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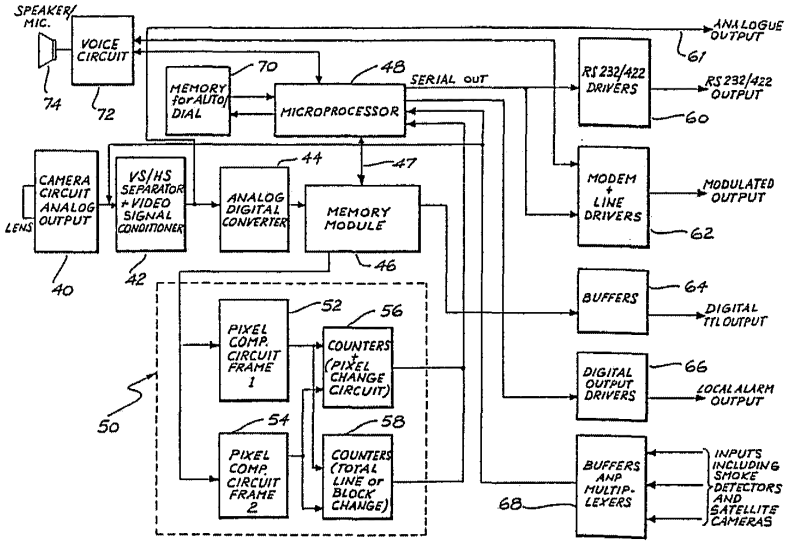

(57) Abstract

A dynamic random access memory (RAM) image sensor (80) in co-operation with driver/de-scramble circuitry (88), microprocessor (84) and grey level difference controller (85) provides a digital image having, for example, a 32 grey level resolution. The digital image can be processed by pixel comparator (86) and microprocessor (84) to detect changes between image frames, for example, to indicate motion of an object. The comparator (86) can operate at real time rates, e.g. 50 frames/second. The result of such detected changes and/or the image can then be transmitted through interfaces (90), (92), (94), (96) or (98) while interface (100) provides communication of external sources with the camera. Bidirectional voice communication is also possible through the interfaces (90)-(100) in analogue or digital format with voice circuit (72) and speaker/microphone (74). This provides a camera with "inbuilt" processing capabilities providing autonomy. The camera can then be incorporated into a system having at least one camera, at least one base station and a communication link connecting the camera and base station.

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DIGITAL IMAGE ACQUISITION SYSTEM

TECHNICAL FIELD

The present invention relates to an imaging system, and in particular to an imaging system employing an "intelligent" camera. The intelligent camera can be used with a dynamic RAM acting as an image sensor. The dynamic RAM image sensor enables a fully digital system to be implemented.

There are a variety of situations in which an imaging system can be employed. These range from security systems through to robotic systems. In general any imaging system in which an image needs to be transmitted to a central or alternative location can employ the present invention.

BACKGROUND ART

In known systems, for example closed circuit television systems, a camera unit such as a vidicon captures the image and then transmits it in analogue form to a station via coaxial cable. Any processing that needs to be performed is usually done at the station. This is at a normally remote central location where with the provision of an analogue to digital converter (ADC) and computer any necessary processing functions are performed. The output from the camera may also be converted into digital form before being transmitted over the communication link. The bandwidth of the communication link places a further limitation and expense on this type

of system.

It is also known to use motion detection software or hardware in security systems to indicate the presence of an intruder or of some disturbance in a given observed space. These know systems generally employ a remote camera which communicates via a communication link with a central observation and processing facility. The central processing facility performs the motion detection with a computer. The communication bandwidth required between the camera and the facility may need to be of the order of several MHz to provide analysis in real time as required for these types of situations. In addition available cameras only provide an analogue output requiring an analogue to digital converter to provide the digital format needed for processing by the computer.

A known imaging device which provides a digital output is a dynamic RAM having a transparent window as disclosed in US patent specification 4441125 to Parkinson. This image sensor uses the light sensitive semi-conductor memory elements of the dynamic RAM to provide a black and white image or it can be employed to provide a variable grey scale output. This image sensor has been described for use in low cost applications such as robots and toys. It is much cheaper and of small size compared with other imaging devices such as vidicons and CCDs (charged coupled devices). The Parkinson specification describes various modes for operating the dynamic RAM as an image sensor. The sensitivity of the sensor can be controlled by varying the rate of scanning of the array or by changing the

threshold value for the determination of the logic state of the cells of the RAM. By scanning the cells with a threshold value which follows a repeating sequence of voltage steps shades of grey can be determined for an image. This can also be achieved by scanning the cell arrays at various rates (periods).

DISCLOSURE OF INVENTION

The present invention overcomes the disadvantages in the prior art referred to above by providing a novel method of operating an image sensor employing a dynamic RAM and also an imaging unit employing a camera or imaging device which has associated with the imaging device processing capabilities giving autonomy to the actual imaging device to provide an "intelligent" camera. The intelligent camera can then be employed in a system providing intelligent bi-directional communication with a base station.

In accordance with one aspect of the invention there is provided a method of image acquisition using a dynamic random access memory (RAM) image sensor having a transparent window through which a lens can focus an image on an array of radiation sensitive cells of said dynamic RAM image sensor including the steps of: setting the cells of said dynamic RAM to a fully charged state, scanning the said image sensor to provide a series of images of variable exposure lengths, storing the said series of images of variable exposure lengths in a buffer, and processing said series of images of variable exposure lengths to provide a measure of the difference between

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