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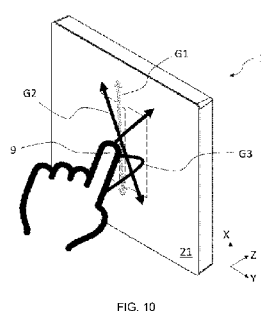
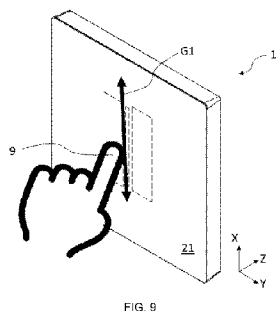
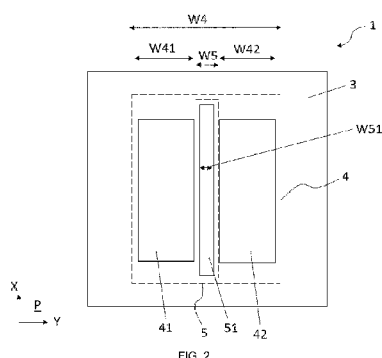
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(54) Title: DIMMING CONTROLLER AND ASSOCIATED METHODS AND USE



(57) **Abstract:** The present invention discloses dimming controller comprising an interface panel having a front face designed to be touched by an user to interact with the dimming controller and a back face, a support designed to attach the dimming controller to an object and an electronic board comprising a dimming area; the electronic board is sandwiched between the interface panel and the support; the electronic board comprises a first surface facing the back face and a second surface. The distance between the first surface and the back face is smaller than or equal to 0.4 mm, preferably the distance between the first surface and the back face is smaller than or equal to 0.3 mm, more preferably the distance between the first surface and the back face is smaller than or equal to 0.25 mm. The dimming area comprises a first dimming zone and a second dimming zone. The first dimming zone comprises N_f capacitive segments forming a first linear array. The second dimming zone comprising N_s capacitive segments forming a second linear array. N_f , N_s are natural numbers and are equal to or greater than 2 ($N_f, N_s \geq 2$). The first dimming zone is electrically isolated from the second dimming zone. The dimming zone further comprises a lighting zone separating the first dimming zone and the second dimming zone. The lighting zone comprises a lighting slot. The electronic board comprises N_l LEDs forming a lighting linear array and designed to illuminate through the interface panel via the lighting slot, where N_l is a natural number and is equal to or greater than 2 ($N_l \geq 2$). The width of the lighting zone is smaller than or equal to 12 mm, preferably the width of the lighting zone is smaller than or equal to 10 mm, more preferably the width of the lighting zone is smaller than or equal to 8 mm and even more preferably the width of the lighting zone is smaller than or equal to 6 mm.



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Dimming controller and associated methods and use

Description

Technical Field

- [0001] The present invention relates to a dimming controller to provide electronic signals, whatever the protocol (I2C, KNX, Zigbee, Matter, ...). Those electronic signals can activate any electronical device such as : light, roller shutter, heating system, electrochromic window or alike. The electronical signals provided by the dimming controller generate control messages to a power stage in charge of controlling any electronical device as described above in order to modify the power such as on/off, increase/decrease, or alike or to change the status of specific functions such as the colour of a lighting system
- [0002] Thus, the invention concerns multiple domains where a dimming controller, especially for a domestic use, can be used to control a function such as the intensity of a light source, the opening and the closing of a roller shutter, the light transmission of an active glazing, the temperature of the heating system, the speed of a fan or alike.

Background Art

- [0003] Conventionally, a dimming controller controls a function by a long pressure on a rocker or with a slider.
- [0004] Conventional dimming controllers can include a user interface having plurality of buttons-like to receive inputs from a user. To response to such inputs, such dimming controllers can comprise status indicators (visual, sensitive) for providing feedbacks to the user.
- [0005] These status indicators are installed in a different place than the place used to control the function.
- [0006] The difficulty with conventional dimming controllers for the user is to control a function and having the feedbacks at a different location.
- [0007] The following description relates to building applications but it's understood that the invention may be applicable to others fields like automotive or transportation applications.

Summary of invention

[0008] The present invention relates, in a first aspect, to a dimming controller.

[0009] The dimming controller comprises

- an interface panel having a front face designed to be touched by an user to interact with the dimming controller and a back face,
- a support designed to attach the dimming controller to an object and
- an electronic board comprising a dimming area; the electronic board is sandwiched between the interface panel and the support; the electronic board comprises a first surface facing the back face and a second surface.

[0010] The solution as defined in the first aspect of the present invention is based on that the distance between the first surface and the back face is smaller than or equal to 0.4 mm, preferably the distance between the first surface and the back face is smaller than or equal to 0.3 mm, more preferably the distance between the first surface and the back face is smaller than or equal to 0.25 mm.

[0011] The solution as defined in the first aspect of the present invention is also based on that the dimming area comprises a first dimming zone and a second dimming zone. The first dimming zone comprises N_f capacitive segments forming a first linear array. The second dimming zone comprising N_s capacitive segments forming a second linear array. N_f , N_s are natural numbers and are equal to or greater than 2 ($N_f, N_s \geq 2$). The first dimming zone is electrically isolated from the second dimming zone.

[0012] The solution as defined in the first aspect of the present invention is also based on that the dimming zone further comprises a lighting zone separating the first dimming zone and the second dimming zone. The lighting zone comprises a lighting slot.

[0013] The solution as defined in the first aspect of the present invention is also based on that the electronic board comprises N_I LEDs forming a lighting linear array and designed to illuminate through the interface panel via the lighting slot, where N_I is a natural number and is equal to or greater than 2 ($N_I \geq 2$).

[0014] The solution as defined in the first aspect of the present invention is also based on that the width of the lighting zone is smaller than or equal to 12 mm, preferably the width of the lighting zone is smaller than or equal to 10 mm, more preferably the width of the lighting zone is smaller than or equal to 8 mm and even more preferably the width of the lighting zone is smaller than or equal to 6 mm.

- [0015] The present invention allows to activate any electronical device, such as light, roller shutter, heating system, electrochromic window or alike, by a gesture along the lighting zone without any precise positioning of a finger or alike on the lighting zone while helping users to interact more easily with such electronic device.
- [0016] Furthermore, the dimming controller of the first aspect of the invention helps to reduce the size, especially the thickness of a dimming controller.
- [0017] The present invention relates, in a second aspect, to a method to manufacture a dimming controller according to the first aspect. The manufacturing method comprises following steps :
- A1. Providing the interface panel and the electronic board;
 - A2. Sandwiching the electronic board between interface layer and the support.
- [0018] The present invention relates, in a third aspect, to a method to assemble a dimming controller according to the first aspect to an object, especially a wall, to easily and fast assembling said dimming controller on the place where it will be used. The assembling method comprises following steps :
- B1. Providing the dimming controller;
 - B2. Assembling the dimming controller via the support to a functional plate fixed on a block set on a wall.
- [0019] Therefore, the present invention solves the need to interact and command an electronical device with an easy and not precise gesture while reducing the thickness of said dimming controller.
- [0020] It is noted that the invention relates to all possible combinations of features recited in the claims or in the described embodiments.
- [0021] The following description relates to building applications but it's understood that the invention may be applicable to others fields like automotive or transportation applications or any other field where a dimming controller can be used to control and/or command an electronic device.

Brief description of the drawings

This and other aspects of the present invention will now be described in more detail, with reference to the appended drawings showing various exemplifying embodiments of the invention which are provided by way of illustration and not of limitation. The drawings are a schematic representation and not true to scale. The drawings do not

restrict the invention in any way. More advantages will be explained with examples.

FIG. 1 is a schematic view of an interface panel and an electronic board of a dimming controller according to a first embodiment of the invention.

FIG. 2 is a schematic view of an electronic board of a dimming controller according to a second embodiment of the invention.

FIG. 3 is a schematic view of an electronic board of a dimming controller according to a third embodiment of the invention.

FIG. 4 is a schematic view of an electronic board of a dimming controller according to a fourth embodiment of the invention.

FIG. 5 is a schematic view of a dimming controller according to the invention.

FIG. 6 is an exploded 3D schematic view of a dimming controller according to some embodiments of the invention.

FIG. 7 is an exploded 3D schematic view of a dimming controller according to some embodiments of the invention.

FIG. 8 is a schematic view of a dimming area according to some embodiments of the invention.

FIG. 9 is a schematic view of a method to interact with a dimming controller by a gesture substantially along the lighting slot according to some embodiments of the invention.

FIG. 10 is a schematic view of a method to interact with a dimming controller by acceptable gestures near the lighting slot according to some embodiments of the invention.

Detailed description

[0022] It should be appreciated that various embodiments of the present disclosure and the terms used therein are not intended to limit the technological features set forth herein to particular embodiments and include various changes, equivalents, or replacements for a corresponding embodiment. The same reference numbers are used throughout the drawings to refer to the same or like parts.

[0023] As used herein, spatial or directional terms, such as "inner", "outer", "above", "below", "top", "bottom", and the like, relate to the invention as it is shown in the drawing figures. However, it is to be understood that the invention can assume various alternative orientations and, accordingly, such terms are not to be considered as limiting. Further, all numbers expressing dimensions, physical characteristics, processing parameters, quantities of ingredients, reaction

conditions, and the like, used in the specification and claims are to be understood as being modified in all instances by the term "about". Accordingly, unless indicated to the contrary, the numerical values set forth in the following specification and claims are approximations that can vary depending upon the desired properties sought to be obtained by the present invention. In the following description, unless otherwise specified, expression "substantially" mean to within 10%, preferably to within 5%.

