

(12) **United States Patent**
Pirim et al.

(10) **Patent No.:** **US 6,717,518 B1**
(45) **Date of Patent:** **Apr. 6, 2004**

- (54) **METHOD AND APPARATUS FOR DETECTION OF DROWSINESS**
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- (73) Assignee: **Holding B.E.V.S.A., Luxembourg (LU)**
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

- (21) Appl. No.: **09/600,390**
- (22) PCT Filed: **Jan. 15, 1999**
- (86) PCT No.: **PCT/EP99/00300**
- § 371 (c)(1),
(2), (4) Date: **Feb. 9, 2001**
- (87) PCT Pub. No.: **WO99/36893**
- PCT Pub. Date: **Jul. 22, 1999**

- (30) **Foreign Application Priority Data**
- Jan. 15, 1998 (FR) 98 00378
Aug. 25, 1998 (WO) PCT/EP98/05383
- (51) **Int. Cl.⁷** **G08B 23/00**
- (52) **U.S. Cl.** **340/576; 348/143; 382/117**
- (58) **Field of Search** **340/575, 576; 382/100, 103, 115, 117; 348/143, 148, 672**

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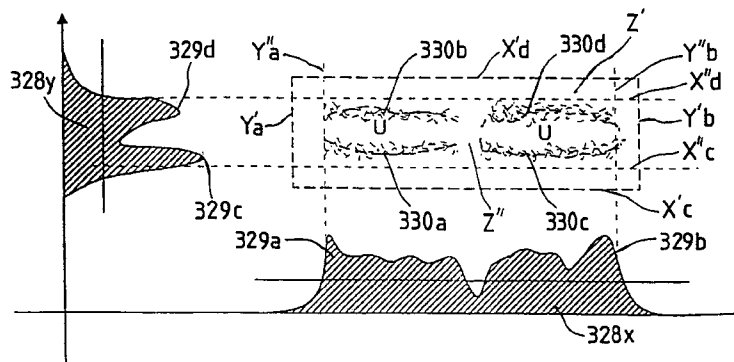
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(57) **ABSTRACT**

In a process of detecting a person falling asleep, an image of the face of the person is acquired. Pixels of the image having characteristics corresponding to an eye of the person are selected and a histogram is formed of the selected pixels. The histogram is analyzed over time to identify each opening and closing of the eye, and characteristics indicative of the person falling asleep are determined. A sub-area of the image including the eye may be determined by identifying the head or a facial characteristic of the person, and then identifying the sub-area using an anthropomorphic model. To determine openings and closings of the eyes, histograms of shadowed pixels of the eye are analyzed to determine the width and height of the shadowing, or histograms of movement corresponding to blinking are analyzed. An apparatus for detecting a person falling asleep includes a sensor for acquiring an image of the face of the person, a controller, and a histogram formation unit for forming a histogram on pixels having selected characteristics. Also disclosed is a rear-view mirror assembly incorporating the apparatus.

