Man machine interface and product embodying such a man machine interface.

Product and man machine interface of such a product, comprising first means for displaying visual data at a predefined display location and second means for sensing touch or proximity information at a predefined touch or proximity sensitive location which is provided at or near said display location, wherein the first means for displaying visual data comprise a plurality of light sources that are arranged in a first array, and the interface is arranged to operate each of the light sources individually, and wherein the second means for sensing touch or proximity information comprise a plurality of light-sensitive elements that are arranged in a second array, and the interface is arranged to monitor each of the light-sensitive elements individually, wherein the light sources and/or the light-sensitive elements are positioned distant from the said predefined display location and/or distant from the said predefined touch or proximity sensitive location.
Man machine interface and product embodying such a man machine interface

The invention relates primarily to a man machine interface comprising first means for displaying visual data at a predefined display location and second means for sensing touch or proximity information at a predefined touch location which is provided at or near said display location, wherein the first means for displaying visual data comprise a plurality of light sources that are arranged in a first array, and the interface is arranged to operate each of the light sources individually, and wherein the second means for sensing touch or proximity information comprise a plurality of light-sensitive elements that are arranged in a second array, and the interface is arranged to monitor each of the light-sensitive elements individually.

US2006/0086896 can be considered relevant to the preamble of claim 1 and relates to an apparatus and method for both displaying graphical output and for sensing. A light emitting diode matrix array is configured to both emit and sense light. The array may be driven in such a way so as to enable the array itself to act as the illumination source, which may also be used for either reflective or scattering optical touch sensing.

In the prior art assembly-centered manufacturing paradigm, displays that may be considered part of a man machine interface, are almost exclusively rectangular flat surfaces that are embedded in a product. While this is useful for many applications where the content displayed is also rectangular, it limits product design and requires products to be designed around the display.

It is an object of the invention to improve the versatility of products and their use.

It is a further object of the invention to increase the number of options that are available in the design process of products.

Accordingly the man machine interface of the inven-
tion, and the product of the invention in which such a man ma-
chine interface is embodied have the features of one or more of the appended claims.

A first aspect of the invention is that the light sources and/or the light-sensitive elements are positioned distant from the said predefined display location and/or distant from the said predefined touch or proximity sensitive location. This provides the possibility to optimize the predefined display location and the predefined touch or proximity sensitive location to the desires of the designer and the needs of a user. It is no longer necessary as in the prior art to provide the light sources and/or the light-sensitive elements at the external surface of the product requiring most of the time that this part of the device where the light sources and/or light-sensitive elements are positioned, is flat; on the contrary in the invention these light sources and light-sensitive elements can be located distant from the external surface at a location which is best suited for these organs. The major benefit of this is that the external surface can be tailored so as to optimize the look and feel, and in general the external design of the product. The versatility of the design process is therewith tremendously increased. It is for instance possible to arrange that the external surface of the product is curved, or even double curved so that the predefined display location and/or the predefined touch or proximity sensitive location may be positioned in a curved plane. It is also possible to have discontinuities at the surface of the product.

Implementation of the man machine interface is suitably done by arranging that there are light transmission paths provided between the light sources and/or the light-sensitive elements on the one hand, and on the other hand the predefined display location and/or the predefined touch or proximity sensitive location.

Beneficially the light sources and the light-sensitive elements are united in organs that are capable to transmit and receive light. In this way effective use can be made of the available space and also cost savings may be realized.
In one embodiment the organs are light emitting diodes (LEDs).

Implementation of the man machine interface can effectively be accomplished where each of the light transmission paths has a first extremity at the predefined display location and/or the predefined touch or proximity sensitive location, and a second extremity distant from the first extremity, at which second extremity the light sources and/or the light-sensitive elements are positioned. As mentioned that predefined display location may have any arbitrary shape.