[0024] Moreover, all ranges disclosed herein are to be understood to be inclusive of the beginning and ending range values and to encompass any and all subranges subsumed therein. For example, a stated range of "1 to 10" should be considered to include any and all subranges between (and inclusive of) the minimum value of 1 and the maximum value of 10; that is, all subranges beginning with a minimum value of 1 or more, e.g. 1 to 6.1, and ending with a maximum value of 10 or less, e.g., 5.5 to 10 unless otherwise specified. Further, as used herein, the terms "deposited over" or "provided over" mean deposited or provided on but not necessarily in surface contact with. For example, a coating "deposited over" a substrate does not preclude the presence of one or more other coating films of the same or different composition located between the deposited coating and the substrate.

[0025] Where the term "comprising" is used in the present description and claims, it does not exclude other elements or steps. Where an indefinite or definite article is used when referring to a singular noun e.g. "a" or "an", "the", this includes a plural of that noun unless something else is specifically stated. In this document, "configured to (or set to)" may be interchangeably used in hardware and software with, for example, "appropriate to", "having a capability to", "changed to", "made to", "capable of", or "designed to" according to a situation. In any situation, an expression "device configured to do" may mean that the device "can do" together with another device or component.

[0026] Furthermore, the terms first, second and the like in the description and in the claims, are used for distinguishing between similar elements and not necessarily for describing a sequence, either temporally, spatially, in ranking or in any other manner. It is to be understood that the terms so used are interchangeable under appropriate circumstances and that the embodiments of the invention described herein are capable of operation in other sequences than described or illustrated

herein. When it is described that a constituent element (e.g., a first constituent element) is "(functionally or communicatively) coupled to" or is "connected to" another constituent element (e.g., a second constituent element), it should be understood that the constituent element may be directly connected to the another constituent element or may be connected to the another constituent element through another constituent element (e.g., a third constituent element).

- [0027] The term "transparent", meaning optically transparent, denotes, unless otherwise specified, a property illustrating the average TL (light transmission) of visible light transmitted through a material in the visible spectrum of at least 1%. Preferably, transparent relates to a TL property of at least 10%. More preferably, transparent denotes a TL of at least 50%. Ideally, transparent denotes a TL of at least 70%.
- [0028] The term "opaque", meaning optically opaque, denotes, unless otherwise specified, a property illustrating the average TL (light transmission) of visible light transmitted through a material in the visible spectrum of at most 1%. Preferably, opaque relates to a TL property of at most 0.5%. More preferably, opaque denotes a TL of at most 0.1%. Ideally, opaque denotes a TL of at most 0.05%.
- [0029] The term "in front of" denotes that first surface is facing the back face of the dimming controller.
- [0030] It is an object of the present invention to alleviate the above described problems and to remove the barriers to easily use a dimming controller with a light indication and response. Especially, the object of the first aspect of the present invention is about a dimming controller.
- [0031] It is understood that the dimming controller is a controller designed to provide electronic signals, whatever the protocol to be used such as I2C, KNX, Zigbee, Matter, ... Those electronic signals can activate any electronical device such as : light, roller shutter, heating system, electrochromic window or alike.. The electronical signals provided by the dimming controller generate control messages to a power stage in charge of controlling any electronical device as described above in order to modify the power (such as on/off, increase/decrease, or alike) or to change the status of specific functions (such as the colour of a lighting system) The dimming controller is able, for example and not limiting, to dim a light source but also to adapt the position of a roller shutter, modify the temperature of a heating system.
- [0032] The diming controller comprises an interface panel.

- [0033] The interface panel has a front face and a back face. Said front and back faces are preferably substantially parallel to each other.
- [0034] The front face is designed to be touched by an user, especially with a finger or alike, to interact with the dimming controller. The gesture of the user on the front face, behind the dimming area, permits to control a function such as the intensity of a light source, the opening and the closing a roller shutter, the light transmission of an active glazing, the temperature of the heating system, the speed of a fan or alike depending of the electrical device to be controlled.
- [0035] The interface panel can be made of any material suitable to transmit the user gesture on the first surface of the electronic board.
- [0036] The interface panel can have different chemical composition, such as plastic-based composition. The plastic-based composition can be PET, polycarbonate, PVC or any other plastic-based suitable to be used as a interface panel for a dimming controller.
- [0037] The interface panel can be cut by any known method, for example, a method in which laser light is irradiated on the surface of the interface panel to cut it, or a method in which a cutter wheel is mechanically cutting can be used.
- [0038] Preferably, the interface panel is a dielectric interface panel to avoid any direct conductivity with the dimming zone.
- [0039] Preferably, the interface panel comprises a glass sheet. References to glass throughout this application should not be regarded as limiting.
- [0040] The glass sheet according to the some embodiments of the present invention can be made of glass which may belong to various categories. The glass can thus be a glass of soda-lime-silica, aluminosilicate or borosilicate type, and the like, comprising at least 50% in weight (wt%) of SiO_2 . The glass composition typically comprises the following components (Comp. A). In all glass compositions described herein, the levels are in expressed in weight percentage, or in weight ppm expressed with respect to the total weight of glass.
- [0041] Preferably, notably for low production costs reasons, the glass composition is a soda-lime-silicate-type glass (Comp. B). According to this embodiment, by "soda-lime-silicate-type glass", it is meant that the following composition :

Table 1

	Comp. A	Comp. B
SiO ₂	40 – 78 wt%	60 – 78 wt%
Al ₂ O ₃	0 – 18 wt%	0 – 8 wt%, pref 0 – 6 wt%
B ₂ O ₃	0 – 18 wt%	0 – 4 wt%, pref 0 – 1 wt%
Na ₂ O	0 – 20 wt%	5 – 20 wt%, pref 10 – 20 wt%
CaO	0 – 15 wt%	0 – 15 wt%, pref 5 – 15 wt%
MgO	0 – 15 wt%	0 – 10 wt%, pref 0 – 8 wt%
K ₂ O	0 – 15 wt%	0 – 12 wt%, pref 0-10 wt%
BaO	0 – 5 wt%	0 – 5 wt%, pref 0 – 1 wt%.

[0042] In the art, “ultra-white” or “extra-clear” glasses are known since years in the solar or building domain, due to their high luminous and/or energetical transmittance. These glasses contain low amount of iron such as 0,002-0,06 wt%, preferably 0.002-0.04 wt%, more preferably 0.002-0.02 wt% of total iron (expressed as Fe₂O₃).

[0043] In addition to its basic elements, glass compositions can include other components, of nature and quantity adapted to the desired effect. To obtain a glass with a very high transmission in the infrared wavelength, specific oxidants such chromium oxide, cobalt oxide, selenium oxide, manganese oxide and/or cerium oxide, can be added.

[0044] Thus, as illustrated in WO2014/128016 and in WO2014/180679, the glass advantageously has a composition which comprises, in a content expressed in percentages in total weight of glass: Total iron (expressed as Fe₂O₃) at a level of 0.002 – 0.06 wt%; and Cr₂O₃ at a level of 0.0001 – 0.06 wt%, preferably 0.002 to 0.06 wt%. Such chromium contents further improve the infrared transmission.

[0045] As exemplified in WO2015/091106, the glass composition can also further comprise cobalt so that it comprises 0.0015 – 1 wt% of Cr₂O₃ and 0,0001 – 1 wt% of Co. In mid iron glass compositions, the glass can typically comprise : Total iron (expressed as Fe₂O₃) 0.02 – 1 wt%, preferably 0.06 – 1 wt%; Cr₂O₃ : 0,002 – 0.5 wt%; and Co 0,0001 – 0,5 wt%.

[0046] Glass compositions based on chromium, cobalt and selenium as illustrated in WO2014/146941, have shown particularly good performance in terms of infrared transmission, while offering interesting possibilities in terms of aesthetics/color : from gray neutrality to light to intense coloring in the gray-bronze range. In this

instance, the glass composition will typically comprises : Total iron (expressed as Fe_2O_3) 0.002 – 1 wt%; Cr_2O_3 0,001- 0.5 wt%; Co 0,0001 - 0,5 wt%; and Se 0,0003 - 0,5 wt%.

[0047] Alternative solutions to obtain a low iron glass with a very high transmission in the infrared can use cerium oxide (0,001 – 1 wt%) and/or a combination of known oxidant such as manganese (MnO from 0,01 to 1 wt%), antimony (Sb_2O_3 from 0.01 to 1 wt%), arsenic (As_2O_3 from 0.01 to 1 wt%), and/or copper (CuO from 0.0002 to 0.1 wt%) as illustrated in WO2015/72983 and in WO2016/008906.