39 Claims, 20 Drawing Sheets



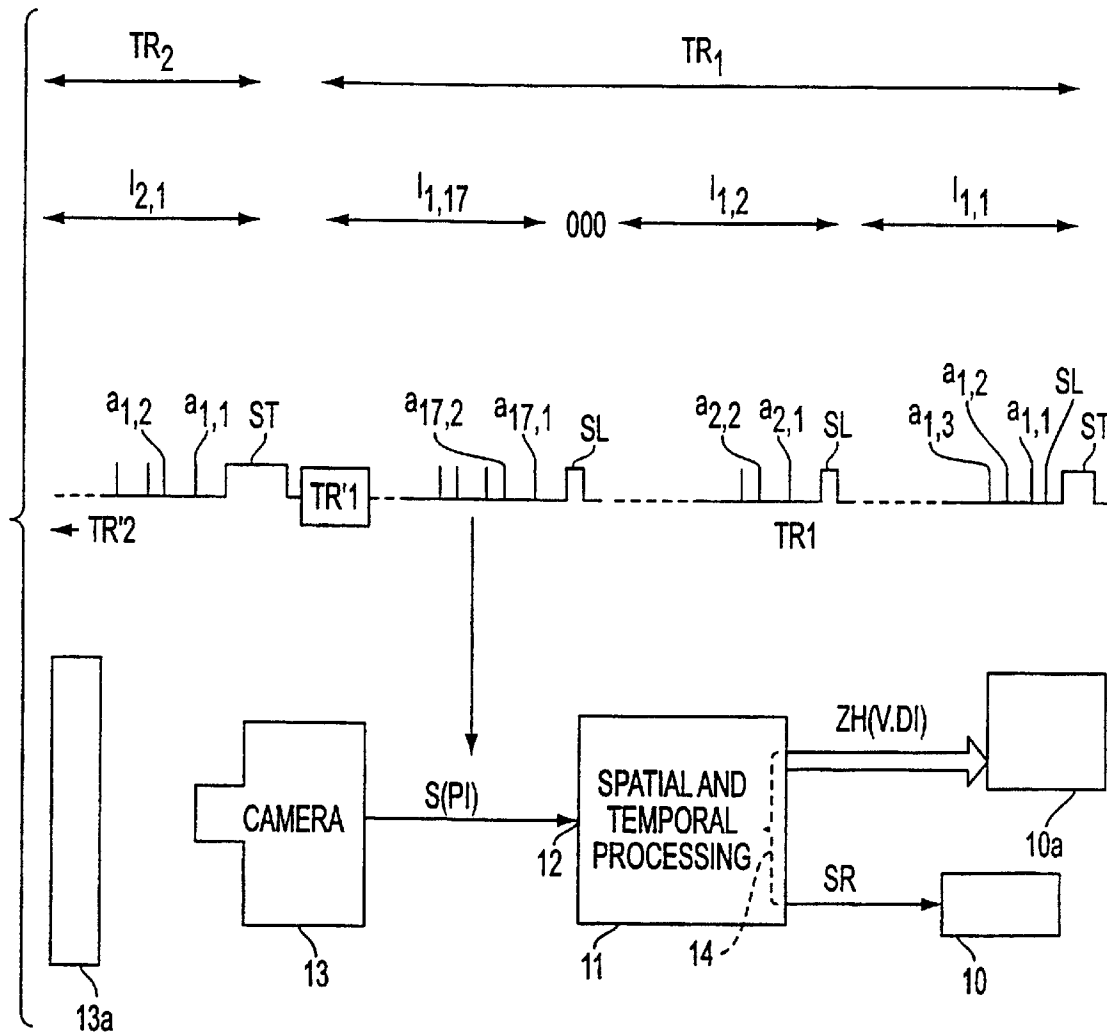


FIG. 1

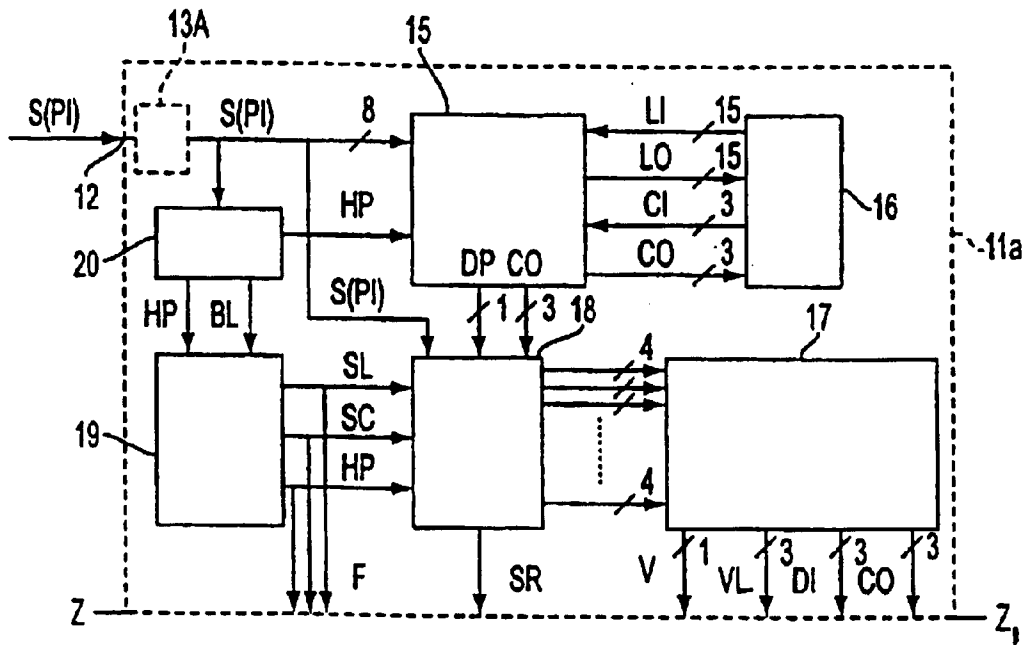


