OEBSYS II
Line Scan Camera Interface and Digital Signal Processor

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The OEBSYS II Line Scan Camera Interface and Digital Signal Processor is a monochromatic, high resolution, high precision image digitizing and processing system designed for use with 80386 based IBM PC/AT compatible computers and in- line pixel array cameras. The following is an overview of the system's features:

-> Compatible with:

EG+G Reticon 1901 Series Photodiode Cameras:

LC1901DAN/LC1901DKN 256 Pixel Line Scan Cameras
LC1901FAN/LC1901FKN 512 Pixel Line Scan Cameras
LC1901HAN/LC1901HKN 1024 Pixel Line Scan Cameras
LC1901KAN/LC1901KKN 2048 Pixel Line Scan Cameras
4096 Pixel Line Scan Cameras (to be released in 1990)

Loral Fairchild Weston CAM1600R CCD Line Scan Cameras (3456 pixel)

-> Supports up to two cameras per system. They can be used as if they are one double-resolution camera or to provide two seperate images (or two different angles of viewing the same image).

-> Digital signal processing rates are equivalent to the maximum output rate of the cameras supported; 10 Mhz. for the EG+G Reticon 1901 Series Cameras and 5 Mhz. for the Loral Fairchild Weston CAM1600R Camera.

-> Light variation compensation allows the use of AC image lighting, a real money saver in situations where lighting conditions are critical. This compensation also eliminates problems that can be caused by power line fluctuations that produce up to plus or minus 15 percent variation in light levels.

-> Two stages of (8-bit) grey level signal processing are provided, each of which has a 64K byte buffer in which each pixel is given a unique processing variable. The first stage is an Arithmetic Logic Unit that provides mask- ing, addition, subtraction (either incoming data minus buffer variable or vice versa), ORing, and XORing. The second stage is a RAM based look-up- table that can be programmed to provide any desired transfer function.

-> A "paging" function allows for multiple sets of signal processor variables. The number of maps available is variable

and is a function of the camera array size. For example, a 256 pixel camera could have up to 128 different pages of pixel processing variables, any one of which can be selected on-the-fly by the software.

-> The contents of a 64K byte grey level data buffer are transferable to the PC. The buffer has the same paging capability as the signal processing buf- fers; multiple scan lines of grey level data (once again, up to 128 lines for a single 256 pixel camera) can be entered into the grey data buffer for on-board grey level image storage.

-> A binary video converter is provided to generate binary (black/white) images from the grey level image. The converter is equipped with dual programmable thresholds and two modes of thresholding. One mode allows the use of the two thresholds to provide programmable amounts of hysteresis. The second mode implements a "window comparator" that can be used to determine if in- coming video is within a programmable range. A planned variation on the binary video converter will allow the two thresholds to be used to decode three light levels instead of two, making it a "trinary video converter". This modification will involve switching only two chips.

-> The output of the binary video converter is passed to a run length encoder that provides approximately 16:1 data compression. Double buffering is employed on the run length encoded data, allowing data to be transfered to the PC even as data is coming in from the camera(s). The run length en- coder will also be modified for use with the trinary video converter.

-> Data transfer timing can be controlled using either interrupts or polling.

-> An external input is provided to synchronize camera exposures with other devices (stepper tables, etc.). Activity at this input is sensed and the camera is automatically switched away from the internal exposure generator. An LED indicates whether or not the internal exposure generator is engaged. Alternatively, the "Sync" front panel output can be used to slave external components to the internal exposure generator. Another input, called START, provides a flag on the PC bus for the purpose of image registration.

-> To facilitate the setting up and monitoring of the cameras, "VERTICAL" and "SYNC" outputs are provided so that the grey level data flowing through the system can be monitored on an inexpensive analog oscilloscope. A switch allows monitoring either before or after signal processing, while another switch causes the thresholds to be superimposed on the scan line. Synch- ronization to either Camera 1 or Camera 2 can be selected, though, if Cam- era 1 is selected, both cameras can be displayed consecutively of the osc- illoscope by reducing its horizontal sweep rate. A "VIDEO PEAK" LED on the front panel indicates when either camera has been driven into saturation.

-> A library of functions is supplied that supports all basic system functions and allows user access to all hardware registers. Specialized higher level functions or customized software systems are available upon request.

-> The system is highly self-testing using the diagnostic software provided.

-> Three external expansion buses are provided for future expansion. The buses were designed around the concept of real time matching of full images (up to 8192 X 12000 pixels or more). The planned hardware features include:

- Threshold/pixel mapping, i.e., a seperate set of thresholds for each pixel (and, as with the other buffers, multiple pages of threshold maps).

- Storage of a master binary image (run length encoded) in RAM and accom- panying logic to compare it with incoming images in real time, outputing only error data.

- Massive expansion of the grey level data and signal processing variable buffers, allowing for more pages and thereby enhancing the grey level image capturing, processing and matching capabilities. The signal pro- cessing variable buffers can be used to store "inverted" images, making grey level image matching a simple process of putting the binary video converter in the "window comparator" mode and watching the output of the run length encoder for out-of-window runs (this can be done without the expander, but only for a limited number of scan lines).