[0048] Other glass compositions of use for the invention herein are those which have been formulated to be easily chemically temperable – more favorable to ion exchange than conventional soda-lime-silica glass compositions while remaining easy to produce, in particular on an existing line of production of classical soda-lime-silica glass. Such glass composition comprises the following components:

Table 2

Comp. C as illustrated in WO2016/169823 and in WO2016/177592	Comp. D as illustrated in WO2018/001965	Comp. E as illustrated in WO2016/091672 and WO2016/198249
$65 \leq \text{SiO}_2 \leq 78 \text{ wt\%}$	$60 \leq \text{SiO}_2 \leq 78 \text{ wt\%}$	$65 \leq \text{SiO}_2 \leq 78 \text{ wt\%}$
$5 \leq \text{Na}_2\text{O} \leq 20 \text{ wt\%}$	$5 \leq \text{NaO} \leq 20 \text{ wt\%}$	$5 \leq \text{Na}_2\text{O} \leq 20 \text{ wt\%}$
$0 \leq \text{K}_2\text{O} < 5 \text{ wt\%}$	$0.9 < \text{K}_2\text{O} \leq 12 \text{ wt\%}$	$1 \leq \text{K}_2\text{O} < 8 \text{ wt\%}$
$1 \leq \text{Al}_2\text{O}_3 < 6 \text{ wt\%}$, pref $3 < \text{Al}_2\text{O}_3 \leq 5 \%$	$4.9 \leq \text{Al}_2\text{O}_3 \leq 8 \text{ wt\%}$	$1 \leq \text{Al}_2\text{O}_3 < 6 \text{ wt\%}$
$0 \leq \text{CaO} < 4.5 \text{ wt\%}$	$0.4 < \text{CaO} < 2 \text{ wt\%}$	$2 \leq \text{CaO} < 10 \text{ wt\%}$
$4 \leq \text{MgO} \leq 12 \text{ wt\%}$	$4 < \text{MgO} \leq 12 \%$	$0 \leq \text{MgO} \leq 8 \text{ wt\%}$
$(\text{MgO}/(\text{MgO}+\text{CaO})) \geq 0.5$, pref $0.88 \leq [\text{MgO}/(\text{MgO}+\text{CaO})] < 1$		$\text{K}_2\text{O}/(\text{K}_2\text{O}+\text{Na}_2\text{O}) : 0.1 - 0.7$

[0049] Preferably, these glasses contain low amount of iron such as 0,0001%-0,06%, preferably 0.002%-0.04%, more preferably 0.002-0.02% of total iron (expressed as Fe_2O_3).

[0050] According to the invention, to reduce breakage risk while facilitating the handling, the interface panel can be a tempered glass sheet.

- [0051] The interface panel can comprises two glass sheets laminated together by a polymer interlayer.
- [0052] Preferably the interlayer is fixing the majority of the surface of the glass sheets.
- [0053] In some embodiments, the interlayer can be made of a single layer of material or multiple layer of single or different material.
- [0054] In some embodiments, the interlayer can be made of single sheet of material or a plurality of sheets placed next to each other to form a single-like sheet.
- [0055] In some embodiments, the interlayer is a glue.
- [0056] In some other embodiments, the interlayer is a interlayer able to laminate the glass sheets together. Preferably, such interlayer can be transparent plastic interlayer. Transparent plastic interlayer can be polyvinyl butyral (PVB), ethylene-vinyl acetate (EVA), polymethyl methacrylate (PMMA), a polycarbonate (PC), a polystyrene (PS), a polyvinyl chloride (PVC), a polyamide (PA), a polyetherimide (PEI), a polyethylene terephthalate (PET), a polyurethane, an acrylonitrile butadiene styrene copolymer (ABS), a styrene acrylonitrile copolymer (SAN), a styrene methyl methacrylate copolymer (SMMA) and any mixtures of these, a crosslinked resin, an ionoplast, an ionomer, a cyclo-olefin polymer (COP), cyclo-Olefin copolymer (COC) or an Optical Clear Adhesive (OCA).
- [0057] Crosslinked or cured resins are known to the skilled person and are three dimensional polymer networks obtained by the crosslinking/curing of low molecular weight species either by reaction with a curing agent also known as crosslinker or upon exposure to heat, UV radiations (UV) or electron beam (EB). Non exhaustive examples of crosslinked resins are epoxy resins, polyurethane resins, UV or EB curable resins. In the present invention, the precursors of the crosslinked resin may be transparent or not provided that the crosslinked resin is transparent.
- [0058] Remark that some polymer mixtures, copolymers and some semi-crystalline polymers can be opaque and non-transparent due to a dispersed phase or due to the presence of crystallites. Hence it is possible that not all compositions of the listed polymers mentioned above are transparent. The person skilled in the art is capable to identify what composition is transparent and hence identify if a given polymer falls within the claimed transparent polymers.
- [0059] In some embodiments, borders of the interface panel can be chamfered to avoid breakage or risk of cut.

- [0060] The glass sheet can be manufactured by a known manufacturing method such as a float method, a fusion method, a redraw method, a press molding method, or a pulling method. As a manufacturing method of the glass sheet, from the viewpoint of productivity and cost, it is preferable to use the float method.
- [0061] The interface panel can be processed, i.e. annealed, tempered,... to respect the specifications of security requirements. The interface panel can be a clear, a transparent or a colored interface panel, tinted with a specific composition or by applying a coating or a plastic layer for example.
- [0062] The interface panel can have any shape to fit to the other elements of the dimming controller and the design of the dimming controller. Preferably, the interface layer has the shape, especially the perimeter, of the dimming controller.
- [0063] Preferably, the thickness of the interface panel is smaller than or equal to 2.5 mm, preferably the thickness of the interface panel is smaller than or equal to 1.5 mm, more preferably the thickness of the interface panel is smaller than or equal to 1.1 mm to minimize the thickness of the dimming element while minimizing interferences between the gesture on the front face and the dimming zone.
- [0064] Preferably, the thickness of the interface panel is equal to or greater than 0.1 mm, preferably the thickness of the interface panel is equal to or greater than 0.3 mm, more preferably the thickness of the interface panel is equal to or greater than 0.5 mm to optimize the signal between the gesture on the front face and the dimming zone.
- [0065] In some embodiments, the front face and/or the back can be surface treated, preferably only the front face is surface treated, with an etching method or a texturing method, to change the touch feeling of the front face, to become an easy-to-clean, anti-glare surface and/or an anti-fingerprint surface. The surface treatment can be made on the whole front face or on a portion of the front face.
- [0066] According to some embodiments of the present invention, the interface panel can comprise a decorative layer on at least a part of the front face and / or the back face. The decorative layer or alike can be deposited over at least a portion of the front face and/or the back face or on the whole surface. The decorative layer can be made of a single or a multiple layers of material. The decorative layer can be a paint deposited by a known method preferably by a inkjet print method.

- [0067] In some embodiments where at least a part of the front face and/or back face is surface treated, the surface treatment can be designed to show to the user where the dimming area is placed under the interface panel.
- [0068] In some embodiments where a decorative layer is disposed on at least a part of the front face and/or back face, the decorative layer can be designed to show to the user where the dimming area is placed under the interface panel.
- [0069] In preferred embodiments, the interface panel is a transparent interface panel with a decorative layer on the back face. More preferably, the decorative layer is an opaque decorative layer.
- [0070] The dimming controller comprises a support designed to attach the dimming controller to an object.
- [0071] The object can be a furniture, such as a desk, a table or alike. The object can also be a building part such as partition, a wall, a frame, a door or alike. The object can also be a vehicle, a train, an airplane or alike.
- [0072] The support is an element fixed to the interface panel. The support can ensure the tightness of the dimming controller. The support can be fixed on the border of the back face, on the edges of the interface panel and/or the border of the front face.
- [0073] In some embodiments, the support is fixed on the back face only to leave visible edges of the interface panel.
- [0074] In some other embodiments, the support is fixed on the back face and on the edges to ensure that elements of the dimming interface are held together.
- [0075] The support can be fixed on the interface panel by a glue, by an overmolding or any other known method. The support can also be directly 3D-printed or injected on the interface panel with the desired shape with a mold and an injection process.
- [0076] The support can be made of plastic such as Polypropylene, PVC, PC-ABS or alike. The support can be made of aluminium, brass or alike. It is understood that with such material, the dimming zone has to be electrically isolated from said material.
- [0077] In preferred embodiments, the support surround the dimming controller.
- [0078] The dimming controller comprises an electronic board. The electronic board is sandwiched between the interface panel and the support.
- [0079] An electronic board is a panel that is not electrically conductive as such.

- [0080] The electronic board is preferably a print circuit board (PCB) and electronic components such as capacitive segments, circuits, capacitance, resistance and alike installed on the PCB.
- [0081] Preferably, the electronic board comprises several layers to facilitate the connection between electric components and then comprises different layers of dielectric materials and conductive circuits sandwiched together.
- [0082] electronic board comprises a first surface facing the back face and a second surface; the second surface is outer and opposite surface to the first surface.
- [0083] Preferably, the electronic board is substantially parallel to the interface panel meaning that the first surface and the back face are substantially parallel.
- [0084] It is preferred to avoid placing electrical components with high thickness on the first surface, capacitive segments and alike are placed on this first surface.
- [0085] The electronic board comprises a dimming area on the first surface
- [0086] The dimming area can have different shapes depending on the interface layer, the possibilities to place all electronic components and/or the desired design.
- [0087] The dimming area can have different geometries, such as slider, rotative, impulsion.
- [0088] In some embodiments, the electronic board can comprises more than one dimming zone. Each dimming zone controls a specific function.
- [0089] In some embodiments, the electronic board can comprise at least a touch zone to ON-OFF a specific function.
- [0090] In some embodiments according to the invention, to maximize the signal between the gesture on the front face and the dimming area, the distance between the first surface of the electronic board and the back face of the interface panel can be smaller than or equal to 0.5 mm, preferably the distance between the first surface of the electronic board and the back face of the interface panel can be smaller than or equal to 0.3 mm, more preferably the distance between the first surface of the electronic board and the back face of the interface panel can be smaller than or equal to 0.1 mm and even more preferably the distance between the first surface of the electronic board and the back face of the interface panel can be smaller than or equal to 0.05 mm.
- [0091] In some preferred embodiment, the first surface of the electronic board is in contact with the back face of the interface panel directly or via a thin layer of tape. The tape layer can be any tape that is limiting the interaction between the gesture and the

dimming area. The term “thin” means a thickness of at most 0.4 mm, preferably at most 0.3 mm and more preferably at most 0.25 mm. The tape can be made of closed cell acrylic or any other suitable material.

