure 5** shows an example of a relationship between a reflection probability of light-reflection on water drops of light and the wavelength of light according to an embodiment of the invention.

[0148] According to Figure 5, the reflection probability of light-reflection on water drops of emitted light is indicated by a relative scattering coefficient. Therefore, the greater the relative scattering coefficient of a wavelength of light, the greater the reflection probability of light-reflection on water drops of light at that wavelength. The relative scattering coefficient is in particular a relative

Raleigh scattering coefficient.

[0149] Figure 5 indicates an example of a possible probability threshold in terms of a threshold T1 for the relative scattering coefficient. For example, it is assumed that the at least one LED-Ls of the lighting system is configured to emit white light of e.g. a CCT of 6500 K and, thus, light of a spectrum between 430 nm and 670 nm, in particular between 430 nm and 650 nm or 415 nm and 665 nm. It is further assumed that the threshold T1 corresponds to the value of the relative scattering coefficient for the wavelength equaling to 540 nm (indicated by the dashed line in Figure 5). According to that assumptions, the control unit of the lighting system is configured to control the light emission of the at least one LED-LS such that, in case the moisture information fulfills the condition regarding the moisture in the area, the control unit controls the at least one LED-LS to emit only light of a spectrum comprising wavelengths greater than 540 nm. Namely, when the control unit controls the at least one LED-LS to emit only light of a spectrum comprising wavelengths greater than 540 nm, then the control unit controls the at least one LED-LS to emit only light of a spectrum comprising a reflection probability of light reflection on water drops smaller than the probability threshold indicated by the threshold T1. For this the at least one LED-LS may comprise or correspond to a monochromatic amber LED light unit configured to emit amber light or a phosphor converted LED light unit configured to emit amber light.

[0150] A monochromatic amber LED light unit may be configured to emit light of a spectrum comprising a relative emission intensity greater than 20% between a wavelength of 580 nm and a wavelength of 605 nm. A monochromatic amber LED light unit may be configured to emit light of a spectrum comprising 20% relative emission intensity at a wavelength of 580 nm and a wavelength of 605 nm. Alternatively, a monochromatic amber LED light unit may be configured to emit light of a spectrum between a wavelength of 565 nm and a wavelength of 620 nm.

[0151] A phosphor converted amber LED light unit may be configured to emit light of a spectrum comprising a relative emission intensity greater than 20% between a wavelength of 542 nm and a wavelength of 670 nm. A phosphor converted amber LED light unit may be configured to emit light of a spectrum comprising 20% relative emission intensity at a wavelength of 542 nm and a wavelength of 670 nm. Alternatively, a phosphor converted amber LED light unit may be configured to emit light of a spectrum between a wavelength of 527 nm and a wavelength of 685 nm. For this alternative, the threshold T1 may be moved to the relative scattering coefficient at a wavelength of e.g. 525 nm. As can be seen from Figure 5, the relative scattering coefficient is only slightly greater for the wavelength 525 nm compared to the wavelength 540 nm. Thus, in this case the reflection probability of light-reflection on water drops of the emitted light may be still acceptable for reducing blinding.

[0152] **Figure 6** schematically shows a lighting system according to an embodiment of the present invention.

[0153] In particular, Figure 6 shows an example of an embodiment according to which the lighting system comprises three or more street luminaires L1, L2, L3 for lighting a street. The above description of the lighting system of the first aspect and Figures 1 (a), 1 (b), 2 and 3 is correspondingly valid for the lighting system of Figure 6, wherein the three street luminaires L1, L2, L3 correspond to three LED-LS of the system. The above description of the lighting system of the first aspect and Figures 1 (a), 1 (b), 2 and 3 is correspondingly valid for each of the luminaires L1, L2, L3, wherein the respective luminaire corresponds to the lighting system. In the following description reference is made to only three luminaires L1, L2, L3 (shown in Figure 6). This is also valid in case the lighting system comprises less or more luminaires.

[0154] As shown in Figure 6, each of the luminaires L1, L2, L3 is configured to wirelessly receive information, in particular moisture information regarding the moisture of the street area, from a local weather station 61, a mobile end device of a person 62 present at the street area, a vehicle 63 driving at the street area and the other luminaires.

[0155] The moisture information regarding moisture of the street area may be locally generate by the lighting system. For example, the moisture information may be generated by one or more sensors of at least one of the luminaires L1, L2, L3 and/or by one or more sensors of the lighting system arranged extern to the luminaires L1, L2, L3. The locally generated moisture information may be provided to each of the luminaires L1, L2, L3 from either one or more other luminaires L3 and/or an optional central control unit of the lighting system. Thus, the moisture information may be provided within the lighting network comprising the three luminaires L1, L2, L3.

[0156] Alternatively or additionally, the moisture information may be provided from outside the lighting system, in particular from a data network. For example, the moisture information may be provided to an optional central control unit of the lighting system and/or to at least one of the luminaires L1, L2, L3, in particular each of the luminaires L1, L2, L3, from a weather forecast station (weather station).

[0157] The above description is not limited to a street area and thus, street luminaires, but is also valid for any area to be illuminated by a lighting system, wherein the lighting system may comprise any type of luminaire or may correspond to any type of luminaire.

Claims

1. A lighting system (1) for providing light to an area, wherein

- the system (1) comprises:

- at least one LED light source (2), LED-LS, configured to emit white light, and
- a control unit (3) configured to control a light emission of the at least one LED-LS (2); and

- the control unit (3) is configured to control the light emission of the at least one LED-LS (2) based on moisture information on moisture in the area such that:
in case the moisture information fulfills a condition regarding the moisture in the area, the control unit (3) controls the at least one LED-LS (2) to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than a probability threshold; wherein
- the at least one LED-LS (2) comprises:

- a first LED unit (4a) configured to emit the white light, and
- a second LED unit (4b) configured to emit light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold; and

- the control unit (3) is configured to control the light emission of the at least one LED-LS (2) such that:

- the first LED unit (4a) emits light, in case the moisture information does not fulfill the condition, and
- only the second LED unit (4b) emits light, in case the moisture information fulfills the condition;
characterised in that

- the second LED unit (4b) is configured to emit

- light of a spectrum comprising a relative emission intensity greater than 20% between a wavelength of 580 nm and a wavelength of 605 nm or a wavelength of 542 nm and a wavelength of 670 nm; or
- light of a spectrum between a wavelength of 565 nm and a wavelength of 620 nm or a wavelength of 527 nm and a wavelength of 685 nm.

2. The lighting system (1) according to claim 1, wherein the moisture information fulfills the condition in case the moisture information informs on at least one of

- a humidity level greater than a humidity threshold,
- precipitation and/or fog, and
- a moisture level of the ground in the area greater than a moisture threshold.

3. The lighting system (1) according to claim 1 or 2, wherein the lighting system (1) comprises at least one of

- a weather condition sensor unit (5a), in particular a precipitation and/or fog sensor unit, configured to detect precipitation and/or fog in the area and provide the detection result as the moisture information to the control unit (3);
- a humidity sensor unit (5b) configured to detect a humidity level of the humidity in the area and provide the detection result as the moisture information to the control unit (3);
- a moisture sensor (5c) unit configured to detect a moisture level of the ground in the area and provide the detection result as the moisture information to the control unit,
- a communication unit (6) configured to receive the moisture information, in particular from a weather forecast station, and provide the moisture information to the control unit (3).

4. The lighting system (1) according to any one of the previous claims, wherein the reflection probability of light-reflection on water drops corresponds to a relative scattering coefficient and the probability threshold corresponds to a threshold (T1) for the relative scattering coefficient.

5. The lighting system (1) according to any one of the previous claims, wherein

- the second LED unit (4b) is a monochromatic amber LED unit configured to emit amber light, or
- the second LED unit (4b) is a phosphor converted LED unit configured to emit amber light.

6. The lighting system (1) according to any one of the previous claims, wherein

- the lighting system (1) comprises a lens unit arranged to modulate the light emitted by the second LED unit (4b), and
- the lens unit comprises an improved beam geometry reducing the reflection probability of light-reflection on water drops of the light emitted by the second LED unit (4b).