FIG. 2

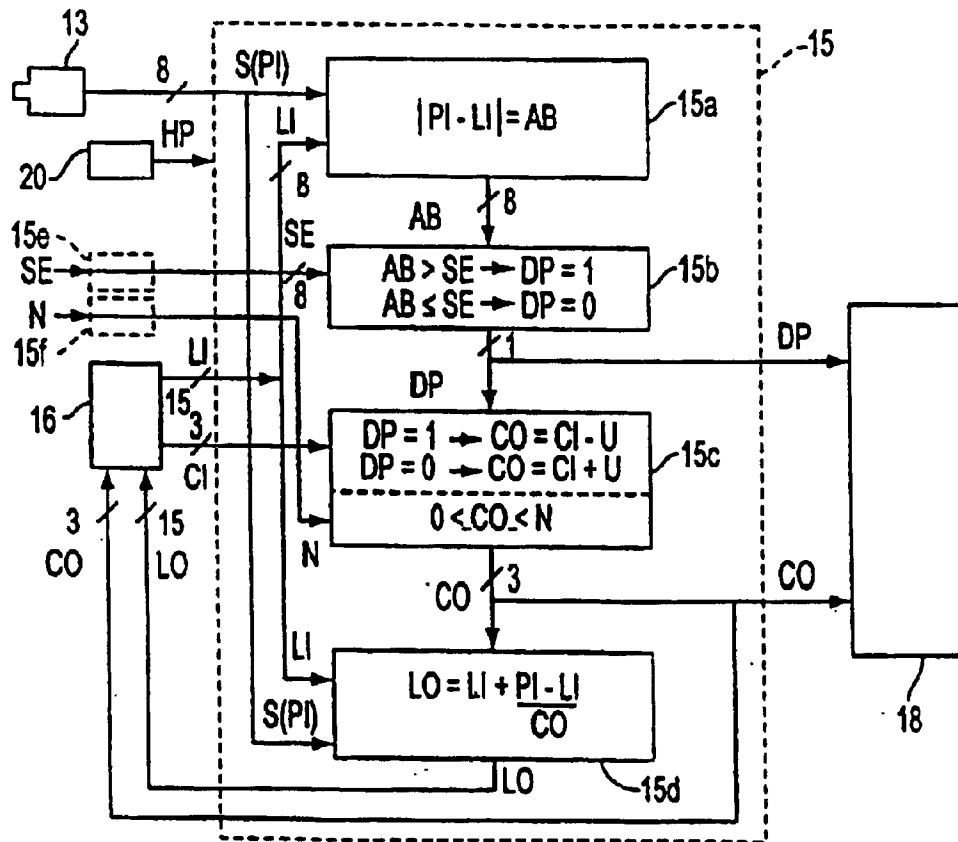


FIG. 3

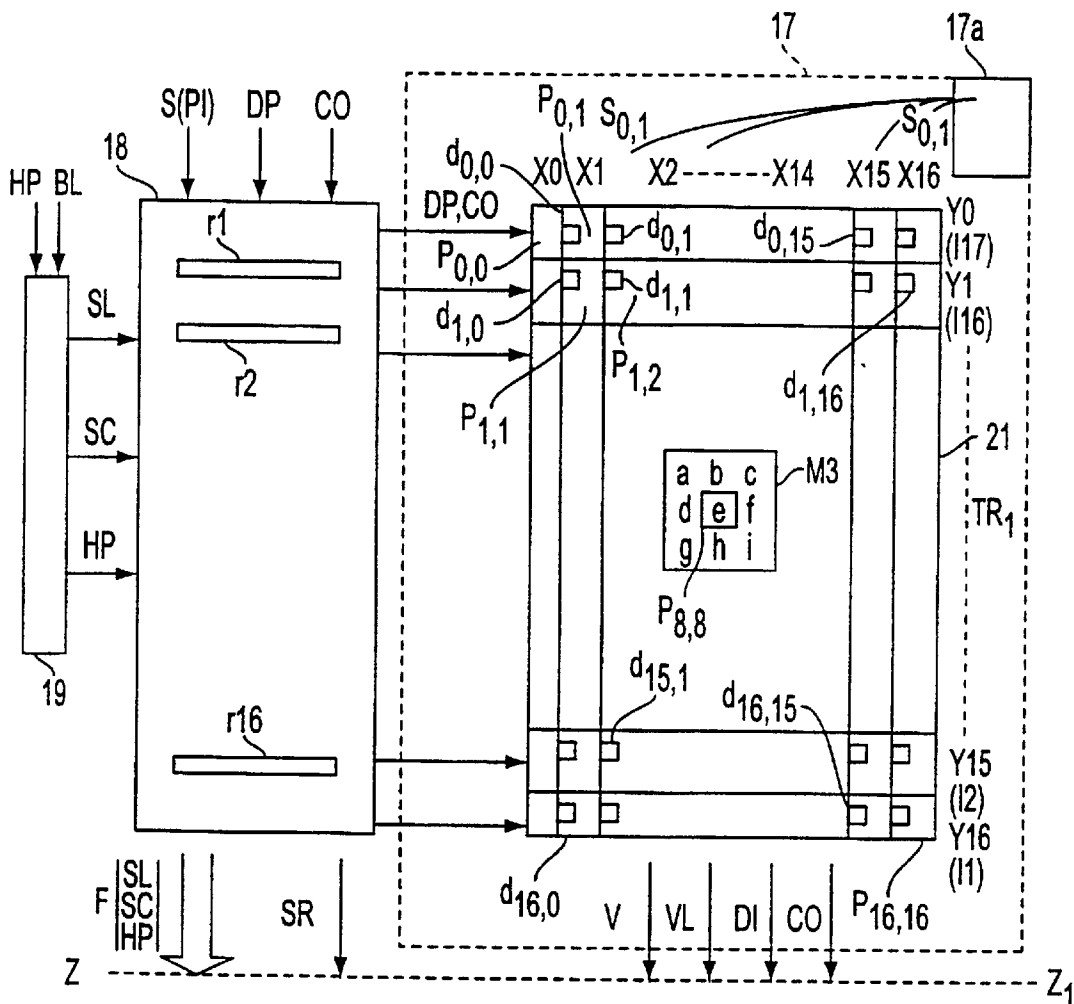


FIG. 4