- [0092] Preferably, the capacitive segments on the first surface are in contact with the interface panel directly or via a thin layer of tape. It is preferred to avoid air between the capacitive segments and the interface panel.
- [0093] It is understood that if a decorative layer and/or a text ration exists on the back surface, the contact is with this layer and/or surface treatment.
- [0094] Preferably, the width of the first dimming zone and / or the width of the second dimming zone is smaller than or equal to 25 mm to be optimise the zone of gesture, more preferably the width of the first dimming zone and / or the width of the second dimming zone is smaller than or equal to 15 mm
- [0095] In some embodiments, the width of the first dimming zone and / or the width of the second dimming zone is equal to or greater than 7 mm.
- [0096] In preferred embodiments, the width of the first dimming zone and the width of the second dimming zone is about 12 mm.
- [0097] According to the invention, the dimming area comprises a first dimming zone and a second dimming zone. The first dimming zone comprises N_f capacitive segments forming a first linear array and the second dimming zone comprises N_s capacitive segments forming a second linear array; where N_f , N_s are natural numbers and are equal to or greater than 2 ($N_f, N_s \geq 2$). The first dimming zone is electrically isolated from the second dimming zone.
- [0098] The first and the second linear array can be straight or curved depending on the shape of the dimming area and the desired needed gesture of interaction.
- [0099] Capacitive segments of the first and/or the second dimming zone
- [00100] In preferred embodiments, the number of capacitive segments of the first dimming zone equals the number of capacitive segments of the second dimming zone ($N_f = N_s$) to reduce the signal noise ratio.
- [00101] In the first and/or the second linear array, capacitive segments are preferably aligned substantially perpendicular to the lighting zone to facilitate the interpretation of the gesture on the front face.
- [00102] Capacitive segments can have various shapes depending on the desired geometry of the capacitive area.

- [00103] Preferably, the capacitive segments have a W-like shape, also called chevron-like shape, to reduce the noise while increasing the signal and the interpretation of the gesture.
- [00104] According to some embodiments of the invention, the dimming zone further comprises a lighting zone separating the first dimming zone and the second dimming zone.
- [00105] The lighting zone comprises a lighting slot. The lighting slot is a straight or curved linear and elongated hole made through the electronic board, meaning from the first surface to the second surface.
- [00106] The electronic board comprises NI LEDs forming a lighting linear array and designed to illuminate through the interface panel via the lighting slot; where NI is a natural number and is equal to or greater than 2 ($NI \geq 2$).
- [00107] The lighting slot, and the lighting zone, is placed between the first dimming zone and the second dimming zone.
- [00108] The lighting linear array can be straight or curved depending on the shape of the dimming area and the desired needed gesture of interaction.
- [00109] Preferably, LEDs are connected on the second surface of the electronic board and illuminating through the light slot and are illuminating through the interface panel to be visible by the user. It means that the interface panel and the decorative layer if exists is/are transparent to lights generated by LEDs.
- [00110] LEDs are punctual LEDs placed to form the lighting linear array. The number of LEDs NI depends on the application and the level of precision desired.
- [00111] Each LED can be a monochromatic LED or a RGB LED. The intensity, the colour and/or ON/OFF can be managed to give a better visual response to a gesture made by the user on the front face. Each LED can be independently powered.
- [00112] According to the present invention, to have a correct interaction while allowing a non-precise gesture along the light zone, the width of the lighting zone is smaller than or equal to 12 mm, preferably the width of the lighting zone is smaller than or equal to 10 mm, more preferably the width of the lighting zone is smaller than or equal to 8 mm and even more preferably the width of the lighting zone is smaller than or equal to 6 mm.
- [00113] In some preferred embodiments, to have a correct visible light generated by LEDs for the user in response to the gesture, the width of the lighting zone is equal to or

greater than 4 mm, preferably the width of the lighting zone is equal to or greater than 5 mm.

[00114] According to one embodiment of the first aspect of the invention and, as illustrated by figures 1 to 7, the dimming controller 1 comprises an interface panel 2, an electronic board 3 and a support 6. The dimming element is extending along a plane, P, defined by a longitudinal axis, X, and a vertical axis, Y. The interface panel has a width, W2, measured along the longitudinal axis, X, and a height, L2, measured along the vertical axis, Y. the electronic board is smaller in X- and Y- axis to be hidden and surrounded by the support. Thicknesses are measured along the Z-axis.

[00115] In some embodiments, W2 is about 10 cm, L2 is about 10 cm and Z2 is at most 2.5 mm, preferably about 1.1 mm or smaller than 1 mm.

[00116] FIG. 1 illustrates a rectangular interface panel 2 with a front face 21. According to the invention, the dimming controller and thus the interface panel can have any shape such as a rectangular shape, in a plan view P. The shape is not limited to a rectangle and may be a circle, a rounded square, a hex or the like depending on the desired design and/or the function to command.

[00117] The interface panel is a substantially flat panel meaning that the front face of the interface panel is parallel to plane P.

[00118] In some embodiments, the interface panel can be curved. The electronic board has to be curved in a corresponding shape to fit have the first surface and the back face substantially parallel.

[00119] FIGs. 1 and 2 also illustrate a first surface 31 of an electronic board. It is understood that the dimming area is placed on the first surface to work properly with the gesture on the front face of the electronic board. The dimming area 4 has a general shape in plane P of a rectangular with a width, W4, measured along the longitudinal axis, X, and a height, L4, measured along the vertical axis, Y. The first dimming zone 41 has a general shape in plane P of a rectangular with a width, W41, measured along the longitudinal axis, X, and a height, L41, measured along the vertical axis, Y. The second dimming zone 42 has a general shape in plane P of a rectangular with a width, W42, measured along the longitudinal axis, X, and a height, L42, measured along the vertical axis, Y. The lighting zone 5 has a general shape in plane P of a rectangular with a width, W5, measured along the longitudinal axis, X, and a height,

L5, measured along the vertical axis, Y. The lighting slot 51 has a general shape in plane P of a rectangular with a width, W51, measured along the longitudinal axis, X, and a height, L51, measured along the vertical axis, Y.

[00120] It is understood that the linear arrays can be elongated along the vertical axis but also along the horizontal axis or in any other direction on the plane P.

[00121] In such embodiments, the first, the second and the lighting linear arrays are straight meaning that capacitive segments (not shown in FIG. 1 or 2) and LEDs (not shown in FIG. 1 or 2) forms independently straight lines formed by aligned punctual capacitive segments or LEDs.

[00122] In some embodiments, as illustrated in FIG. 1, the height of the lighting slot 51 can be equal to or smaller than the height of the first 41 and/or the second 42 dimming zones depending on the requirement of the design and the use.

[00123] The height of the lighting slot corresponds to the number and the size of LEDs needed depending on the desired level of precision expected for a defined use and electronical device.

[00124] The height of the dimming zones corresponds to the number and the size of capacitive segments needed depending on the desired level of precision expected for a defined use and electronical device.

[00125] In some other embodiments, as illustrated in FIG. 2, the height of the lighting slot 51 can be greater than or equal to the height of the first 41 and/or the second 42 dimming zones depending on the requirement of the design and the use.

[00126] Preferably, the height and/or the width of the first 41 and the second 42 dimming zones are equals.

[00127] In some preferred embodiments, the width of the dimming area W4 is about 30 mm and the height of the dimming area L4 is about 30 mm.

[00128] In some preferred embodiments, to ensure the user's experience, the height of the lighting slot L5 is about 50 mm long and the width of the lighting slot W5 is about 1,8 mm wide. the width of the dimming area W4 is about 29.3 mm and the height of the dimming area L4 is about 30.5 mm.

[00129] FIGs. 3 and 4 illustrate other embodiments, where the first, the second and the lighting linear arrays are curved meaning that capacitive segments (not shown in FIG. 3 or 4) and LEDs (not shown in FIG. 3 or 4) forms independently curved lines formed by aligned punctual capacitive segments or punctual LEDs.

[00130] Curved lines can be become a circle as illustrated in Fig. 4 in some embodiments.

[00131] In embodiments with curved linear arrays, dimensions are measured by taking into account the curvature and the width the measured perpendicular to the normal to the curve.

[00132] It is understood that curved linear arrays can have one or more positive or negative radius of curvature. FIGs. 3 and 4 illustrated a single positive radius of curvature.

[00133] FIG. 5 illustrate a lighting slot 51 with LEDs 52 connected on the second surface 22 and illuminating 53 through the interface panel 2 via the lighting slot 51.

[00134] The support 6 permits to sandwich the electronic board 3 between the support 6 and the interface panel 2. The support is attached to the interface panel only on the border of the back face.

[00135] FIG. 5 illustrates an interface panel having a thickness $T2$ measured in the Z-axis, an electronic board having a thickness $T3$ measured in the Z-axis and a distance $T23$ measured in the Z-axis between the first surface 31 and the back face 22.

[00136] Preferably, the distance $T23$ is minimized to reduce noise between the gesture on the front face and the dimming area on the first surface 31.

[00137] FIG. 6 illustrates some embodiments where the first surface 31 is directly in contact with the back face of the interface panel 22 (not shown in FIG.6).

[00138] FIG. 7 illustrates some embodiments where the first surface 31 is in contact via a thin layer of tape 70 with the back face of the interface panel 22 (not shown in FIG.7). The tape can cover the full surface of the first surface 31 or the tape can surround the first surface 31, a very thin air gap can occur.

[00139] In some embodiments, on top of the lighting feedback produced by LEDs in response to the gesture, another feedback can be add to the dimming control such as a haptic response 80 and/or a sound response.

[00140] FIG. 8 illustrates some embodiments of a linear array of capacitive segments of a first dimming zone according to the invention. It is understood that it could be used for a second dimming zone.

[00141] In such embodiments, capacitive segments CSg1, CSg2, CS1, CS2, CS3, CS4, CS5, ... CSn have a chevron-like shape with a width Hs . Parts of a segments have a width $Hs1$, $Hs2$, $Hs3$ and $Hs4$. Preferably, width of each part are equals ($Hs1 = Hs2 = Hs3 = Hs4$) with an angle A equals to 90° .