The invention is also embodied in a product being provided with such a man machine interface. There are many options that come within reach when the invention is applied to particular products. When products have the possibility to display dynamic information on their external surface, this opens the possibility to provide information fitting to the product’s current condition. An example is a razor that provides information on its external surface telling you to clean its heads but only when its heads are full, or a vacuum cleaner that provides information on its external surface letting you know when to empty its bag, or a computer mouse that informs you again with information on its external surface when to change the battery and where to open its lid. Conversely, information that is static on prior art products, for instance imprinted information which is only relevant during some stages of the product’s use, would then not have to be present as long it is not relevant.

Another option is that the product’s display at its external surface would be able to have touch sensitive control elements on any place of said display. Consequently, the form, function and location of a control element could be changed during the product’s lifecycle by for instance updating the firmware of the product that determines where the buttons on the product are positioned. This has many implications for the way the products can be used, but also for the way products age. It also provides the possibility that product designers can create different functionality using the same physical hardware.
Because the function and position of control elements can be altered by changes in software embedded in the product, the products can be user tailored and customized on-the-fly. The same product can work differently for different users, while retaining its core functionality. For example, in an electric toothbrush (assuming that for hygienic reasons each user replaces the brush part of the toothbrush) the on-off button can be in a position to accommodate a child’s hand and on another moment it can accommodate the hand of a grown-up.

In a television remote, buttons can be larger and less in number for an elderly lady or man, while the same remote can exhibit extra buttons for instance for replay options when used by a tech-savvy sports fan.

In one embodiment, changes in product esthetics are possible. The same product can look different based on branding, context factors or user preferences. Colour, texture and other graphical elements can change by adjusting the software that controls the display. Products can thus blend in with their environment or with other products nearby.

With the touch or proximity sensitive control elements information can be gathered and used to deduce the intention that the user has in using the product. A product can thus automatically change its functionality or initiate or close off a functionality depending on how the product is held by the user. For example, a heavy duty drill could can slow down for precision drilling when it is held with two fingers, but speed up for heavy duty drilling when grabbed from the back. A kitchen blender can stop blending as soon as the user does not hold the blender with two hands so as to prevent accidents.

In one embodiment the core functionality of the product depends on the implemented software. The product of the invention can be reprogrammed to have new functionalities. For example, a computer mouse can show two buttons and be used as a mouse, or show more buttons enabling it to be used as a calculator or as remote.

The invention will hereinafter be further elucidated with reference to the drawing showing nonlimiting exemplary embodiments of a man machine interface and products imple-
mented with such an interface.

In the drawing:
- figure 1 schematically shows a man machine interface according to the invention;
- figure 2 shows toothbrushes held by a child’s hand and by an adult hand;
- figure 3 shows remote controls for elderly people and a tech savvy sports fan respectively;
- figure 4 shows different product aesthetics;
- figure 5 shows a drill held in two different ways; and
- figure 6 shows different functionalities of a computer Mouse.

Whenever in the figures the same reference numerals are applied, these numerals refer to the same parts.

Making reference first to figure 1, basic parts of a man machine interface according to the invention are shown.
The man machine interface 1 comprises a usually flat device 2 incorporating a matrix array of light emitting diodes LEDs 3. These LEDs 3 function as light sources 3’ as well as light-sensitive elements 3’’. Further there is distant from the device 2 a plane 4 which may form part of the external surface of a product, such as the products discussed hereinafter with reference to figures 2 - 6. The plane 4 may have any shape and may for instance be double curved or may have discontinuities.

By means of light transmission paths 5, for instance optic fibers or waveguides, information is exchanged between the device 2 that is provided with the light sources 3’ and the light-sensitive elements 3’’, and the plane 4 at which visual data is displayed at predefined display locations 4’, and touch or proximity information from a user is collected at touch or proximity sensitive locations 4’’ and returned to the device 2 for further processing. Accordingly each of the light transmission paths 5 has a first extremity in the (curved) plane 4 and at the predefined display location 4’ and/or the predefined touch or proximity sensitive location 4’’ in said plane 4, and a second extremity distant from the first extremity, at which second extremity the light sources 3’ and/or the light-sensitive elements 3’’ are positioned, which are pref-
erably embodied as LEDs 3.