7. The lighting system (1) according to any one of the previous claims, wherein

- the lighting system is a luminaire,
- the at least one LED-LS (2) corresponds to at least one LED module,
- the luminaire (1) comprises a driver module (7)

for driving the at least one LED module, and
- the driver module (7) comprises the control unit (3).

8. The lighting system (1) according to any one of claims 1 to 6, wherein the lighting system (1) comprises two or more LED-LS (2) and each LED-LS (2) is a luminaire.

9. The lighting system (1) according to claim 8, wherein

- at least one, in particular each, of the two or more LED-LS (2) comprises a local control unit (8) configured to control the light emission of the respective LED-LS (2) based on moisture information on the moisture in the area such that:

  - in case the moisture information fulfills the condition regarding the moisture in the area, the local control unit controls the respective LED-LS (2) to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold; and/or

- the control unit (3) is part of one of the two or more LED-LS (2) and is configured to control the light emission of the two or more LED-LS (2).

10. The lighting system according to claim 8 or 9, wherein

- the control unit (3) is a central control unit that is configured to receive the moisture information from a weather forecast station and/or from at least one of the two or more LED-LS (2), and
- the control unit (3) is configured to control the light emission of the two or more LED-LS (2) based on the moisture information such that:
in case the moisture information fulfills the condition regarding the moisture in the area, the control unit (3) controls the two or more LED-LS (2) to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

11. The lighting system according to any one of claims 8 to 10, wherein

- the control unit (3) is a central control unit that is configured to receive the moisture information from a weather forecast station and/or from at least one of the two or more LED-LS (2), and
- the control unit (3) is configured to control the light emission of the two or more LED-LS (2) based on the moisture information such that:
the control unit (3) controls a group of one or more LED-LS (2) of the two or more LED-LS (2) to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold, in case the moisture information fulfills the condition regarding the moisture in an area associated with the group of one or more LED-LS (2).

12. The lighting system according to claim 8 or 9, wherein

- the control unit (3) is part of one of the two or more LED-LS (2),
- the control unit (3) is configured to control the light emission of the two or more LED-LS (2) and receive the moisture information from a central control unit, from a weather forecast station and/or from at least one of the two or more LED-LS (2), and
- the control unit (3) is configured to control the light emission of the two or more LED-LS (2) based on the moisture information such that:
in case the moisture information fulfills the condition regarding the moisture in the area, the control unit (3) controls the two or more LED-LS (2) to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold.

13. The lighting system according to claim 8, 9 or 12, wherein

- the control unit (3) is part of one of the two or more LED-LS (2),
- the control unit (3) is configured to control the light emission of the two or more LED-LS (2) and receive the moisture information from a central control unit, from a weather forecast station and/or from at least one of the two or more LED-LS (2), and
- the control unit (3) is configured to control the light emission of the two or more LED-LS (2) based on the moisture information such that:
the control unit (8) controls a group of one or more LED-LS (2) of the two or more LED-LS (2) to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold, in case the moisture information fulfills the condition regarding the moisture in an area associated with the group of one or more LED-LS (2).

14. The lighting system (1) according to any one of claims 8 to 13, wherein each LED-LS (2) comprises a communication unit for communicating, in particular wirelessly, with other devices, in particular other LED-LS (2) of the lighting system (1).

15. A method for providing light to an area, wherein the

method comprises the steps

- emitting, by at least one LED light source (2), LED-LS, white light, and
- controlling, by a control unit (3), a light emission of the at least one LED-LS (2) based on moisture information on a moisture in the area such that:

  - in case the moisture information fulfills a condition regarding the moisture in the area, the control unit (3) controls the at least one LED-LS (2) to emit only light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than a probability threshold; wherein

- the at least one LED-LS (2) comprises:

  - a first LED unit (4a) configured to emit the white light, and
  - a second LED unit (4b) configured to emit light of a spectrum comprising a reflection probability of light-reflection on water drops smaller than the probability threshold; and

- the method comprises controlling, by the control unit (3), the light emission of the at least one LED-LS (2) such that:

  - the first LED unit (4a) emits light, in case the moisture information does not fulfill the condition, and
  - only the second LED unit (4b) emits light, in case the moisture information fulfills the condition;

characterised in that
the second LED unit (4b) is configured to emit
- light of a spectrum comprising a relative emission intensity greater than 20% between a wavelength of 580 nm and a wavelength of 605 nm or a wavelength of 542 nm and a wavelength of 670 nm; or
- light of a spectrum between a wavelength of 565 nm and a wavelength of 620 nm or a wavelength of 527 nm and a wavelength of 685 nm.

Patentansprüche

1. Beleuchtungssystem (1) zum Bereitstellen von Licht an einen Bereich, wobei

   - das System (1) umfasst:
   - mindestens eine LED-Lichtquelle (2), LED-LS, die konfiguriert ist, um weißes Licht abzugeben, und
   - eine Steuereinheit (3), die konfiguriert ist, um eine Lichtabgabe der mindestens einen LED-LS (2) zu steuern; und
   - die Steuereinheit (3) konfiguriert ist, um die Lichtabgabe der mindestens einen LED-LS (2) basierend auf einer Feuchteinformation über Feuchte in dem Bereich derart zu steuern, dass: falls die Feuchteinformation eine Bedingung bezüglich der Feuchte in dem Bereich erfüllt, die Steuereinheit (3) die mindestens eine LED-LS (2) steuert, um nur Licht eines Spektrums abzugeben, das eine Reflexionswahrscheinlichkeit von Lichtreflexion an Wassertropfen umfasst, die kleiner als ein Wahrscheinlichkeitsschwellenwert ist; wobei
   - die mindestens eine LED-LS (2) umfasst:
   - eine erste LED-Einheit (4a) konfiguriert ist, um das weiße Licht abzugeben, und
   - eine zweite LED-Einheit (4b) konfiguriert ist, um Licht eines Spektrums abzugeben, das eine Reflexionswahrscheinlichkeit der Lichtreflexion an Wassertropfen umfasst, die kleiner als der Wahrscheinlichkeitsschwellenwert ist; und
   - die Steuereinheit (3) konfiguriert ist, um die Lichtabgabe der mindestens einen LED-LS (2) derart zu steuern, dass:

     - die erste LED-Einheit (4a) Licht abgibt, falls die Feuchteinformation die Bedingung nicht erfüllt, und
     - nur die zweite LED-Einheit (4b) Licht abgibt, falls die Feuchteinformation die Bedingung erfüllt;
     dadurch gekennzeichnet, dass
     - die zweite LED-Einheit (4b) konfiguriert ist zum Abgeben von:
     - Licht eines Spektrums, umfassend eine relative Abgabeintensität von größer als 20 % zwischen einer Wellenlänge von 580 nm und einer Wellenlänge von 605 nm oder einer Wellenlänge von 542 nm und einer Wellenlänge von 670 nm; oder
     - Licht eines Spektrums zwischen einer Wellenlänge von 565 nm und einer Wellenlänge von 620 nm oder einer Wellenlänge von 527 nm und einer Wellenlänge von 685 nm.

2. Beleuchtungssystem (1) nach Anspruch 1, wobei die Feuchteinformation die Bedingung erfüllt, falls die Feuchteinformation über mindestens eines informiert von:

   - einem Feuchtigkeitsgehalt, der größer als ein Feuchtigkeitsschwellenwert ist,
   - einem Niederschlag und/oder Nebel und
   - einem Feuchtegehalt des Bodens in dem Bereich, der größer als ein Feuchteschwellenwert ist.