- [00142] Each segment has a height W_s and are separated from the next one by a distance W_a . The height W_s is function of the thickness of the sum between the interface panel and the distance T_{23} . The larger the sum between the interface panel and the distance T_{23} , the larger the height W_s is.
- [00143] Preferably, the height W_s is equal to or greater than 1 mm ($W_s \geq 1 \text{ mm}$). The height W_s is smaller than or equal to 4 mm ($W_s \leq 4 \text{ mm}$).
- [00144] The distance W_a is comprises between 0.5 mm and 2 mm ($0.5 \text{ mm} \leq W_a \leq 2 \text{ mm}$).
- [00145] The width W_{41} of the first dimming zone 41 and the width W_{42} of the second dimming zone 42 are respectively the sum of the width of corresponding segments W_s with the distance A_{hg} and the distance A_{hd} .
- [00146] Preferably, the width H_s is comprised between 7 mm and 15 mm.
- [00147] In preferred embodiments, the width H_s is about 12mm and distances A_{hd} and A_{hg} are about 1mm ($A_{hd} \cong 1 \text{ mm}$; $A_{hg} \cong 1 \text{ mm}$) meaning that the width W_{41} and/or the width W_{42} is preferably about 14 mm.
- [00148] In some embodiments, to maximize the signal between the gesture on the front face and the dimming area, the electronic board comprises a hatched plane 35, electrically conductive, surrounding dielectric zones 41, 42.
- [00149] In some embodiments, to minimize the noise around LEDs, the hatched panel comprises a dielectric zone 36.
- [00150] Capacitive segments are separated from the shield by a distance A_{hd} and A_{hg} on each side.
- [00151] Capacitive segments can be considered as sensor pad formed by a copper, or alike, trace on the electronic board surrounded by a plane. The plane can be connected to a ground or to a signal generator.
- [00152] The capacitance between a segment and the hatched plane changes when the user moves his finger on the front face above the dimming area. The variation of capacitance causes a variation of the electrical signal received by a Capacitive Sensing Interface CSI integrated in a microcontroller or alike.
- [00153] It means the interpretation is to pass from an analogic signal to a digital signal to be converted by a software or alike to control the desired function. Preferably, this interpretation is powered by the microcontroller.

- [00154] Preferably, the CSI is composed of an analogical interface which measures the signal of every capacitive segment. Signals are digitally converted and processed, then stored in memory to be provided.
- [00155] The implementation of the CSI consists in configuration of its hardware parameters and choosing the capacitance measurement method. The hardware parameters of CSI are configured taking into account the type of the sensors and lower levels settings.
- [00156] Capacitance measurement can be performed according to two different ways, "Mutual Capacitance" and "Self-Capacitance". In this last mode, the capacity is measured between a pin connected to the capacitive sensor and the ground. The measurement is performed by applying a switching signal to the pad and sampling the current to convert it digitally. When the user fingertip touched the front face it forms an additional parallel capacitance. This results in a current change which is then converted in a digital value. By comparing the change of digital value to a threshold, the software detects activity on the sensor.
- [00157] Capacitive segments are connected to an input of the CSI. As long as there are enough resources, additional segments can be implemented.
- [00158] In some preferred embodiments, the ESL is about 30 mm but depending the design, the dimensions and number of capacitive segments for the desired function.
- [00159] In some embodiments, in order to reinforce the signal to noise ratio, the hatched plane surrounding capacitive sensors may be driven by a signal identical to the sensor switching signal, instead of being connected to ground. The hatched plane, or rather the shield, is then connected to a generator integrated in the microcontroller. This function is generally implemented to protect the capacitive touch area from liquid droplets. This reduces the parasitic capacitance due to the trace from the sensor pad to the input pin of the microcontroller. In preferred embodiments, it could be important to consider this aspect because when the user's finger is spread over both dimming zones, the generated signal is much lower. This can be a problem with higher interface panel thickness. When one segment is scanned by the CSI, the adjacent segment are connected to the driven shield.
- [00160] Preferably, two dummy segments CSg1 CSg2 are implemented at the ends of the linear array. When a segment is scanned, adjacent segments are connected to shield. To maintain a uniform signal level from all segments, it is preferred to connect

the two dummy segments to the shield. The effective slider length ESL is the distance between these two dummy segments. To maintain a uniform signal level from all the capacitive segments it is preferred to physically connect the two dummy segments to either ground or driven shield signal.

[00161] One of the general recommendation for a slider design, is to surround the sliders by the hatched plane can be connected to the ground or the shield to increase the ratio signal/noise while ensuring a good signal even if droplet are present on the interface panel. This is not the case in the present invention because of the presence of the lighting slot between the two dimming zones.

[00162] The present invention permits to combine good sensitivity with the continuity of lighting.

[00163] In some preferred embodiments, to ensure robustness to parasites, an electronic board comprises at least four layers preventing parasites on sensor signals.

[00164] A specific embodiment of layers can be as following, from the first surface to the second surface :

- Capacitive segments on the first surface and capacitive sensors are at least partially surrounded by hatched plane connected to a shield;
- Layer for trace of sensor signals;
- Layer for hatched plane connected to shield;
- The microcontroller layer;
- Series resistances, such as 560 ohms series resistances for instance, can be placed close to the microcontroller so that the radiated noise picked by the traces gets filtered at the input of the device.

[00165] In preferred embodiments, to maximize the ratio signal/noise, the height W_s is about 1 mm and the distance W_a is about 1 mm.

[00166] Dimensions and shape of the interface panel W_2 and L_2 depends of the desired application and aesthetic.

[00167] In preferred embodiments, the surface in the plane P, meaning dimensions and shape, of the interface panel is greater than the surface and shape of the electronic board in order to cover the electronic board to hide and protect the electronic board. The support surrounds entirely the perimeter of the electronic board, being fix on the back face and/or on edges of the interface panel.

- [00168] In such embodiments, the electronic board is protected from the outside of the dimming controller to ensure tightness of the dimming controller while protecting a user to be able to touch energized electrical elements such as components comprised by the electronic board.
- [00169] Dimensions and shape of the electronic board depends of the clutter of electric components, dimming areas, lighting slots,...
- [00170] The width of the lighting zone W5 is smaller than or equal to 12 mm, preferably the width of the lighting zone is smaller than or equal to 10 mm, more preferably the width of the lighting zone is smaller than or equal to 8 mm and even more preferably the width of the lighting zone is smaller than or equal to 6 mm.
- [00171] The width of the lighting zone W5 is equal or greater than 4 mm, preferably the width of the lighting zone W5 is equal or greater than 5 mm to ensure the user's experience while keeping a good ratio signal/noise and avoid any perturbation on the command signal of LEDs.
- [00172] In preferred embodiments, the width of the lighting zone W5 is about 5.3 mm.
- [00173] For a light switch, or alike, to have a precise graduation of the intensity of the light, the first and the second dimming zones can comprises at least 5 capacitive segments ($N_f \geq 5$; $N_s \geq 5$), preferably at least 7 capacitive segments ($N_f \geq 7$; $N_s \geq 7$), and more preferably at least 9 capacitive segments ($N_f \geq 9$; $N_s \geq 9$). The electronic board comprises at least 5 LEDs ($N_I \geq 5$), preferably at least at least 7 LEDs ($N_I \geq 7$), and more preferably at least 9 LEDs ($N_I \geq 9$). The number of LEDs is independent of the number of capacitive segments.
- [00174] According to the second aspect of the invention to sandwich the electronic board between interface layer and the support, the support can provide some elements 65, such as pins, to easily sandwich at the desired location the electronic board . In the electronic board corresponding elements 35, such as holes, can be provided. The sandwiching step can be made with a glue, an injection and/or mechanically with mechanical elements or any other suitable method.
- [00175] According to the third aspect of the invention, the support comprises on the outer side, the side that is not sandwiched, of the dimming controller, some elements with defined shape and dimensions and designed to be plugged and/or to be assembled with a functional plate. Such elements can be standard and/or specific to be adapted to any and/or some functional plates that already exist on the market. The functional

plate can be fixed to a block set fixed on a wall. This permits to fix the dimming controller according to the first aspect to a wall. It is understood that cables are connected before the fixation to the wall. It is understood that the wall can be any other object where a dimming controller can be installed on.

[00176] The dimming controller can stand alone with a specific cover, meaning that the dimming controller can control the function wirelessly, without connecting cables linked to the electrical device. The support can be assembled with such specific cover or can be the specific cover.

[00177] The present invention relates, in a fourth aspect, to the use of a dimming controller according to any claim 1 to 12 to control a defined function such as the intensity of a light source, the opening and the closing a roller shutter, the light transmission of an active glazing, the temperature of the heating system, the speed of a fan or alike in response to a gesture G1, G2, G3 on the front face of the interface panel.

[00178] The present invention relates, in a fifth aspect and as illustrated in FIGs. 9 and 10, to a method to control a defined function such as the intensity of a light source, the opening and the closing a roller shutter, the light transmission of an active glazing, the temperature of the heating system, the speed of a fan or alike in response to a gesture on the front face of the interface panel.

[00179] The method comprises a step of touching the front face 21 of the interface panel with a single finger 9 or alike over the dimming zone with a gesture G1, G2, G3.

[00180] In response to the gesture G1, G2, G3, depending of the gesture, in the same time, some LEDs can light on, off and/or change their light intensity to indicate the modification and the action on the electrical device.

[00181] FIG. 9 illustrates a simple gesture G1 along the lighting slot. The user with his finger can easily follow LEDs to control the electrical device and change the current state, for example changing the light intensity of a room, heating up a heating system, decrease or increase the light transmission of an active glazing,... and immediately see the change on the lighting linear area with the change of the state of some LEDs in response. For example, LEDs from the bottom to the top can change their intensity from a defined value to an upper value to see a bar-like increasing/decreasing under the finger.

