VIDEO PERCEPTION INCORPORATED

MOVING CAMERA APPLICATIONS OF THE IPP3000

BACKGROUND

The IPP3000 performs video motion detection. It provides an alarm status and also generates tracking data. It was originally intended for stationary mount applications with an area array camera or a linear array camera.

A typical video camera will not exactly retrace the same each scan. The camera retrace can vary +/- 1 pixel in both the horizontal and vertical directions. It can also vary in signal magnitude. Both of these problems have been corrected by the IPP3000 design enhancements; the IPP3000 permits misalignments of +/- 4 pixels in either/both the horizontal and vertical directions. This capability permits it to be used with a movable platform providing the misalignment does not exceed the IPP3000 design tolerance.

GOALS

It is the goal of this proposal to utilize the IPP3000 within a moving platform application to perform the following:

1) The system will provide viewing of the platform video camera output on a video monitor. At the same time, digitized output from the camera will operate the IPP3000 to produce both motion alarm status and tracking data.
2) The tracking data can be utilized by the platform to perform automatic tracking of an intrusion.
3) The platform can be panned (in either direction and at any speed up to maximum) while monitoring for motion.
4) The system can provide motion detection with the camera tilted into one of three positions. Motion detection must be suspended while transitioning between tilt positions.
5) Areas may be masked to inhibit motion detection.
6) Update rate of the Reference RAM is optional; full field motion detection is accomplished at the rate of 30 times-per-second.

BLOCK DIAGRAM OF PAN/TILT CAMERA PLATFORM OPERATION

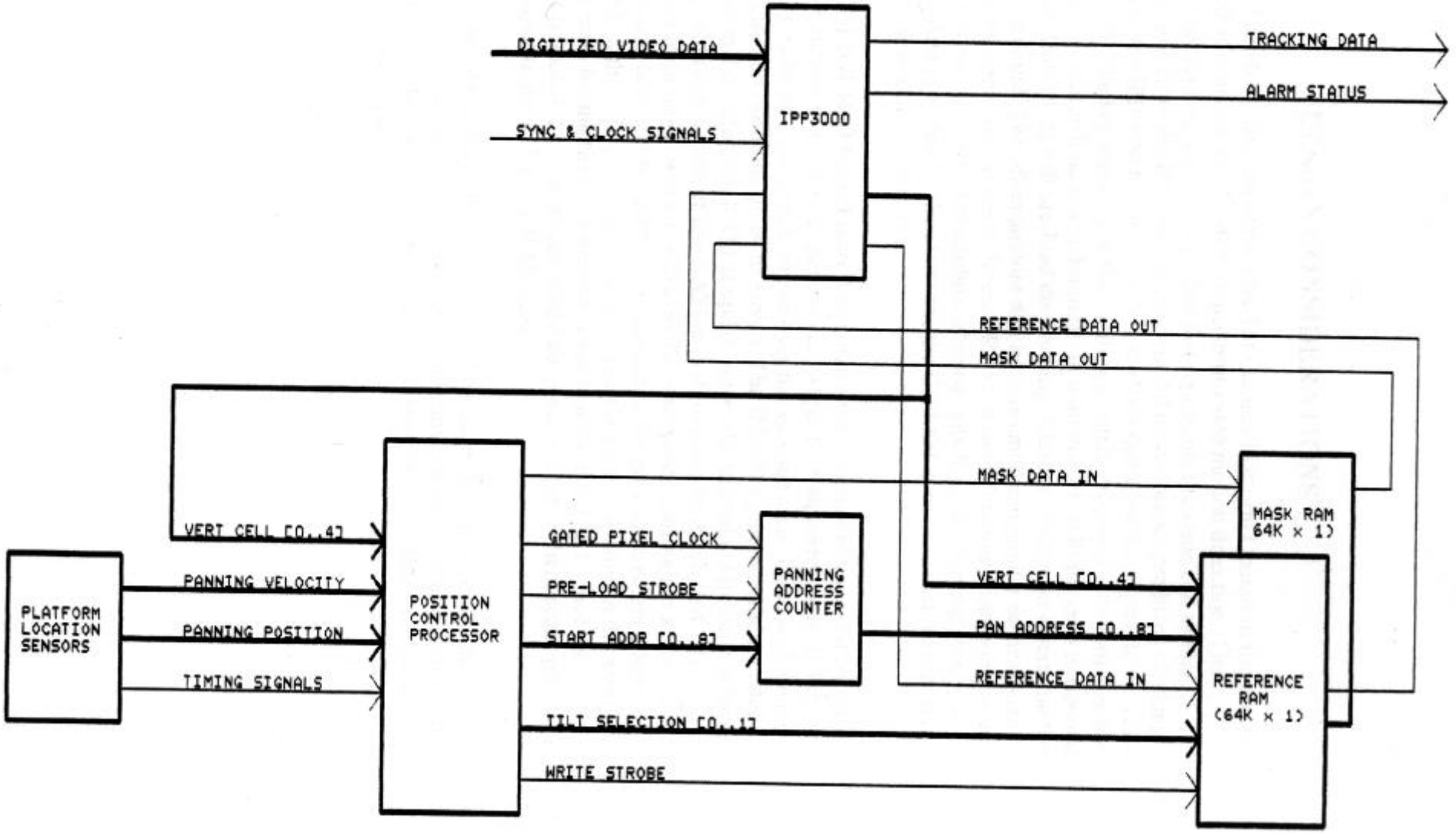
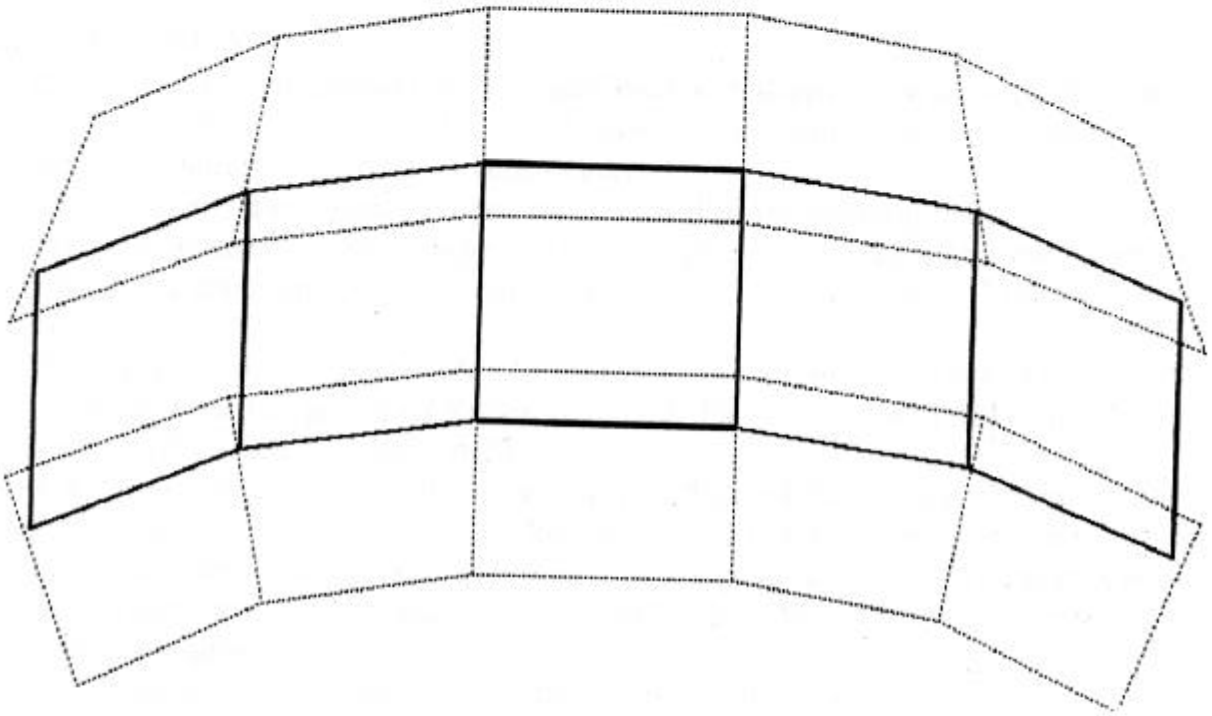