3. Beleuchtungssystem (1) nach Anspruch 1 oder 2, wobei das Beleuchtungssystem (1) mindestens eines umfasst von:

- einer Wetterbedingungssensoreinheit (5a), insbesondere eine Niederschlags- und/oder Nebelsensoreinheit, die konfiguriert ist, um Niederschlag und/oder Nebel in dem Bereich zu erfassen und das Erfassungsergebnis als die Feuchteinformation an die Steuereinheit (3) bereitzustellen;
- einer Feuchtigkeitssensoreinheit (5b), die konfiguriert ist, um einen Feuchtigkeitsgehalt der Feuchtigkeit in dem Bereich zu erfassen und das Erfassungsergebnis als die Feuchteinformation an die Steuereinheit (3) bereitzustellen;
- einer Feuchtesensoreinheit (5c), die konfiguriert ist, um einen Feuchtegehalt des Bodens in dem Bereich zu erfassen und das Erfassungsergebnis als die Feuchteinformation an die Steuereinheit bereitzustellen,
- einer Kommunikationseinheit (6), die konfiguriert ist, um die Feuchteinformation, insbesondere von einer Wettervorhersagestation, zu empfangen und die Feuchteinformation an die Steuereinheit (3) bereitzustellen.

4. Beleuchtungssystem (1) nach einem der vorstehenden Ansprüche, wobei die Reflexionswahrscheinlichkeit der Lichtreflexion an Wassertropfen einem relativen Streukoeffizienten entspricht und der Wahrscheinlichkeitsschwellenwert einem Schwellenwert (T1) für den relativen Streukoeffizienten entspricht.

5. Beleuchtungssystem (1) nach einem der vorstehenden Ansprüche, wobei

- die zweite LED-Einheit (4b) eine monochromatische gelbe LED-Einheit ist, die konfiguriert ist, um gelbes Licht abzugeben, oder
- die zweite LED-Einheit (4b) eine leuchtstoffumgewandelte LED-Einheit ist, die konfiguriert ist, um gelbes Licht auszugeben.

6. Beleuchtungssystem (1) nach einem der vorstehenden Ansprüche, wobei

- das Beleuchtungssystem (1) eine Linseneinheit umfasst, die angeordnet ist, um das durch die zweite LED-Einheit (4b) ausgegebene Licht zu modulieren, und
- die Linseneinheit eine verbesserte Strahlgeometrie umfasst, die die Reflexionswahrscheinlichkeit von Lichtreflexion an Wassertropfen des Lichts verringert, das durch die zweite LED-Einheit (4b) ausgegeben wird.

7. Beleuchtungssystem (1) nach einem der vorstehenden Ansprüche, wobei

- das Beleuchtungssystem eine Leuchte ist,
- die mindestens eine LED-LS (2) mindestens einem LED-Modul entspricht,
- die Leuchte (1) ein Treibermodul (7) zum Antreiben des mindestens einen LED-Moduls umfasst und
- das Treibermodul (7) die Steuereinheit (3) umfasst.

8. Beleuchtungssystem (1) nach einem der Ansprüche 1 bis 6, wobei das Beleuchtungssystem (1) zwei oder mehr LED-LS (2) umfasst und jede LED-LS (2) eine Leuchte ist.

9. Beleuchtungssystem (1) nach Anspruch 8, wobei

- mindestens eine, insbesondere jede, der zwei oder mehr LED-LS (2) eine lokale Steuereinheit (8) umfasst, die konfiguriert ist, um die Lichtabgabe der jeweiligen LED-LS (2) basierend auf der Feuchteinformation über die Feuchte in dem Bereich derart zu steuern, dass:
- falls die Feuchteinformation die Bedingung bezüglich der Feuchte in dem Bereich erfüllt, die lokale Steuereinheit die jeweiligen LED-LS (2) steuert, um nur Licht eines Spektrums, umfassend eine Reflexionswahrscheinlichkeit von Lichtreflexion an Wassertropfen, auszugeben, die kleiner als der Wahrscheinlichkeitsschwellenwert ist; und/oder
- die Steuereinheit (3) Teil von einer der zwei oder mehr LED-LS (2) ist und konfiguriert ist, um die Lichtabgabe der zwei oder mehr LED-LS (2) zu steuern.

10. Beleuchtungssystem nach Anspruch 8 oder 9, wobei

- die Steuereinheit (3) eine zentrale Steuereinheit ist, die konfiguriert ist, um die Feuchteinformation von einer Wettervorhersagestation und/oder von mindestens einer der zwei oder mehr LED-LS (2) zu empfangen, und
- die Steuereinheit (3) konfiguriert ist, um die Lichtabgabe der zwei oder mehr LED-LS (2) basierend auf der Feuchteinformation derart zu steuern, dass:
falls die Feuchteinformation die Bedingung bezüglich der Feuchte in dem Bereich erfüllt, die Steuereinheit (3) die zwei oder mehr LED-LS (2) steuert, um nur Licht eines Spektrums abzugeben, das eine Reflexionswahrscheinlichkeit von Lichtreflexion an Wassertropfen umfasst, die kleiner als der Wahrscheinlichkeitsschwellenwert ist.

11. Beleuchtungssystem nach einem der Ansprüche 8 bis 10, wobei

- die Steuereinheit (3) eine zentrale Steuereinheit ist, die konfiguriert ist, um die Feuchteinformation von einer Wettervorhersagestation und/oder von mindestens einer der zwei oder mehr LED-LS (2) zu empfangen, und
- die Steuereinheit (3) konfiguriert ist, um die Lichtabgabe der zwei oder mehr LED-LS (2) basierend auf der Feuchteinformation derart zu steuern, dass:
die Steuereinheit (3) eine Gruppe aus einer oder mehreren LED-LS (2) der zwei oder mehreren LED-LS (2) steuert, um nur Licht eines Spektrums abzugeben, umfassend eine Reflexionswahrscheinlichkeit der Lichtreflexion an Wassertropfen, die kleiner als der Wahrscheinlichkeitsschwellenwert ist, falls die Feuchteinformation die Bedingung bezüglich der Feuchte in einem Bereich erfüllt, der der Gruppe aus einer oder mehreren LED-LS (2) zugeordnet ist.

12. Beleuchtungssystem nach Anspruch 8 oder 9, wobei

- die Steuereinheit (3) Teil einer der zwei oder mehr LED-LS (2) ist,
- die Steuereinheit (3) konfiguriert ist, um die Lichtabgabe der zwei oder mehr LED-LS (2) zu steuern und die Feuchteinformation von einer zentralen Steuereinheit, von einer Wettervorhersagestation und/oder von mindestens einer der zwei oder mehr LED-LS (2) zu empfangen, und
- die Steuereinheit (3) konfiguriert ist, um die Lichtabgabe der zwei oder mehr LED-LS (2) basierend auf der Feuchteinformation derart zu steuern, dass:
falls die Feuchteinformation die Bedingung bezüglich der Feuchte in dem Bereich erfüllt, die Steuereinheit (3) die zwei oder mehr LED-LS (2) steuert, um nur Licht eines Spektrums abzugeben, das eine Reflexionswahrscheinlichkeit von Lichtreflexion an Wassertropfen umfasst, die kleiner als der Wahrscheinlichkeitsschwellenwert ist.

13. Beleuchtungssystem nach Anspruch 8, 9 oder 12, wobei

- die Steuereinheit (3) Teil einer der zwei oder mehr LED-LS (2) ist,
- die Steuereinheit (3) konfiguriert ist, um die Lichtabgabe der zwei oder mehr LED-LS (2) zu steuern und die Feuchteinformation von einer zentralen Steuereinheit, von einer Wettervorhersagestation und/oder von mindestens einer der zwei oder mehr LED-LS (2) zu empfangen, und
- die Steuereinheit (3) konfiguriert ist, um die Lichtabgabe der zwei oder mehr LED-LS (2) basierend auf der Feuchteinformation derart zu steuern, dass:
die Steuereinheit (8) eine Gruppe aus einer oder mehreren LED-LS (2) der zwei oder mehreren LED-LS (2) steuert, um nur Licht eines Spektrums abzugeben, umfassend eine Reflexionswahrscheinlichkeit der Lichtreflexion an Wassertropfen, die kleiner als der Wahrscheinlichkeitsschwellenwert ist, falls die Feuchteinformation die Bedingung bezüglich der Feuchte in einem der Gruppe aus einer oder mehreren LED-LS (2) zugeordneten Bereich erfüllt.

