the first full paragraph of col. 11, e.g.:

> Referring to FIG. 3, the display and sensor section 600 provides information from the vehicle sensors 4a **to the microcontroller 510 for use in calculating the hazard level** presented by targets indicated from the received radar signal. In the preferred embodiment of the present invention, **each of the sensors are coupled to the system processor 107** which controls both the obstacle detection and collision avoidance system, and the operational event recording system. In the preferred embodiment of the present invention, **the sensors are sampled or "polled" in known fashion.** However, any means for reading the sensors is within the scope of the present invention. For example, the sensors may cause an interrupt to the microcontroller 510 within the digital electronics section 500 of the system processor 107 at intervals. When the microcontroller 510 recognizes the interrupt, the microcontroller 510 reads the output of the sensor 4a that is responsible for generating the interrupt. Furthermore, it is within the scope of the present invention to include **a discrete processor** that is **dedicated to monitoring each of the sensors and storing the output of each in the ERA. Recording some or all of the data collected from each of the sensors** would make accident reconstruction **more reliable** and **less expensive**.

the paragraph bridging cols. 21-22, e.g.:

> The DSP 508 is coupled to the microcontroller 510. The microcontroller 510 is coupled to the clock 514, which determines the operational speed of the microcontroller 510. In the preferred embodiment of the present invention, the microcontroller 510 operates at approximately 16 MHz. **The microcontroller 510** is also coupled to a local **random access memory (RAM) 512**, a battery backed RAM/Real-time clock 25, and a Flash Programmable Read Only Memory (PROM) 520. The Flash PROM 520 stores the instructions which the microcontroller 510 executes. The microcontroller 510 uses the local RAM 512 as a utility memory space in which the microcontroller 510 stores previously detected target information and a record of events.

col. 23, line 55-col. 2, line 56, esp. section 6, e.g.:

> In the context of the obstacle detection and collision avoidance system, the digital electronics system 500 is coupled to a display and sensor section 600. The display and sensor section 600 has a display, indicators and/or actuators 4b, for displaying indications to a user and/or controlling various aspects of vehicle operation (for example, flashing a dashboard warning light to a user if a vehicle is approaching too rapidly, and/or, in extreme conditions, automatically activating the vehicle brakes and/or air bag).

> The display and sensor section 600 of FIG. 2 is shown in more detail in FIG. 12. The display and sensor section 600 includes a monitoring section 601, a warning section 603, and a sensor section 605.
>
> The sensor section 605 includes a multiplicity of sensors, such as a vehicle steering sensor 608, a brake sensor 610, a power monitor sensor 612, a windshield wiper sensor 614, and a speed coil sensor 616 a turn signal sensor 617, and/or a blind spot detector 618. The microcontroller 510 is coupled to each sensor 608, 610, 612, 614, 616, 617, and 618. <u>The sensors provide information **which is used to determine** *whether* there is a *danger present*</u> or to *alter the factors used to compute a hazard level*. For example, if the microcontroller 510 detects that the windshield wipers of the vehicle have been turned on, thus indicating a rain condition, the preferred following distance from targets may be lengthened to account for longer stopping distances on a wet road. Additionally, the power output by the transmitter may be increased to compensate for the attenuation caused by rain or snow conditions.
>
> <u>If a danger is present, the microcontroller 510 activates an appropriate visual and/or audio warning.</u> **<u>The level of the danger is preferably determined based</u> upon brake lag, <u>brake rate,</u> vehicle speed, <u>closing rate</u>, target distance, and the reaction time of the operator. In the preferred embodiment, an average reaction time is used.** ....
>
> ...
>
> The monitoring section 601 preferably includes an EIA RS-232 port <u>connector 602</u>. The RS-232 **port connector 602 provides a port** from which target information can be communicated to external devices, and **from which diagnostics can be performed on the system.** <u>The microcontroller 510 is coupled to RS-232 port connector 602, thereby providing information</u> and system access to external devices coupled to the port connector 602.

col. 24, line 62-col. 29, line 64, e.g.:

> FIG. 13 shows a more detailed block diagram of the ERA of the preferred embodiment of the present invention, showing **a RAM card 20** coupled through an interface receptacle 21 **to a microcontroller 22** (<u>which may be the microcontroller 510 shown in FIGS. 3 and 8, but can be an independent microcontroller coupled to the microcontroller 510</u>). In the preferred embodiment, **the microcontroller 22 includes a real-time clock.** <u>The microcontroller 22 is also coupled to a non-volatile **memory device 23.**</u>
> ..." In the preferred embodiment, the memory device 23 is a "flash" programmable memory device...and a battery backed RAM/Real-time clock

25. Such devices are electrically alterable, but retain their data even after power is removed from the device. Alternatively, the memory device 23 may comprise, for example, dynamic RAM with a battery backup and refresh circuitry, static RAM with a battery backup, electrically alterable read-only memory, or other solid-state, non-volatile memory technologies known in the art.

The microcontroller 22 and non-volatile memory device 23 are coupled in known fashion by Address and Data buses, and read/write control lines FLASHCSB, RD, WR, as shown, such that the microcontroller 22 can read data from, and write data to, the non-volatile memory device 23. **The memory device 23 is preferably used to store programs to be executed by the microcontroller 22 for control of all, or various aspects, of the components shown in FIG. 3.**

...

