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[Continued on next page]

(54) Title: MULTI-PURPOSE PLASMONIC AMBIENT LIGHT SENSOR AND VISUAL RANGE PROXIMITY SENSOR

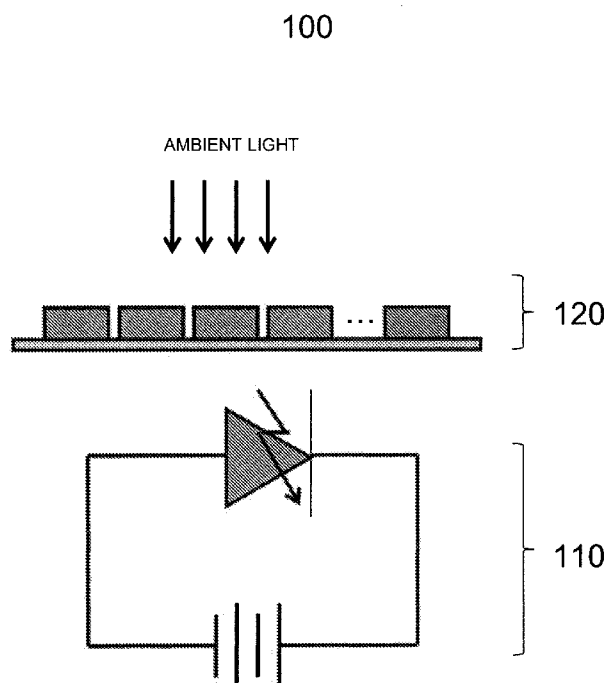


Figure 1

(57) Abstract: A visible wavelength range proximity sen-  
sor includes a visible light emitter with a peak wavelength  
in a visible wavelength range, and a plasmonic ambient  
light sensor, where a proximity sensing mode and an ambi-  
ent light sensing mode are time multiplexed.



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**A. CLASSIFICATION OF SUBJECT MATTER*****H01L 31/09(2006.01)i, H01L 31/10(2006.01)i, H01L 31/101(2006.01)i***

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)

IPC: G01J 3/50, G01N 21/17, G01N 21/27, H01J 5/16

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

KOREAN UTILITY MODELS AND APPLICATIONS FOR UTILITY MODELS SINCE 1975

JAPANESE UTILITY MODELS AND APPLICATIONS FOR UTILITY MODELS SINCE 1975

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

eKOMPASS(KIPO internal) &amp; keyword : plasmon, ambient, and sensor

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                     | Relevant to claim No. |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A         | US 2007-0051881 A1 (ASHDOWN, IAN) 08 March 2007<br>See abstract; paragraphs [0041]-[0065]; claims 1, 4; Figs. 1-4.                                     | 1-24                  |
| A         | KR 10-2003-0042576 A (ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE) 02 June 2003<br>See abstract; pages 5-7; claims 1, 29; Figs. 1, 3, 5, 10. | 1-24                  |
| A         | US 05313264 A (IVARSSON et al.) 17 May 1994<br>See abstract; column 8, line 25 - column 11, line 28; Figs. 1-6, 12.                                    | 1-24                  |



Further documents are listed in the continuation of Box C.



See patent family annex.

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

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| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---------------------|----------------------------|---------------------|
| US 2007-0051881 A1                        | 08.03.2007          | US 07388665 B2             | 17.06.2008          |
| KR 10-2003-0042576 A                      | 02.06.2003          | KR 10-0407821 B1           | 01.12.2003          |
|                                           |                     | US 2003-0099422 A1         | 29.05.2003          |
|                                           |                     | US 06807323 B2             | 19.10.2004          |
| US 05313264 A                             | 17.05.1994          | EP 0442921 A1              | 28.08.1991          |
|                                           |                     | EP 0534941 A1              | 07.04.1993          |
|                                           |                     | EP 0442921 B1              | 12.01.1994          |
|                                           |                     | EP 0534941 B1              | 16.06.1999          |
|                                           |                     | JP 4501462 T               | 12.03.1992          |
|                                           |                     | JP 4504765 T               | 20.08.1992          |
|                                           |                     | JP 03-294605 B2            | 05.04.2002          |
|                                           |                     | JP 03-064313 B2            | 12.05.2000          |
|                                           |                     | US 05164589 A              | 17.11.1992          |
|                                           |                     | WO 1990-005295 A1          | 17.05.1990          |
|                                           |                     | WO 1990-005317 A1          | 17.05.1990          |