14. Beleuchtungssystem (1) nach einem der Ansprüche 8 bis 13, wobei jede LED-LS (2) eine Kommunikationseinheit zum Kommunizieren, insbesondere drahtlos, mit anderen Vorrichtungen, insbesondere anderen LED-LS (2) des Beleuchtungssystems (1), umfasst.

15. Verfahren zum Bereitstellen von Licht an einen Bereich, wobei das Verfahren die Schritte umfasst:

- Abgeben, durch mindestens eine LED-Lichtquelle (2), LED-LS, von weißem Licht und
- Steuern, durch eine Steuereinheit (3), einer Lichtabgabe der mindestens einen LED-LS (2) basierend auf der Feuchteinformation über eine Feuchte in dem Bereich, derart, dass:

  - falls die Feuchteinformation eine Bedingung bezüglich der Feuchte in dem Bereich erfüllt, die Steuereinheit (3) die mindestens eine LED-LS (2) steuert, um nur Licht eines Spektrums abzugeben, das eine Reflexionswahrscheinlichkeit von Lichtreflexion an Wassertropfen umfasst, die kleiner als ein Wahrscheinlichkeitsschwellenwert ist; wobei
  - die mindestens eine LED-LS (2) umfasst:

    - eine erste LED-Einheit (4a), die konfiguriert ist, um das weiße Licht abzugeben, und
    - eine zweite LED-Einheit (4b), die konfiguriert ist, um Licht eines Spektrums, umfassend eine Reflexionswahrscheinlichkeit von Lichtreflexion an Wassertropfen, die kleiner als der Wahrscheinlichkeitsschwellenwert ist, abzugeben; und
    - das Verfahren das Steuern der Lichtabgabe der mindestens einen LED-LS (2) durch die Steuereinheit (3) derart umfasst, dass:

- die erste LED-Einheit (4a) Licht abgibt, falls die Feuchteinformation die Bedingung nicht erfüllt, und
- nur die zweite LED-Einheit (4b) Licht abgibt, falls die Feuchteinformation die Bedingung erfüllt;

dadurch gekennzeichnet, dass

die zweite LED-Einheit (4b) konfiguriert ist zum Abgeben von:

- Licht eines Spektrums, umfassend eine relative Abgabeintensität von größer als 20 % zwischen einer Wellenlänge von 580 nm und einer Wellenlänge von 605 nm oder einer Wellenlänge von 542 nm und einer Wellenlänge von 670 nm; oder
- Licht eines Spektrums zwischen einer Wellenlänge von 565 nm und einer Wellenlänge von 620 nm oder einer Wellenlänge von 527 nm und einer Wellenlänge von 685 nm.

Revendications

1. Système d'éclairage (1) permettant de fournir de la lumière à une zone, dans lequel

Système d'éclairage (1) comprenant :

- au moins une source lumineuse LED (2), LED-LS, configurée pour émettre une lumière blanche, et
- une unité de commande (3) configurée pour contrôler une émission de lumière d'au moins une LED-LS (2) ; et
- l'unité de commande (3) est configurée pour commander l'émission de lumière de l'au moins une LED-LS (2) en fonction des informations sur l'humidité dans la zone, de telle sorte que :

si l'information sur l'humidité remplit une condition concernant l'humidité dans la zone, l'unité de commande (3) commande l'au moins une LED-LS (2) pour qu'elle n'émette que de la lumière d'un spectre comprenant une probabilité de réflexion de la lumière sur les gouttes d'eau inférieure à un seuil de probabilité ; dans lequel

- l'au moins une LED-LS (2) comprend :
- une première unité LED (4a) configurée pour émettre la lumière blanche, et
- une seconde unité LED (4b) configurée pour émettre de la lumière d'un spectre comprenant une probabilité de réflexion de la lumière sur les gouttes d'eau inférieure au seuil de probabilité ; et
- l'unité de commande (3) est configurée pour commander l'émission de lumière de l'au moins une LED-LS (2) de sorte que :

- la première unité LED (4a) émet de la lumière si l'information sur l'humidité ne remplit pas la condition, et
- seule la seconde unité LED (4b) émet de la lumière si l'information sur l'humidité ne remplit pas la condition ;

caractérisé en ce que

- la seconde unité LED (4b) est configurée pour émettre
- de la lumière d'un spectre comprenant une intensité d'émission relative supérieure à 20 % entre une longueur d'onde de 580 nm et une longueur d'onde de 605 nm ou une longueur d'onde de 542 nm et une longueur d'onde de 670 nm ; ou
- de la lumière d'un spectre compris entre une longueur d'onde de 565 nm et une longueur d'onde de 620 nm ou une longueur d'onde de 527 nm et une longueur d'onde de 685 nm.

2. Système d'éclairage (1) selon la revendication 1, dans lequel l'information sur l'humidité remplit la condition si l'information sur l'humidité renseigne sur au moins l'un parmi

- un niveau d'humidité supérieur à un seuil d'humidité,
- des précipitations et/ou du brouillard, et,
- un niveau d'humidité du sol dans la zone supérieur à un seuil d'humidité.

3. Système d'éclairage (1) selon la revendication 1 ou 2, dans lequel le système d'éclairage (1) comprend au moins l'un parmi

- une unité de détection des conditions météorologiques (5a), en particulier une unité de détection des précipitations et/ou du brouillard, configurée pour détecter les précipitations et/ou le brouillard dans la zone et fournir le résultat de la détection sous forme d'information sur l'humidité à l'unité de commande (3) ;
- une unité de détection de l'humidité (5b) configurée pour détecter un niveau d'humidité dans la zone et fournir le résultat de la détection sous forme d'information sur l'humidité à l'unité de commande (3) ;
- une unité de détection de l'humidité (5c) configurée pour détecter un niveau d'humidité dans

la zone et fournir le résultat de la détection sous forme d'information sur l'humidité à l'unité de commande,

- une unité de communication (6) configurée pour recevoir les informations sur l'humidité, en particulier d'une station de prévisions météorologiques, et pour fournir les informations sur l'humidité à l'unité de commande (3).

4. Système d'éclairage (1) selon l'une quelconque des revendications précédentes, dans lequel la probabilité de réflexion de la lumière sur les gouttes d'eau correspond à un coefficient de diffusion relatif et le seuil de probabilité correspond à un seuil (T_1) pour le coefficient de diffusion relatif.

5. Système d'éclairage (1) selon l'une quelconque des revendications précédentes, dans lequel

- la seconde unité LED (4b) est une unité LED ambrée monochromatique configurée pour émettre une lumière ambrée, ou
- la seconde unité LED (4b) est une unité LED convertie au phosphore configurée pour émettre une lumière ambrée.

6. Système d'éclairage (1) selon l'une quelconque des revendications précédentes, dans lequel

- le système d'éclairage (1) comprend une unité de lentille agencée pour moduler la lumière émise par la seconde unité LED (4b), et
- l'unité de lentille comprend une géométrie de faisceau améliorée réduisant la probabilité de réflexion de la lumière sur les gouttes d'eau de la lumière émise par la seconde unité LED (4b).

7. Système d'éclairage (1) selon l'une quelconque des revendications précédentes, dans lequel

- le système d'éclairage est un luminaire,
- l'au moins une LED-LS (2) correspond à au moins un module LED,
- le luminaire (1) comprend un module de pilotage (7) pour piloter au moins un module LED, et
- le module de pilotage (7) comprend l'unité de commande (3).

8. Système d'éclairage (1) selon l'une quelconque des revendications 1 à 6, dans lequel le système d'éclairage (1) comprend deux ou plusieurs LED-LS (2) et chaque LED-LS (2) est un luminaire.

