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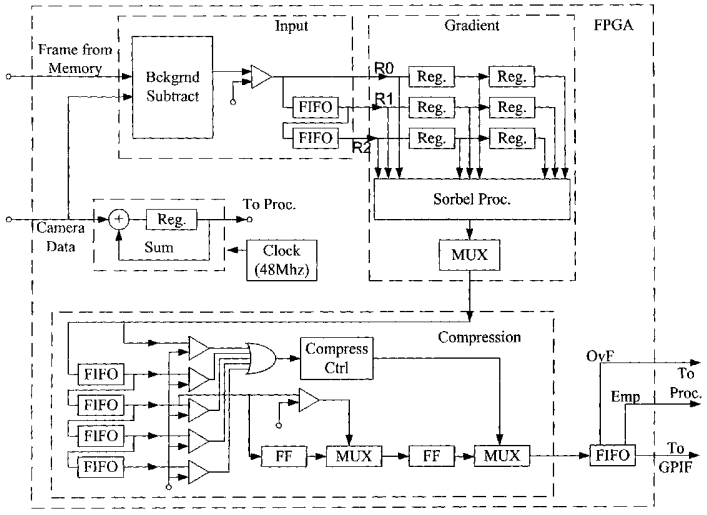
[Continued on next page]

(54) Title: GRADIENT CALCULATING CAMERA BOARD



(57) Abstract: In a machine vision system utilizing computer processing of image data, an imaging module incorporates the image sensor as well as pre-processing circuitry, for example, for performing a background subtraction and/or a gradient calculation. The pre-processing circuitry may also compress the image information. The host computer receives the pre-processed image data and performs all other calculations necessary to complete the machine vision application, for example, to determine one or more wheel alignment parameters of a subject vehicle. In a disclosed example useful for wheel alignment, the module also includes illumination elements, and the module circuitry provides associated camera control. The background subtraction, gradient calculation and associated compression require simpler, less expensive circuitry than for typical image pre-processing boards. Yet, the pre-processing at the imaging module substantially reduces the processing burden on the host computer when compared to machine vision implementations using direct streaming of image data to the host computer.

WO 2004/059575 A3

ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 03/40311

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06T1/00 G06T5/00

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 7 G06T H04N

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 practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 118 485 A (HORIKAWA TOYOFUMI ET AL) 12 September 2000 (2000-09-12) figure 4	1,7,21
X	ANONYMOUS: "iMVS 157 Technical Specification" October 2002 (2002-10), FASTCOM TECHNOLOGY , LAUSANNE, CH , XP002279802	1,7,10, 21,22,24
Y	the whole document	2,3,8,9, 16-20, 25,26

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 August 2004	20. 10. 2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Rockinger, O

2

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ANONYMOUS: "iMVS Image Processing Basic Package: Summary, Version 1.9" December 2001 (2001-12), FASTCOM TECHNOLOGY , LAUSANNE, CH , XP002279803	1,7,10, 21,22,24
Y	page 7	2,3,8,9, 16-20, 25,26
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Y	the whole document	16-20, 25,26
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Y	the whole document	16-20, 25,26
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 03/40311

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-26

   image processing sensor and method including gradient calculation and sensor to host communication

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2. claims: 27-31

   image processing method for background compensation including image data compression

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3. claims: 32-35

   image processing sensor including a field programmable gate array (FPGA)

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4. claims: 36-37

   image processing sensor including an active cooling circuit

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5. claim: 38

   image processing sensor including an electronic strobe circuit

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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