[00182] FIG. 10 illustrates other compatible gestures G2, G3 thanks to the dimming controller of the first aspect of the present invention. The user can still control the

electrical device without strictly following the lighting slot by passing from one side to the other.

[00183] The invention permits to allow an user to intuitively control the graduation of any information by moving the fingertip on the front face over the dimming area even if the dimming area is hidden by a decorative layer or alike.

[00184] This dual dimming zones architecture allows to detect position of the user's finger either with the left slider or the right one independently. A trajectory crossing the line is then possible. The dimming controller of the present invention permits to accept various gestures G1, G2, G3,... on the front face while keeping a perfect control of an electrical device.

Claims

Claim 1. Dimming controller (1), the dimming controller comprises

- an interface panel (2) having a front face (21) designed to be touched by an user to interact with the dimming controller and a back face (22),
- a support (6) designed to attach the dimming controller to an object and
- an electronic board (3) comprising a dimming area (4) and ; the electronic board is sandwiched between the interface panel and the support; the electronic board comprises a first surface (31) facing the back face and a second surface (32);

characterized in that the distance (T23) between the first surface and the back face is smaller than or equal to 0.4 mm, preferably the distance (T23) between the first surface and the back face is smaller than or equal to 0.3 mm, more preferably the distance (T23) between the first surface and the back face is smaller than or equal to 0.25 mm;

in that the dimming area (4) comprises a first dimming zone (41) and a second dimming zone (42); the first dimming zone comprising Nf capacitive segments forming a first linear array, the second dimming zone comprising Ns capacitive segments forming a second linear array; where Nf, Ns are natural numbers and are equal to or greater than 2 ($Nf, Ns \geq 2$) the first dimming zone is electrically isolated from the second dimming zone;

in that the dimming zone (4) further comprises a lighting zone (5) separating the first dimming zone and the second dimming zone; the lighting zone comprises a lighting slot (51);

in that the electronic board comprises NI LEDs (52) forming a lighting linear array and designed to illuminate through the interface panel via the lighting slot; where NI is a natural number and is equal to or greater than 2 ($NI \geq 2$);

and in that the width of the lighting zone (W5) is smaller than or equal to 12 mm, preferably the width of the lighting zone is smaller than or equal to 10 mm, more preferably the width of the lighting zone is smaller than or equal to 8 mm and even more preferably the width of the lighting zone is smaller than or equal to 6 mm.

- Claim 2. Dimming controller according to claim 1, wherein the width of the lighting zone is equal to or greater than 4 mm, preferably the width of the lighting zone is equal to or greater than 5mm..
- Claim 3. Dimming controller according to any preceding claims, wherein the thickness of the interface panel is smaller than or equal to 2.5 mm, preferably the thickness of the interface panel is smaller than or equal to 1.5 mm, more preferably the lighting zone is smaller than or equal to 1.1 mm.
- Claim 4. Dimming controller according to any preceding claims, wherein the thickness of the interface panel is equal to or greater than 0.1 mm, preferably the thickness of the interface panel is equal to or greater than 0.3 mm, more preferably the lighting zone is equal to or greater than 0.5 mm.
- Claim 5. Dimming controller according to any preceding claims, wherein the interface panel is a glass sheet comprising at least 50% in weight of SiO₂.
- Claim 6. Dimming controller according to claim 5, wherein the interface panel is a tempered glass sheet.
- Claim 7. Dimming controller according to any preceding claims, wherein the interface panel comprises a decorative layer on at least a part of the front face and / or the back face.
- Claim 8. Dimming controller according to any preceding claims, wherein the width of the first dimming zone and / or the width of the second dimming zone is smaller than or equal to 25 mm.
- Claim 9. Dimming controller according to any preceding claims, wherein the width of the first dimming zone and / or the width of the second dimming zone is equal to or greater than 10 mm.
- Claim 10. Dimming controller according to any preceding claims, wherein the number of capacitive segments of the first dimming zone equals the number of capacitive segments of the second dimming zone.
- Claim 11. Dimming controller according to any preceding claims, wherein segments of the first dimming zone and the second dimming zone are aligned substantially perpendicular to the lighting zone.
- Claim 12. Dimming controller according to any preceding claims, wherein segments of the first dimming zone and the second dimming zone have a chevron-like shape.

Claim 13. Method to manufacture a dimming controller according to any preceding claims, the method comprises following steps :

- A1. Providing the interface panel and the electronic board;
- A2. Sandwiching the electronic board between interface layer and the support.

Claim 14. Method to assemble a dimming controller according to any claim 1 to 12 to an object, the method comprises following steps :

- B1. Providing the dimming controller;
- B2. Assembling the dimming controller via the support to a functional plate fixed on a block set on a wall.

Claim 15. Use of a dimming controller according to any claim 1 to 12 to control a defined function such as the intensity of a light source, the opening and the closing a roller shutter, the light transmission of an active glazing, the temperature of the heating system, the speed of a fan or alike in response to a gesture (G1, G2, G3) on the front face of the interface panel.