9. Système d'éclairage (1) selon la revendication 8, dans lequel

- au moins une, en particulier chacune, des deux ou plusieurs LED-LS (2) comprend une unité de commande locale (8) configurée pour commander l'émission de lumière des LED-LS (2) respectives sur la base d'informations relatives à l'humidité dans la zone, de telle sorte que :

  - si l'information sur l'humidité remplit la condition relative à l'humidité dans la zone, l'unité de commande locale commande la LED-LS (2) respective pour qu'elle n'émette que de la lumière d'un spectre comprenant une probabilité de réflexion de la lumière sur les gouttes d'eau inférieure au seuil de probabilité ; et/ou
  - l'unité de commande (3) fait partie de l'une des deux ou plusieurs LED-LS (2) et est configurée pour commander l'émission de lumière des deux ou plusieurs LED-LS (2).

10. Système d'éclairage selon la revendication 8 ou 9, dans lequel

- l'unité de commande (3) est une unité de commande centrale configurée pour recevoir les informations sur l'humidité d'une station de prévision météorologique et/ou d'au moins une des deux ou plusieurs LED-LS (2), et
- l'unité de commande (3) est configurée pour commander l'émission de lumière des deux ou plusieurs LED-LS (2) sur la base des informations relatives à l'humidité, de telle sorte que : si l'information sur l'humidité remplit la condition concernant l'humidité dans la zone, l'unité de commande (3) commande les deux ou plusieurs LED-LS (2) pour qu'elle n'émette que de la lumière d'un spectre comprenant une probabilité de réflexion de la lumière sur les gouttes d'eau inférieure au seuil de probabilité.

11. Système d'éclairage selon l'une quelconque des revendications 8 à 10, dans lequel

- l'unité de commande (3) est une unité de commande centrale configurée pour recevoir les informations sur l'humidité d'une station de prévision météorologique et/ou d'au moins une des deux ou plusieurs LED-LS (2), et
- l'unité de commande (3) est configurée pour commander l'émission de lumière des deux ou plusieurs LED-LS (2) sur la base des informations relatives à l'humidité, de telle sorte que : l'unité de commande (3) commande un groupe d'une ou plusieurs LED-LS (2) parmi les deux ou plusieurs LED-LS (2) pour émettre uniquement de la lumière d'un spectre comprenant une probabilité de réflexion de la lumière sur les gouttes d'eau inférieure au seuil de probabilité, au cas où l'information sur l'humidité remplit la condition relative à l'humidité dans une zone as-

sociée au groupe d'une ou plusieurs LED-LS (2).

12. Système d'éclairage selon la revendication 8 ou 9, dans lequel

- l'unité de commande (3) fait partie de l'une des deux ou plusieurs LED-LS (2),
- l'unité de commande (3) est configurée pour commander l'émission de lumière des deux ou plusieurs LED-LS (2) et recevoir les informations sur l'humidité d'une unité de commande centrale, d'une station de prévisions météorologiques et/ou d'au moins une des deux ou plusieurs LED-LS (2), et
- l'unité de commande (3) est configurée pour commander l'émission de lumière des deux ou plusieurs LED-LS (2) sur la base des informations relatives à l'humidité, de telle sorte que :
si l'information sur l'humidité remplit la condition concernant l'humidité dans la zone, l'unité de commande (3) commande les deux ou plusieurs LED-LS (2) pour qu'elle n'émette que de la lumière d'un spectre comprenant une probabilité de réflexion de la lumière sur les gouttes d'eau inférieure au seuil de probabilité.

13. Système d'éclairage selon la revendication 8, 9 ou 12, dans lequel

- l'unité de commande (3) fait partie de l'une des deux ou plusieurs LED-LS (2),
- l'unité de commande (3) est configurée pour commander l'émission de lumière des deux ou plusieurs LED-LS (2) et recevoir les informations sur l'humidité d'une unité de commande centrale, d'une station de prévisions météorologiques et/ou d'au moins une des deux ou plusieurs LED-LS (2), et
- l'unité de commande (3) est configurée pour commander l'émission de lumière des deux ou plusieurs LED-LS (2) sur la base des informations relatives à l'humidité, de telle sorte que :
l'unité de commande (8) commande un groupe d'une ou plusieurs LED-LS (2) parmi les deux ou plusieurs LED-LS (2) pour émettre uniquement de la lumière d'un spectre comprenant une probabilité de réflexion de la lumière sur les gouttes d'eau inférieure au seuil de probabilité, au cas où l'information sur l'humidité remplit la condition relative à l'humidité dans une zone associée au groupe d'une ou plusieurs LED-LS (2).

14. Système d'éclairage (1) selon l'une quelconque des revendication 8 à 13, dans lequel chaque LED-LS (2) comprend une unité de communication pour communiquer, en particulier sans fil, avec d'autres dispositifs, en particulier d'autres LED-LS (2) du système d'éclairage (1).

15. Procédé de fourniture de lumière à une zone, dans lequel le procédé comprend les étapes consistant à

- émettre, par au moins une source lumineuse LED (2), LED-LS, de la lumière blanche, et
- commander, par une unité de commande (3), une émission lumineuse de l'au moins une LED-LS (2) sur la base d'informations relatives à l'humidité dans la zone, de telle sorte que :
- si l'information sur l'humidité remplit une condition concernant l'humidité dans la zone, l'unité de commande (3) commande l'au moins une LED-LS (2) pour qu'elle n'émette que de la lumière d'un spectre comprenant une probabilité de réflexion de la lumière sur les gouttes d'eau inférieure à un seuil de probabilité ; dans lequel
- l'au moins une LED-LS (2) comprend :
- une première unité LED (4a) configurée pour émettre la lumière blanche, et
- une seconde unité LED (4b) configurée pour émettre de la lumière d'un spectre comprenant une probabilité de réflexion de la lumière sur les gouttes d'eau inférieure au seuil de probabilité ; et
- le procédé consiste à commander, par l'unité de commande (3), l'émission de lumière de l'au moins une LED-LS (2) de telle sorte que :
- la première unité LED (4a) émet de la lumière si l'information sur l'humidité ne remplit pas la condition, et
- seule la seconde unité LED (4b) émet de la lumière si l'information sur l'humidité ne remplit pas la condition ;

caractérisé en ce que

la seconde unité LED (4b) est configurée pour émettre

- de la lumière d'un spectre comprenant une intensité d'émission relative supérieure à 20 % entre une longueur d'onde de 580 nm et une longueur d'onde de 605 nm ou une longueur d'onde de 542 nm et une longueur d'onde de 670 nm ; ou
- de la lumière d'un spectre compris entre une longueur d'onde de 565 nm et une longueur d'onde de 620 nm ou une longueur d'onde de 527 nm et une longueur d'onde de 685 nm.

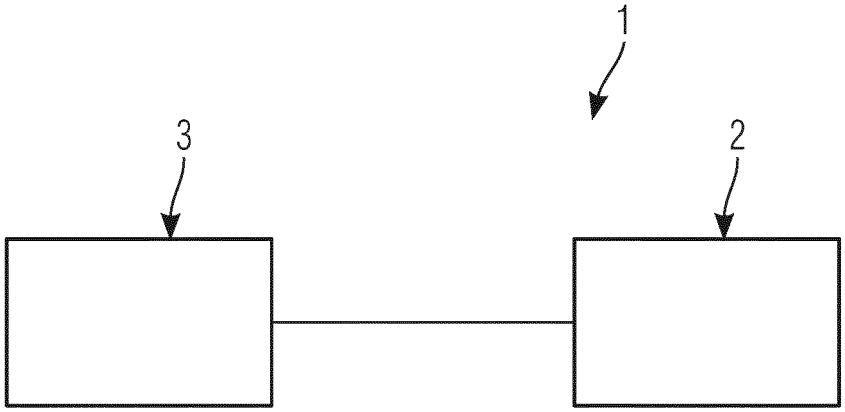

Fig. 1 (a)