The RAM card 20 comprises **one or more** non-volatile **memory** devices and appropriate control and interface circuitry. The RAM card 20 may comprise, for example, dynamic RAM with a battery backup and refresh circuitry, static RAM with a battery backup, flash memory devices, electrically alterable read-only memory, or other solid-state, non-volatile memory technologies known in the art. The data storage capacity of the RAM card 20 is a matter of design choice and available integrated circuit chip capacity and size. In the illustrated embodiment, the capacity of the RAM card 20 is at least 32 kBytes.

In the preferred embodiment, the microcontroller 22 begins a data transfer to the RAM card 20...

After the desired operation (e.g., Read or Write) is specified by the 56-protocol word, a first byte is read from or written to the designated address a bit at a time. The address is then automatically incremented to the next location, and a next byte is read or written. **As desired, the microcontroller 22 can write any data from the non-volatile memory device 23 to the RAM card 20, or vice versa.**

...

In the illustrated embodiment, the memory 54 is a static RAM with sustaining power supplied by a battery 55, permitting the RAM card 20 to be removed from the RAM card receptacle 21. The battery backup also protects against data loss if the power from the RAM card receptacle 21 is interrupted due to system failure or an accident.

If fixed-size data blocks are used, data stored in the memory 54 is delimited by an implicit block size. If variable-size data blocks are used, the data preferably contain internal record and field length counts and/or unique delimiters, so that the blocks can be read back in a meaningful manner. Such variable-size record structures are well-known in the art. However, for simplicity of implementation, the preferred embodiment of the invention uses fixed-size data blocks.

In operation, a RAM card 20 would be inserted into the RAM card receptacle 21. In the preferred embodiment, selected data would be gathered from the vehicle sensors 4a and/or the digital electronics section 500 by the microcontroller 22, typically after the vehicle is started. The data is stored into the RAM card 20 by the microcontroller 22 at periodic intervals, which may be **determined by time and/or by distance traveled**. *The microcontroller 22 may also do some computation on the data,* such as determining a miles-per-gallon value or average speed, to derive processed data for storage in the RAM card 20.

In general, **data blocks would be stored** in the RAM card 20 beginning at the **first location** in the **memory 54**. The address is incremented to point to **successive storage locations for storing subsequent data blocks.**

Different modes of operation can be used. In a first mode, selected data is stored approximately every 0.5 seconds, until the memory 54 on the RAM card 20 is full (which, in the illustrated embodiment, takes about 15 minutes). Thereafter, the address sent to the RAM card 20 by the microcontroller 22 is reset to the first address used, causing the oldest data in the memory 54 to be overwritten with new data (i.e., the memory 54 is operated as a circular queue). This provides a "moving window" of the last 15 minutes of operation (or longer, if longer intervals or a larger capacity memory 54 are used)...

In a second mode of operation, the memory 54 is divided, in a static or dynamic fashion, into *multiple logical "pages"* for **storing independent sets of data.** A "current" page may be used to record a moving window of, for example, selected data from the last 5 or 10 minutes of operation, as described above for the first mode of operation. One or more additional pages can be used to record, for example, selected data (which need not be the same items of data stored in the current page) for fixed or variable time periods for later analysis. Such data may include, for example, information related to vehicle maintenance. In such a case, when a page fills up, writing stops, in order to preserve an archival record of the selected data. A page would be "reset" after a read-out of the data or upon execution of a specific command, permitting new data to be written to the page.

In one variation of the second mode of operation, a first page may be used to record a moving window of selected data. **If an accident occurs**, the first page of data is "frozen", *and a next page is used for subsequent recording*. An accident condition may be detected automatically, or indicated by activation of a manual switch. In this manner, data can be captured for later analysis of the accident.

In another variation of the second mode of operation, *recording to a page other than the current page* may be **triggered by an unusual event**, such as a vehicle operational or performance value exceeding a preset threshold value, or an accident. For instance, it may be desirable to record drive train sensor values only if one or more values, such as engine temperature, exceed a threshold value. As another example, such recording may be triggered by an unusual condition that may indicate an accident, such as a sudden acceleration or deceleration, sudden application of the brakes, activation of an air bag, etc. Recording can also be **triggered** manually. Recording such information on a separate page in memory, and **only upon being triggered by a particular event,** permits capturing data for later analysis of vehicle and/or driver performance.

In a third mode of operation, the recording rate may be increased **upon the occurrence of an unusual condition,** such as a sudden acceleration or deceleration, sudden application of the brakes, activation of an air bag, etc., in order to store more data values surrounding the event, for later analysis.

One skilled in the art would recognize that **variations and combinations of these modes of operation could be implemented** with the present invention as a matter of design choice.

The selected data may be any of the values mentioned above, or similar values. **Further, not all of the values selected need be recorded at the same rate.** For example, information that can change rapidly, such as the status of the brake system, vehicle speed, turning conditions, and other information useful for accident reconstruction purposes, may be recorded very frequently (e.g., every 0.2 seconds). Information that changes more slowly, or is less pertinent to accident reconstruction, such as engine temperature, coolant temperature, etc., may be recorded less frequently (e.g., every 5 seconds, or every mile).

In accordance with one means to read out the data collected in the RAM card 20, the RAM card 20 is removed from the interface receptacle on the automotive system and **inserted in a similar interface coupled to a personal computer. The data can then be displayed on the computer or stored on a different memory device, such as a floppy disk or a hard drive in the computer.**

...

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