With this arrangement there are in this man machine interface 1 first means 3, 4, 5 for displaying visual data at a predefined display location 4' in plane 4, and second means which preferably are the same as the first means 3, 4, 5 for sensing touch or proximity information at a predefined touch or proximity sensitive location 4'' in said plane 4. The first means 3, 4, 5 for displaying visual data comprise a plurality of light sources 3'', in particular LEDs 3, that are arranged in a first array. It is important that the interface 1 is arranged to operate each of the light sources 3 individually. Likewise the second means 3, 4, 5 for sensing touch or proximity information comprise a plurality of light-sensitive elements 3'' as embodied in said LEDs 3, that are arranged in a second array which preferably equates with the first array. It is also important that the interface is arranged to monitor each of the light-sensitive elements 3'' individually.

Figures 2-6 show different examples of products embodied with the man machine interface of the invention.

Figure 2 shows the example of an electric toothbrush wherein the on off button can be in a position to accommodate a child's hand (the figure on the left) and on another moment it can accommodate the hand of a grown-up (the figure on the right).

Figure 3 shows a television remote control, having in the left-hand part of the figure buttons that are larger and less in number suitable for an elderly woman or man, while the same remote control shown in the right hand part of the figure exhibits extra buttons for instance for replay options when used by a tech-savvy sports fan.

Figure 4 shows that changes in product aesthetics are possible. The same product can look different based on branding, context factors or user preferences. Colour, texture and other graphical elements can change by adjusting the software that controls the display of the product which may cover it the entire external surface of the product. The product of the invention can thus blend in with its environment or with other products nearby.
Figure 5 represents a drill machine provided with touch or proximity sensitive control elements which are used to gather information and use this to deduce the intention that the user has in using the drill machine. The drill machine can slow down for precision drilling when it is held with two fingers as shown in the left-hand part of the figure, while the same machine can automatically speed up for heavy duty drilling when also grabbed from the back as shown in the right-hand part of the figure.

In the embodiment of a computer mouse shown in figure 6 the core functionality of this mouse depends on the implemented software. In the left-hand part of the figure the mouse has only a few buttons corresponding to the conventional use of a mouse. It can also show more buttons enabling it to be used as a calculator as shown in the right-hand part of the figure.

It will be clear from the foregoing that there are many feasible variations possible for implementation of a very diverse collection of products incorporating a man machine interface in accordance with the invention, without departing from the spirit of the invention as embodied in the appended claims. The invention merits therefore a protection as provided by the appended claims as read in their broadest possible scope, without being deemed restricted to merely the examples of products as discussed herein.
CONCLUSIES

1. Manmachine-interface (1) omvattende eerste middelen (3, 4, 5) voor het weergeven van visuele data op een voorafbepaalde weergavelocatie (4’) en tweede middelen (3, 4, 5) voor het waarnemen van aanraak- of nabijheidsinformatie op een voorafbepaalde aanraak- of nabijheidsgevoelige locatie (4’’)

welke voorzien is ter plekke of nabij genoemde weergavelocatie, waarbij de eerste middelen (3, 4, 5) voor het weergeven van visuele data een veertal lichtbronnen (3’) omvatten die opgenomen zijn in een eerste array, en de interface is inge-richt om ieder van de lichtbronnen (3’) individueel werkzaam te laten zijn, en waarbij de tweede middelen (3, 4, 5) voor het waarnemen van aanraak- of nabijheidsinformatie een veertal lichtgevoelige elementen (3’’) bezitten die in een tweede ar-ray zijn opgenomen, en de interface is ingericht voor het waarnemen van ieder van de lichtgevoelige elementen (3’’) af-zonderlijk, met het kenmerk, dat de lichtbronnen (3’) en/of de lichtgevoelige elementen (3’’) op afstand geplaatst zijn van de genoemde voorafbepaalde weergavelocatie (4’) en/of op afstand van de genoemde voorafbepaalde aanraak- of nabijheidsge-