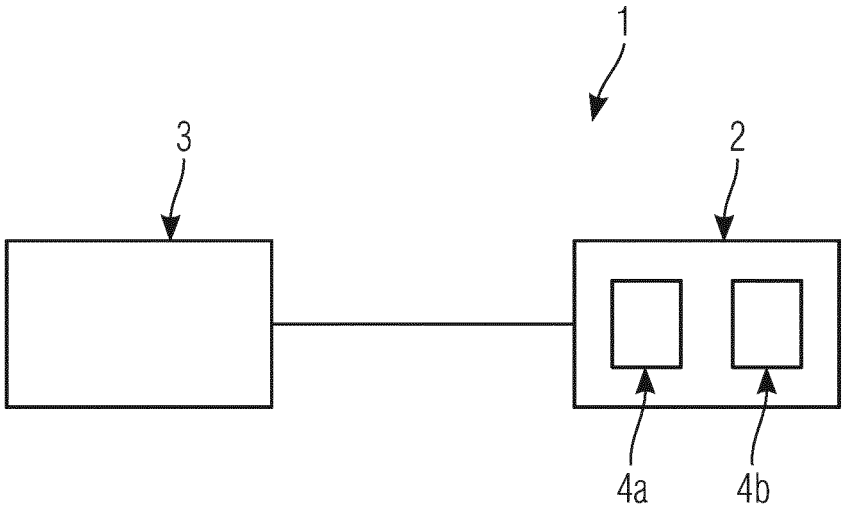

Fig. 1 (b)