Drawings

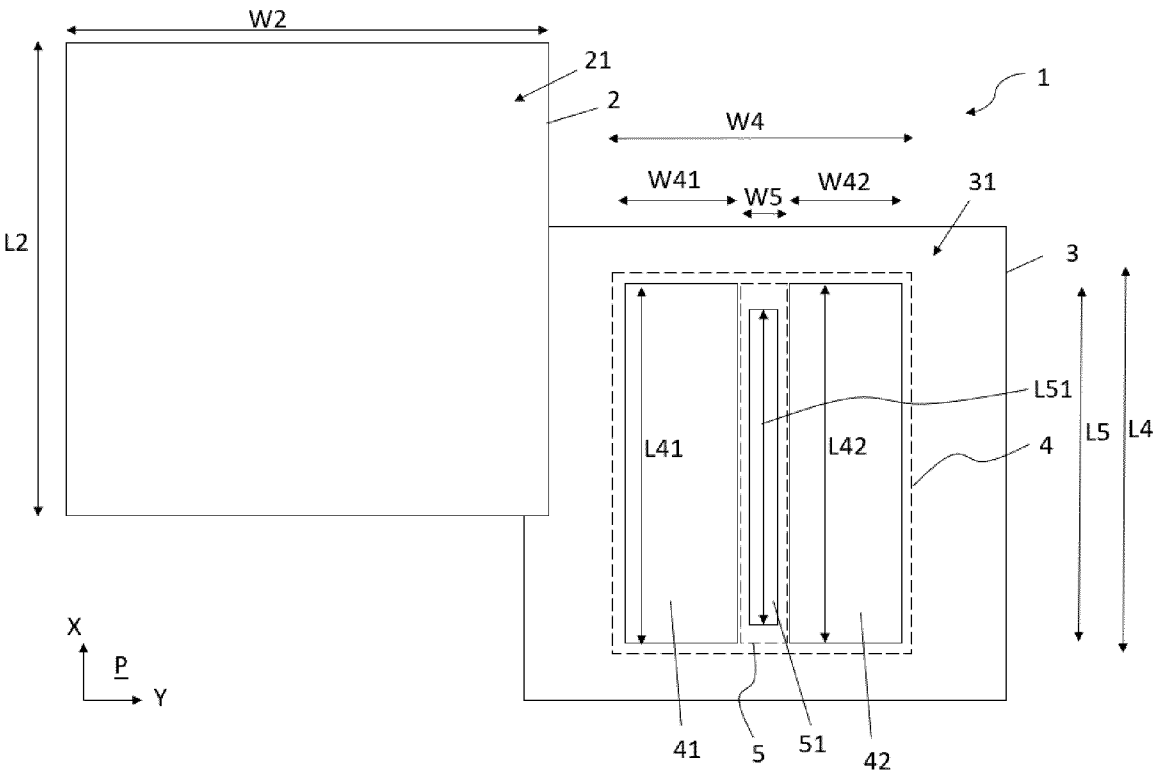


FIG. 1

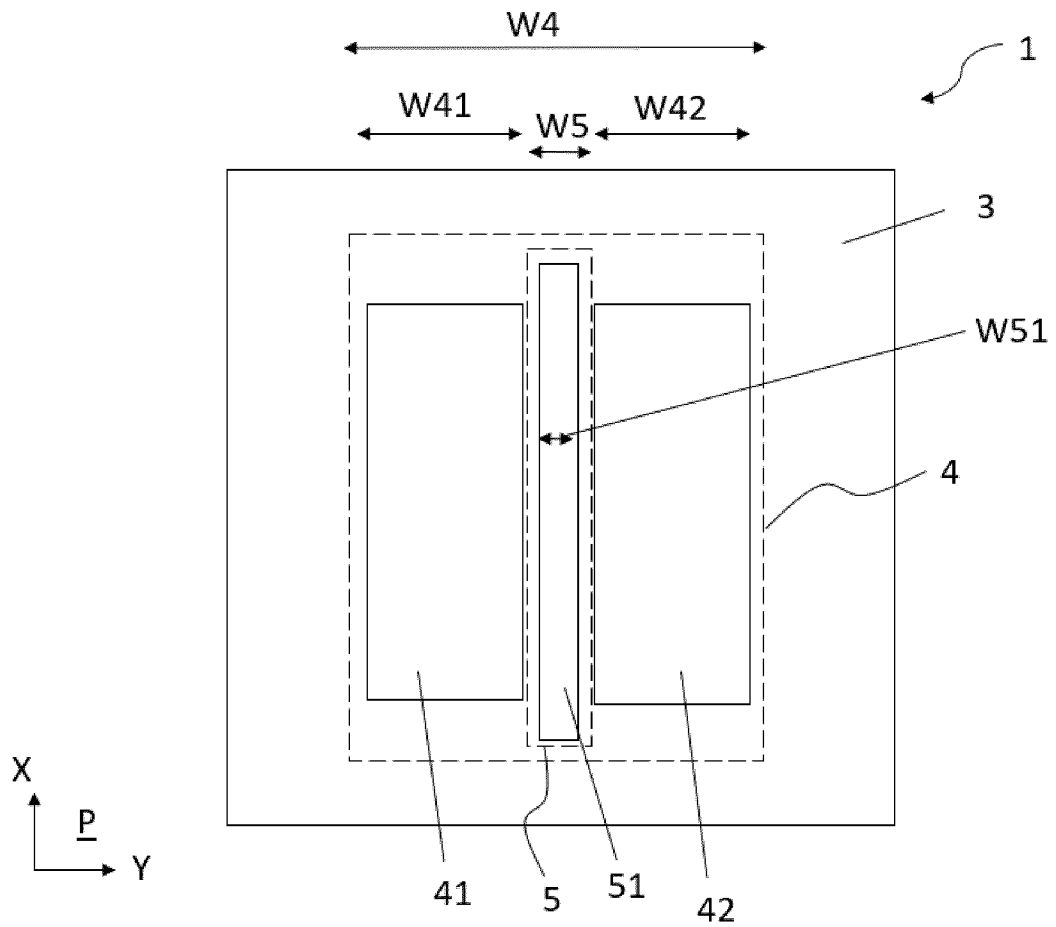


FIG. 2

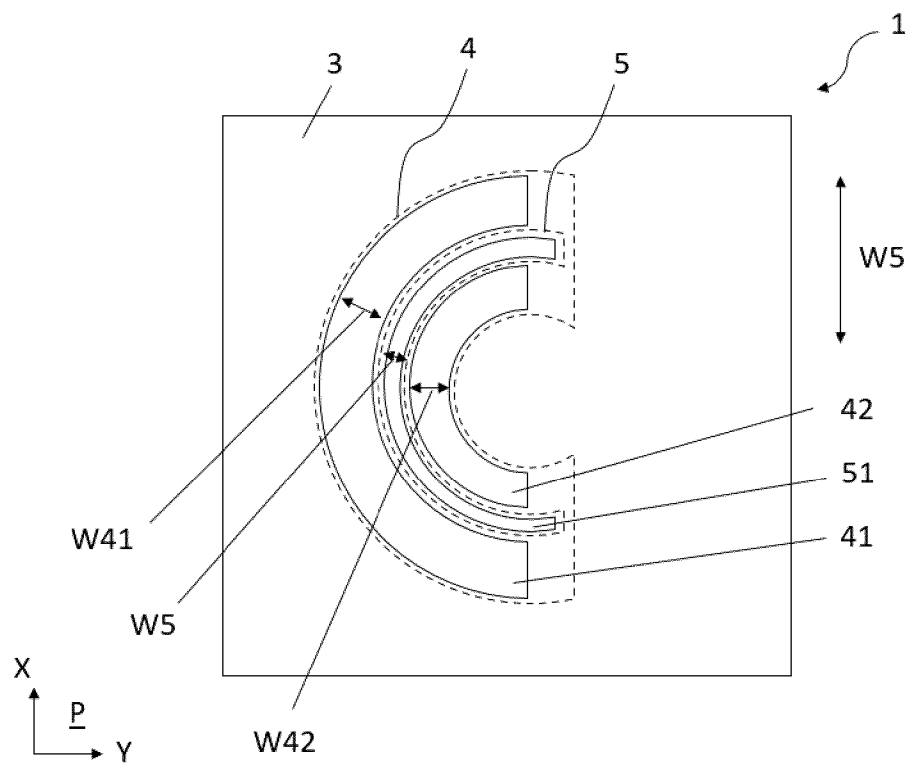


FIG. 3

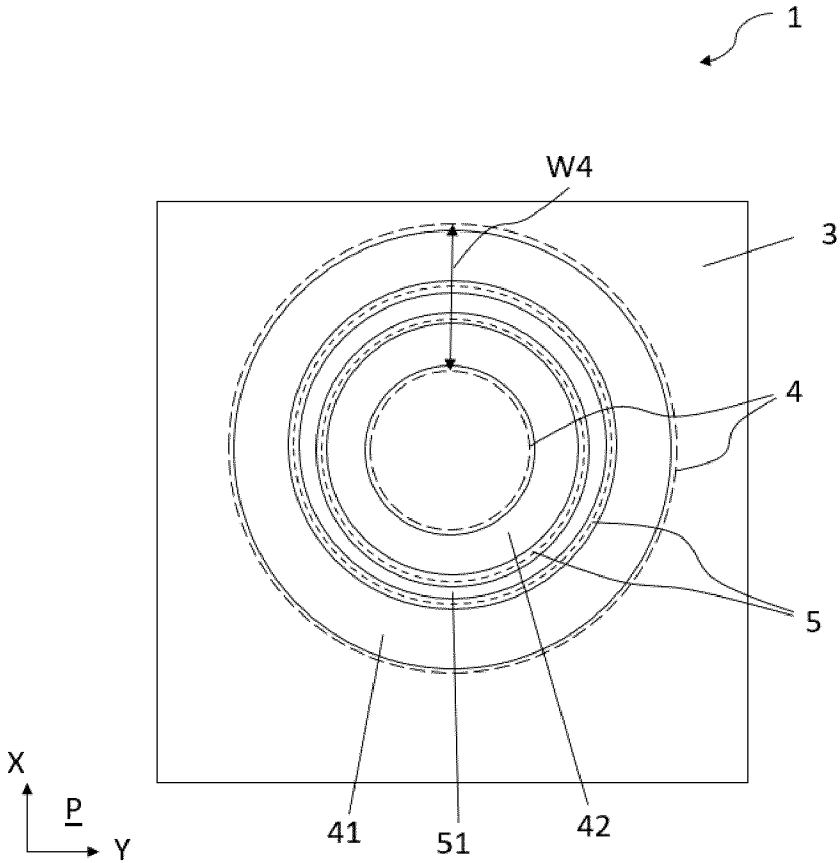


FIG. 4

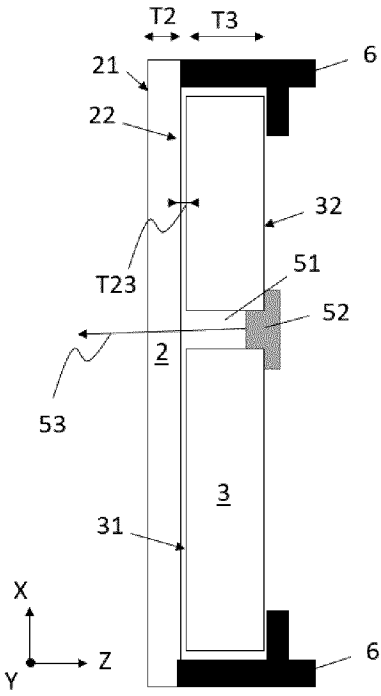


FIG. 5

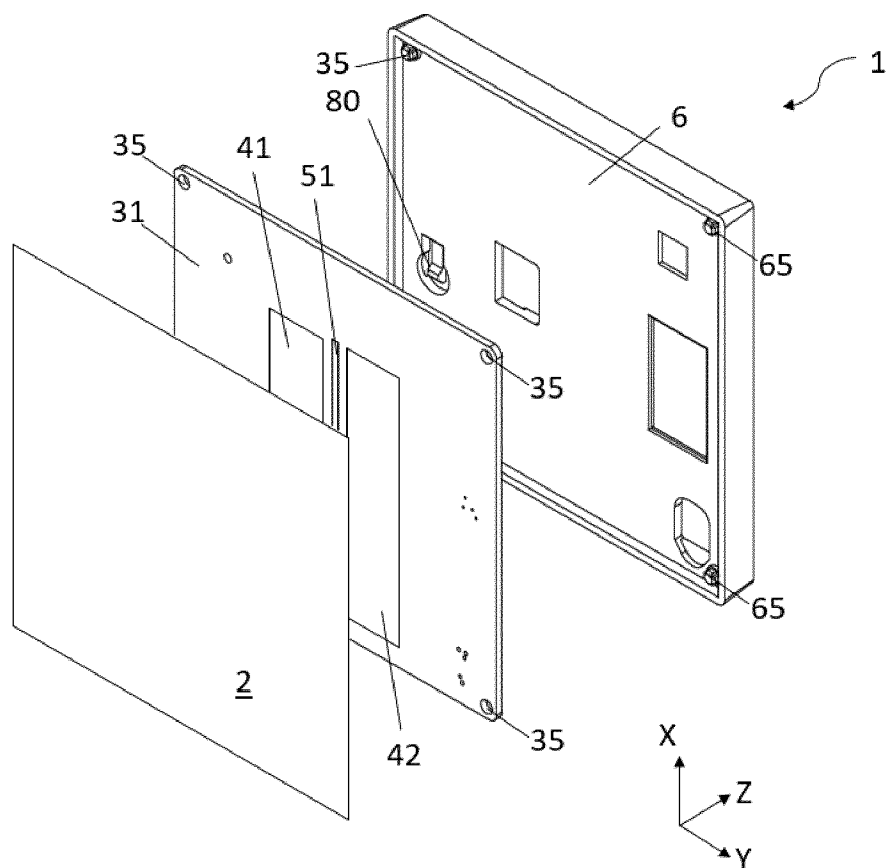


FIG. 6

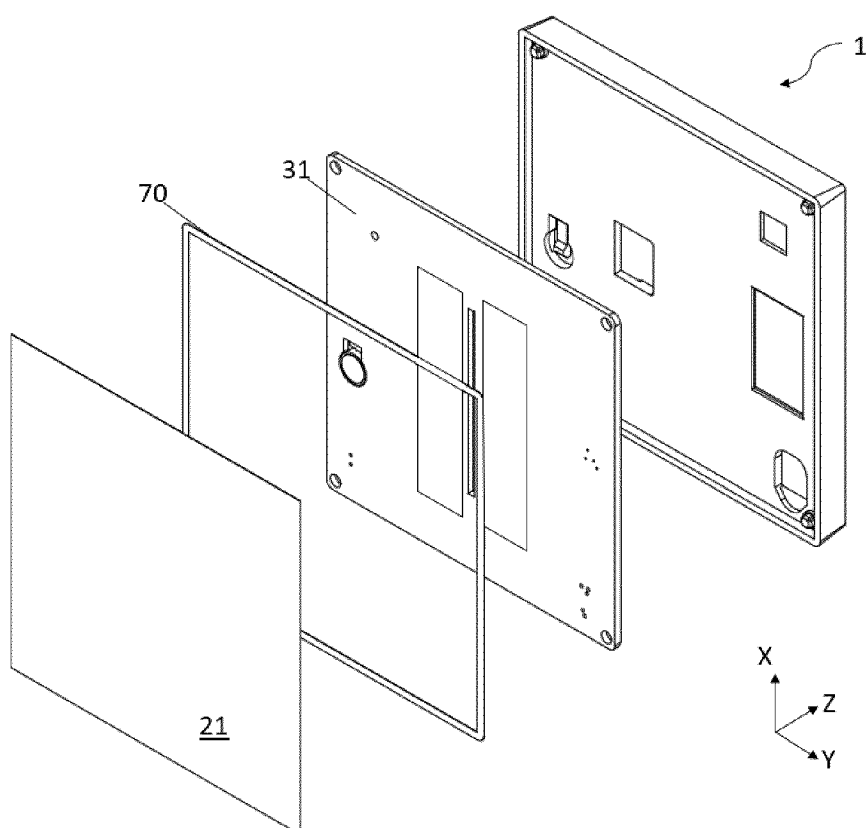


FIG. 7

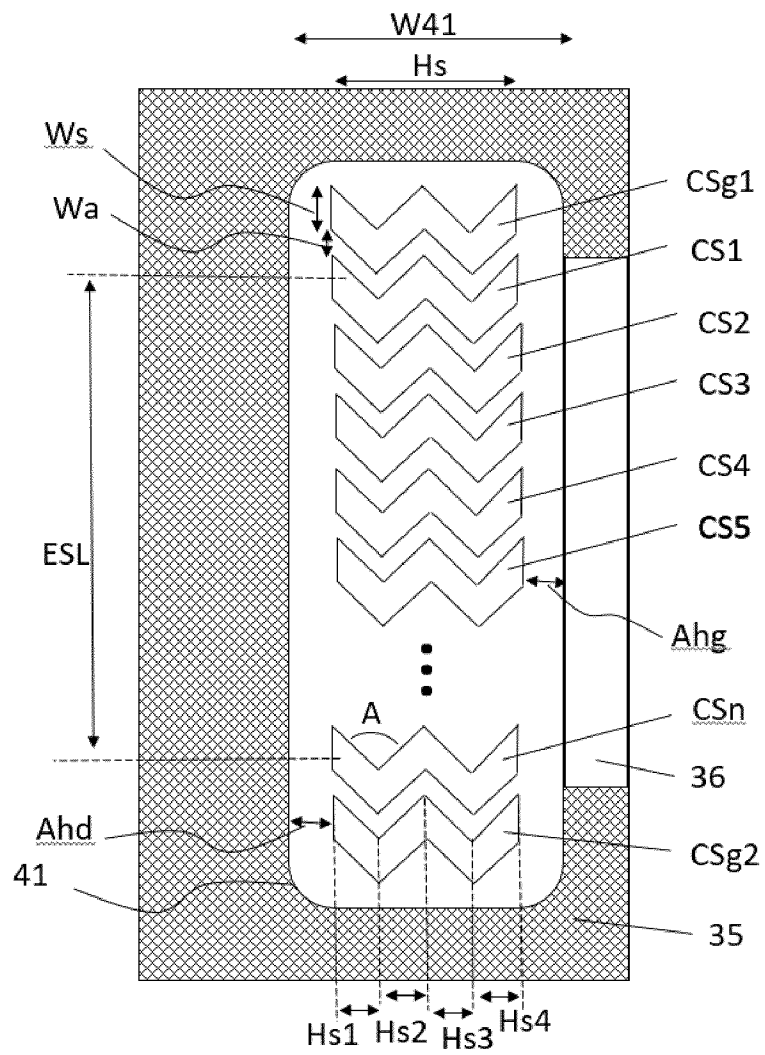


FIG. 8

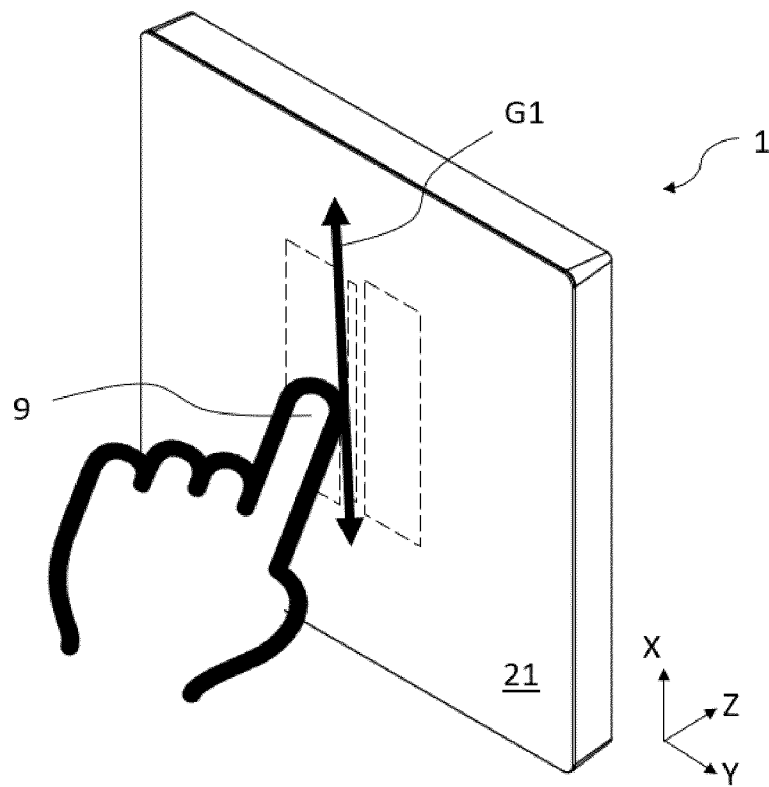


FIG. 9

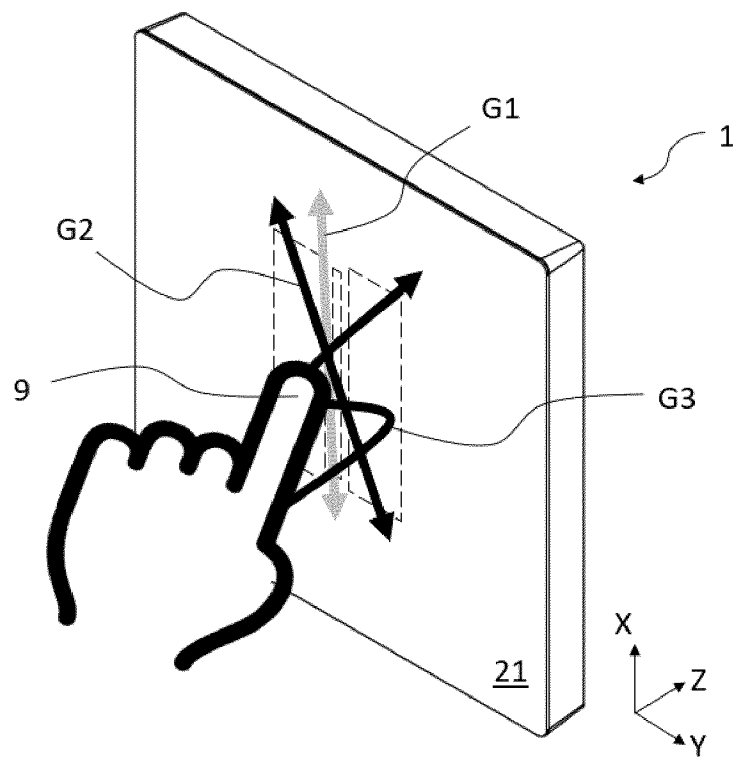


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2023/061194

A. CLASSIFICATION OF SUBJECT MATTER**INV. H03K17/96****ADD.**

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H03K

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

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

EPO-Internal, WPI Data**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 211 551 544 U (ZHONGSHAN MINGYI SMART HOME TECH CO LTD)	1-6,
	22 September 2020 (2020-09-22)	8-11,
Y	the whole document	13-15
	-----	7, 12
Y	EP 2 187 132 A2 (ELECTROLUX HOME PROD CORP [BE]) 19 May 2010 (2010-05-19)	7, 12
A	paragraph [0034]; figures 3A, 4A	1-6,
	-----	8-11,
		13-15



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

21 June 2023

Date of mailing of the international search report

29/06/2023

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Authorized officer

Fermentel, Thomas

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2023/061194

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
CN 211551544	U	22-09-2020	NONE	
EP 2187132	A2	19-05-2010	EP 2187132 A2	19-05-2010
			EP 2192350 A1	02-06-2010