2. Manmachine-interface (1) volgens conclusie 1, met het kenmerk, dat de voorafbepaalde weergavelocatie (4’) en/of de voorafbepaalde aanraak- of nabijheidsgevoelige locatie (4’’) gepositioneerd zijn in een voorafbepaald gevormd vlak (4).

3. Manmachine-interface (1) volgens conclusie 1 of 2, met het kenmerk, dat er lichttransmissiepaden (5) zijn voor-zien tussen de lichtbronnen (3’) en/of de lichtgevoelige ele-

4. Manmachine-interface (1) volgens een der voorgaande conclusies, met het kenmerk, dat de lichtbronnen (3’) en de lichtgevoelige elementen (3’’) verenigd zijn in organen (3) die in staat zijn om licht te zenden en ontvangen.

5. Manmachine-interface volgens conclusie 4, met het
kenmerk, dat de organen lichtemitterende diodes (3) (LEDs) zijn.

6. Manmachine-interface (1) volgens een der conclusies 3-5, met het kenmerk, dat ieder van de lichttransmissiepaden (5) een eerste uiteinde bezit in een voorafbepaald vlak (4) op de voorafbepaalde weergavelocatie (4') en/of de voorafbepaalde aanraak- of nabijheidsgevoelige locatie (4''), en een tweede uiteinde op afstand van het eerste uiteinde, op welk tweede uiteinde de lichtbronnen (3') en/of de lichtgevoelige elementen (3'') zijn voorzien.

7. Product waarin een manmachine-interface volgens een der conclusies 1-6 is opgenomen.

8. Product volgens conclusie 7, met het kenmerk, dat de manmachine-interface is ingericht voor het weergeven van dynamische informatie op het externe oppervlak van het product, welke informatie is afgestemd op de actuele conditie van het product.


10. Product volgens een der conclusies 7-9, met het kenmerk, dat de manmachine-interface is ingericht om werkzaam te zijn in overeenstemming met software die in het product is opgenomen en welke is ingericht om de positie en/of het aantal en/of de functie van de aanraak- of nabijheidsgevoelige regelelementen te veranderen.

11. Product volgens een der conclusies 7-10, met het kenmerk, dat deze software bezit die de werking van het product bepaalt.

12. Product volgens conclusie 11, met het kenmerk, dat de software samenwerkt met de aanraak- of nabijheidsgevoelige regelelementen van de manmachine-interface, zodat de werkzaamheid van het product afhangt van een grip die een gebruiker heeft op het product.
SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

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Aanvrager (Naam)

Technische Universiteit Delft

Datum van het verzoek voor een onderzoek van internationaal type

16-11-2013

Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr.

SN 61011

I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

G016F3/042

II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimumdocumentatie

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Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

III. GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES (opmerkingen op aanvullingsblad)

IV. GEBREK AAN EENHEID VAN UITVINDING (opmerkingen op aanvullingsblad)

Form PCT/ISA 201 A (11/2000)
ONDERZOEKSRAPPORT BETREFFENDE HET
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND
VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar
de stand van de techniek
NL 2011177

A. CLASSIFICATIE VAN HET ONDERWERP

INV. G06F3/042

ADD.

Volgens de Internationale Classificatie van ontocrollen (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimum documentatie (classificatie gevolgd door classificatiesymbolen)
G06F

Onderzochte andere documentatie dan de minimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)
EPO-Internal, WPI Data

C. VAN BELANG GEACHTE DOCUMENTEN

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X Verdere documenten worden vermeld in het vervolg van vak C.