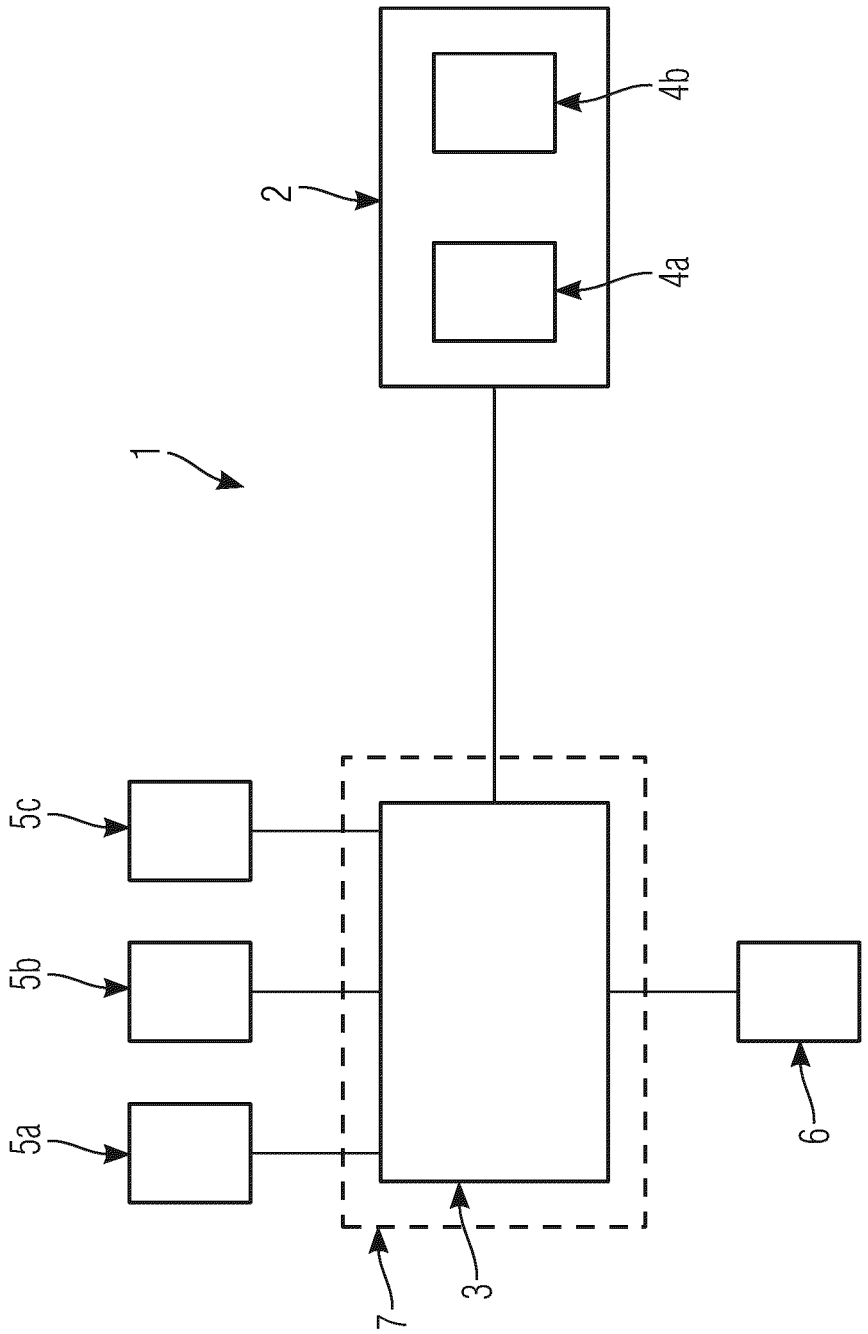

Fig. 2

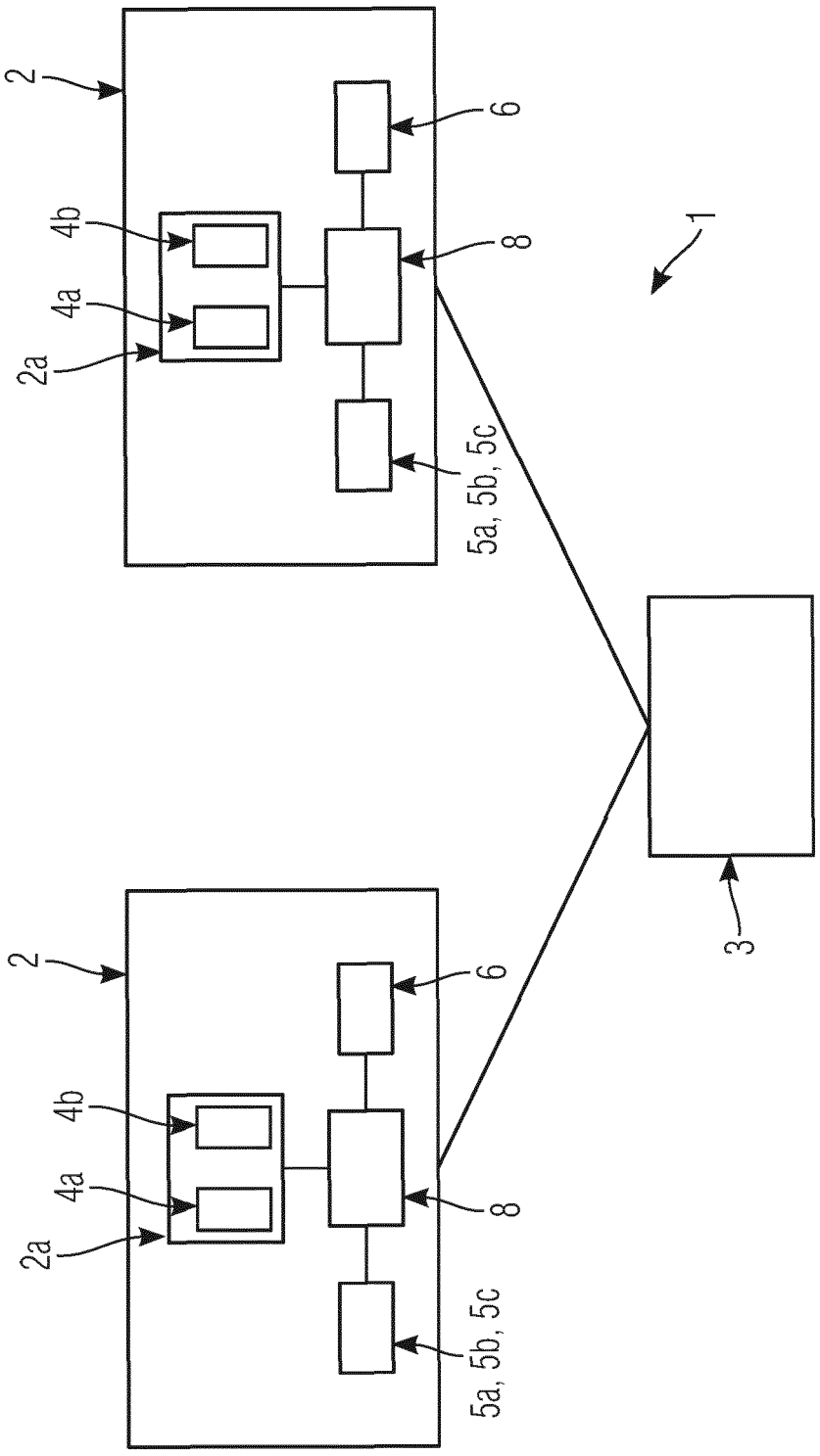

Fig. 3

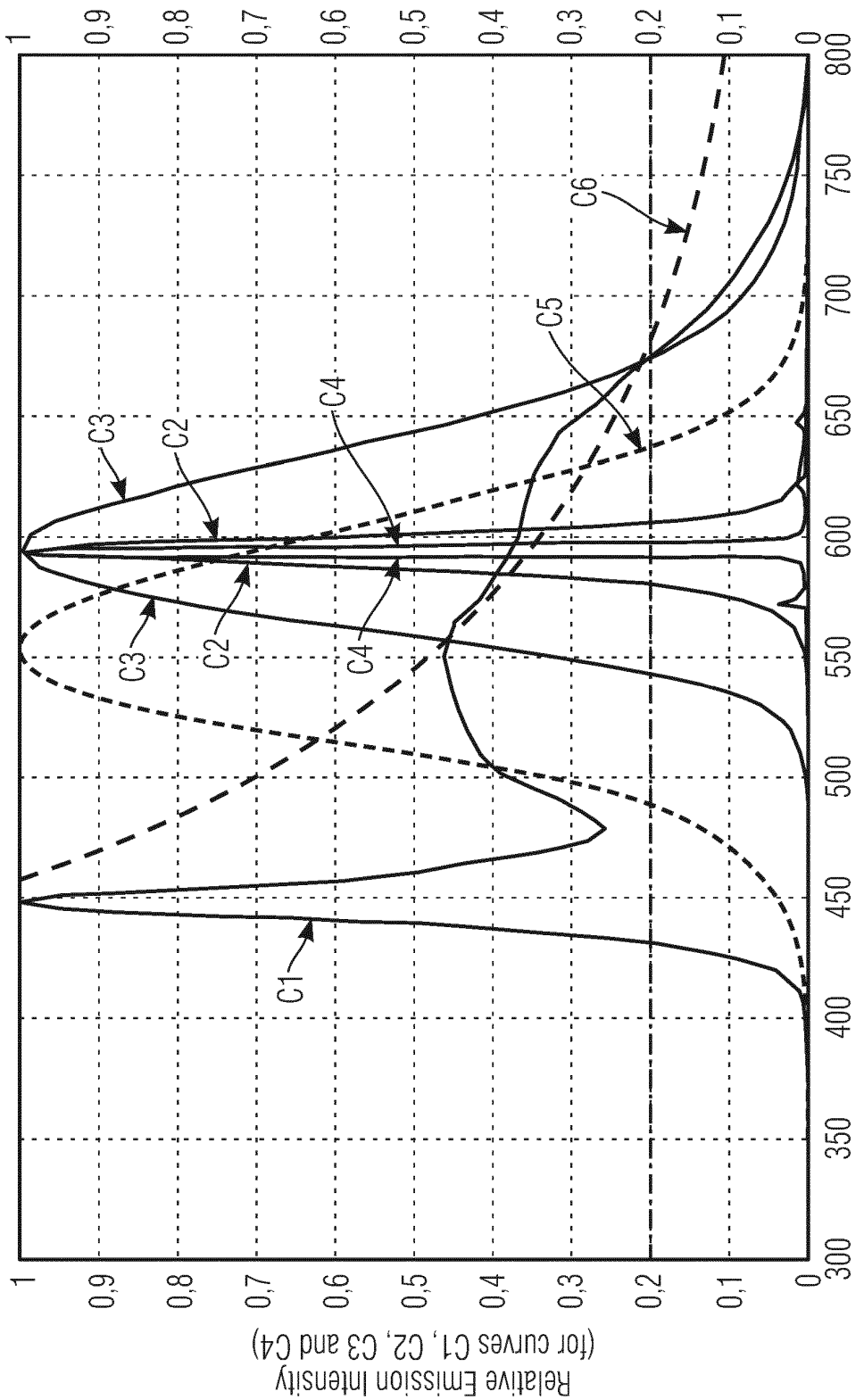
Relative Emission Intensity
(for curves C1, C2, C3 and C4)
average spectral sensitivity of human visual perception of brightness
(for curve C5)
reflection probability (normalized to a wavelength of 460 nm)
(for curve C6)
Wavelength (nm)
C1
C2
C3
C4
C5
C6

Fig. 4

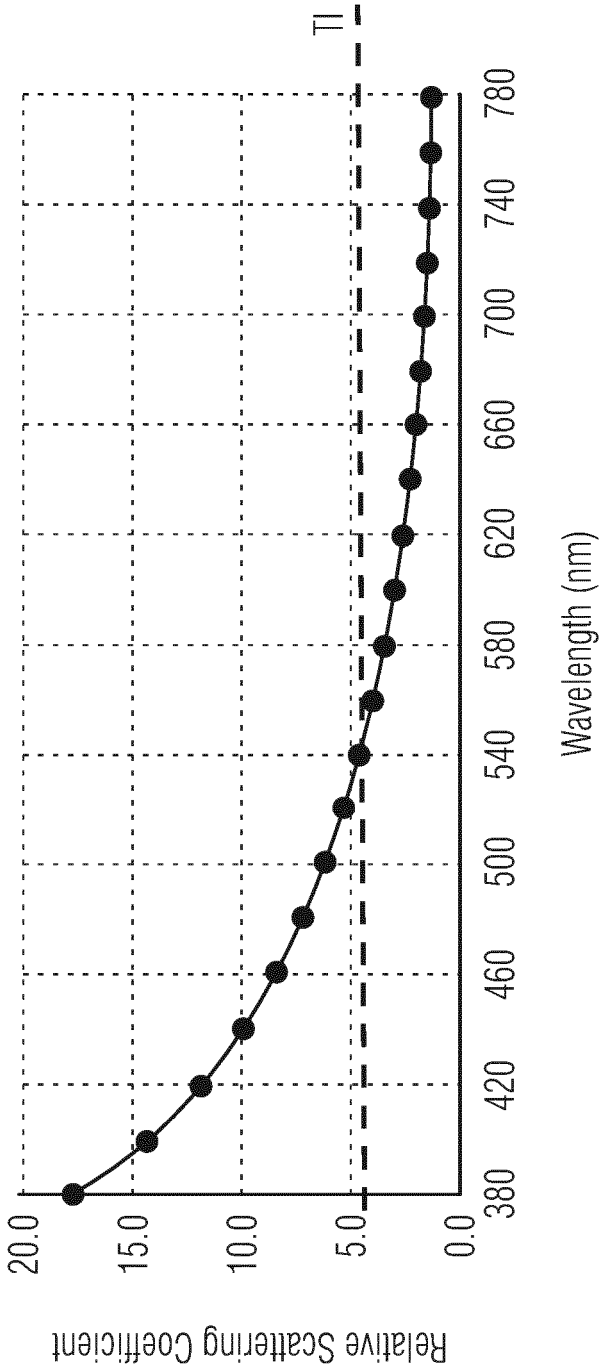
Tl
20.0
15.0
10.0
5.0
0.0
380
420
460
500
540
580
620
660
700
740
780
Wavelength (nm)
Relative Scattering Coefficient