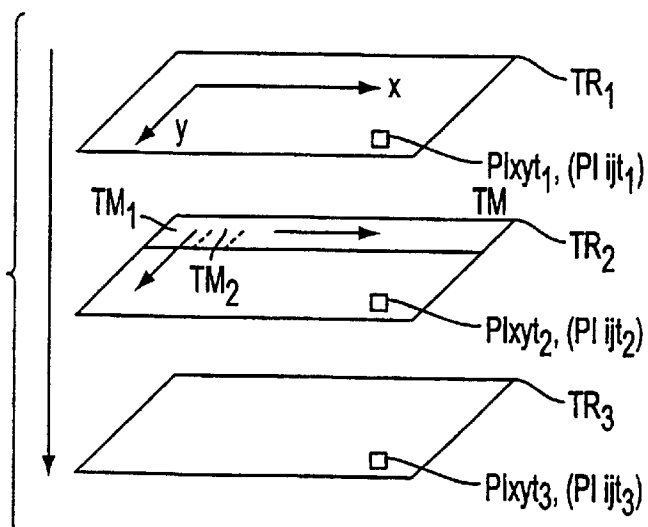


FIG. 5

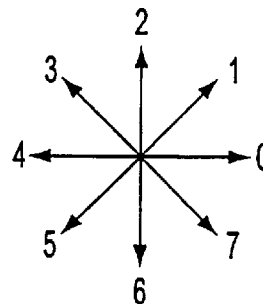


FIG. 6

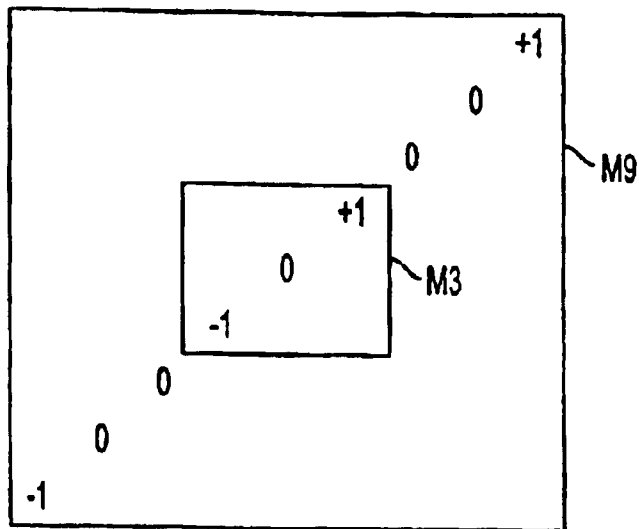