X Leden van dezelfde ontocofamilie zijn vermeld in een bijlage

* Speciale categorieën van aangehaalde documenten
* "A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft
* "D" in de ontocovragen vermeld
* "E" eerdere ontocovragen, gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven
* "L" om andere redenen vermelde literatuur
* "O" niet-schriftelijke stand van de techniek
* "P" tussen de voorrangstdatum en de indieningsdatum gepubliceerd literatuur

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid
18 december 2013

Naam en adres van de instantie
European Patent Office, P.B. 5818 Patentissen 2
NL - 2280 HV Rijswijk
Tel: (+31-70) 340-2040,
Fax: (+31-70) 340-3016

De bevoegde ambtenaar
Reise, Berit

Formuler: PCT/ISA/2001 (tweede blad) (Januari 2004)

bladzijde 1 van 2
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**OCTROOICENTRUM NEDERLAND**

**WRITTEN OPINION**

File No. SN61011  
Filing date (day/month/year) 16.07.2013  
Priority date (day/month/year)  
Application No. NL2011177  

International Patent Classification (IPC)  
INV. G06F3/042  

Applicant  
Technische Universiteit Delft

This opinion contains indications relating to the following items:

- ☒ Box No. I  Basis of the opinion
- - Box No. II  Priority
- - Box No. III  Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- - Box No. IV  Lack of unity of invention
- ☒ Box No. V  Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- - Box No. VI  Certain documents cited
- - Box No. VII  Certain defects in the application
- - Box No. VIII  Certain observations on the application

Examiner  
Reise, Berit

Form NL237A (Dekblad) (July 2006)
Box No. I  Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any nucleotide and/or amino acid sequence disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:
      - [ ] a sequence listing
      - [ ] table(s) related to the sequence listing
   
   b. format of material:
      - [ ] on paper
      - [ ] in electronic form
   
   c. time of filing/furnishing:
      - [ ] contained in the application as filed.
      - [ ] filed together with the application in electronic form.
      - [ ] furnished subsequently for the purposes of search.

3. [ ] In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. V  Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

   Novelty
   - Yes: Claims 4, 5, 12
   - No: Claims 1-3, 6-11

   Inventive step
   - Yes: Claims
   - No: Claims 1-12

   Industrial applicability
   - Yes: Claims 1-12
   - No: Claims

2. Citations and explanations

   see separate sheet
Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following document:
   D1 US 2010/073328 A1 (LYNCH BRIAN [US] ET AL) 25 maart 2010 (2010-03-

2 Independent claim 1
The present application does not meet the criteria of patentability, because the subject-matter of independent claim 1 is not new.

D1 discloses (the references in parentheses applying to this document):
- a optical touch screen (figure 2 display module 200 and optical sensor 250)
- display and optical sensor array (paragraph [0024])
- individually controllable display light sources (implicit TFT display)
- distance between display/sensor and viewable surface / touch surface (figure 2 anisotropic cover).

3 Dependent claims 2-12 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of novelty and/or inventive step.

3.1 Dependent claims 2, 3, 6-11 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements with respect to novelty as there is no additional subject matter in the claims

2 (see D1 figure 4A or 4B),
3 (see D1 figure 3B),
6 (see D1 figure 2),
7 (see D1 figures 6A-6C),
8 (see D1 figures 6A-6C implicit),
9 (see D1 figures 6A-6C portable devices like mobile phone),
10 (see D1 figures 6A mobile phone implicit),
11 (see D1 figures 6A mobile phone implicit) which is not disclosed in document D1.
3.2 The additional subject matter of claims 4 (emitter/detector in one element) and 5 (emitter/detector is a LED) is known to the skilled person. The skilled person would choose according to circumstances which kind of optical touch display is employed.

3.3 Devices with a touch screen are generally controlled depending on the user interface object a user touches or the kind of grip (claim 12) and therefore the contact area the user has with the touch screen. The use of a user interface to control the functions of a device is not inventive.