Fig. 5

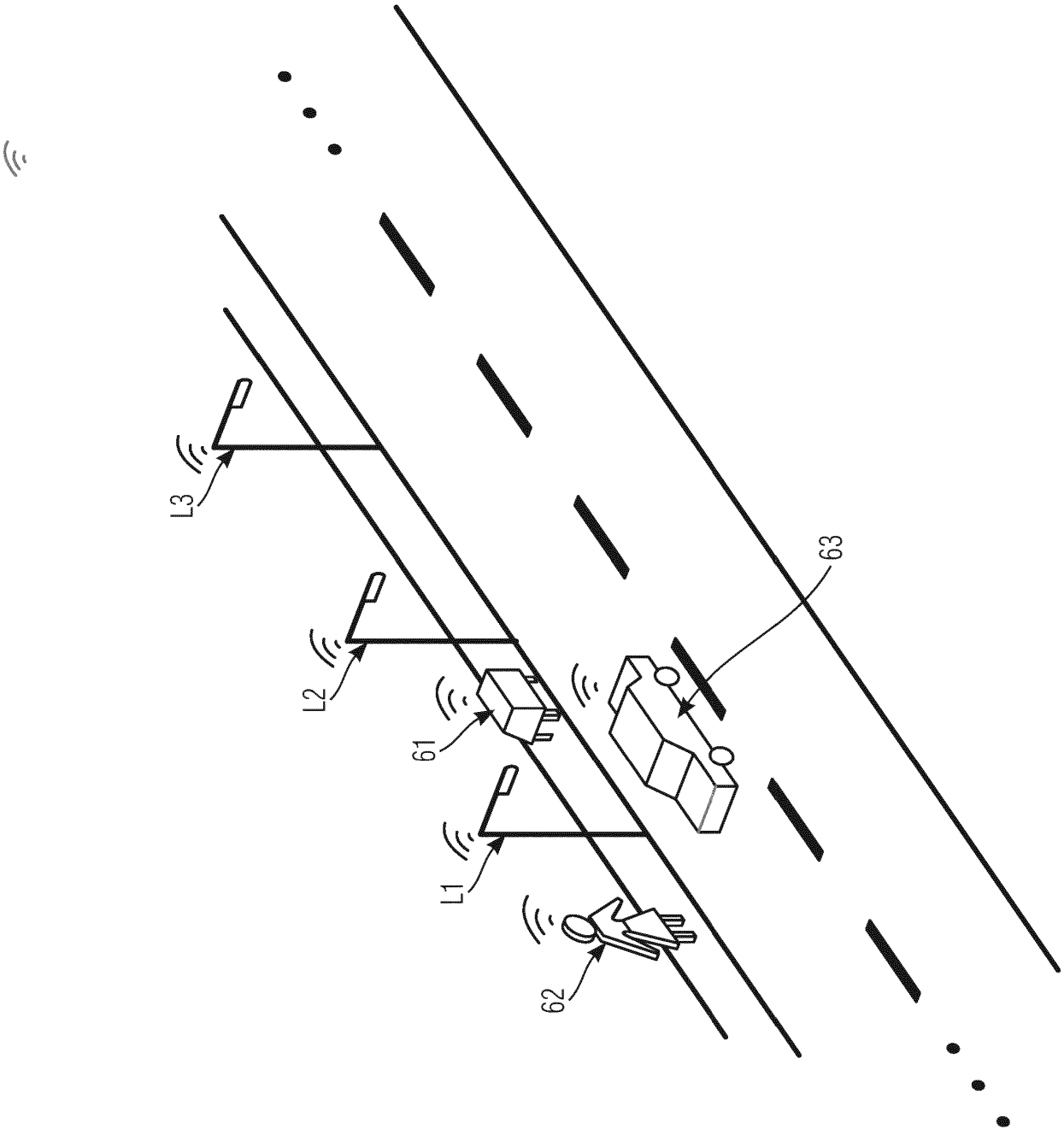

Fig. 6

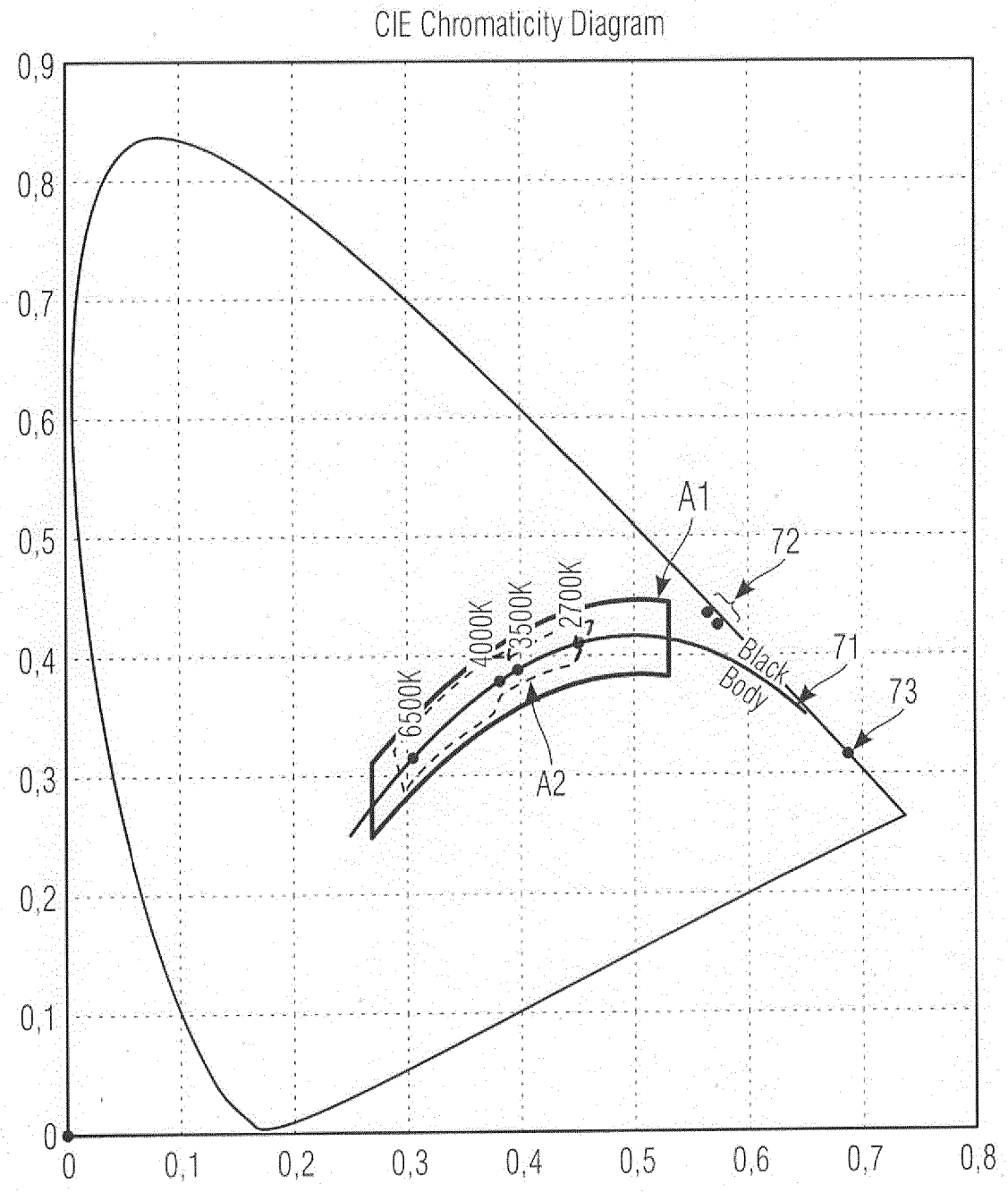
CIE Chromaticity Diagram
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
0
0,1
0,2
0,3
0,4
0,5
0,6
0,7
0,8
A1
72
6500K
4000K
3500K
2700K
Black
Body
71
73
A2

Fig. 7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 10405399 B1 **[0005]**