FIG. 7

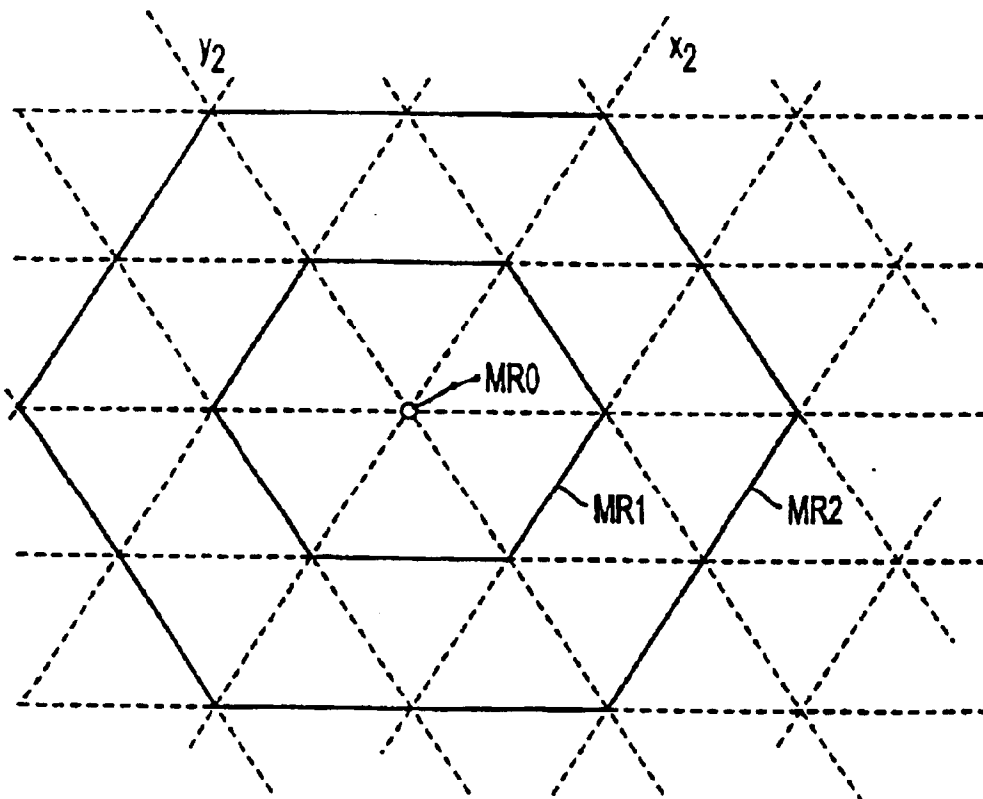


FIG. 8

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