FIGURE 1
FIELD CAPTURE STRUCTURE
OF PANORAMIC VIEW
(3 Tilt Positions)



NOTES:

1. A panoramic view (at a fixed tilt angle) can be completed by capture of 5 full screens of encoded data.
2. The above diagram shows 3 tilt angle panoramic views.
3. Capture of encoded data must be stored in the Reference RAM; this requires storage of 15 full images.

DESIGN CONSIDERATIONS

OVERVIEW: The block diagram of the Pan/Tilt Camera Platform Operation illustrates a configuration that employs the IPP3000 to perform video motion detection. The Reference RAM addressing must recover data that represents the same cell as that produced in real time from the IPP3000. A Panning Address Counter produces clocking at the same rate as the IPP3000 to develop reference data that should compare to the real-time data produced. The key function of the Position Control Processor is to initialize the counter at an address that will be in synchronization with the IPP3000 for each horizontal scan line. A Start Addr [0..8] will pre-load the Panning Address Counter to determine the horizontal offset amount. The offset amount will be constant throughout a vertical scan. A Mask RAM is the same size as the Reference RAM. It uses the same addressing as the Reference RAM. It contains data that inhibits selected cells from developing motion data. It is loaded from data provided by the platform; the IPP3000 does not assist (except for addressing) in loading data to the RAM.

PAN/TILT CONFIGURATION: Figure 1 illustrates the structure of captured encoded data required to function as a reference panoramic image. Five adjacent image fields (in the pan direction) make up a panoramic image over the viewing area. Three such images, one for each of three tilt positions, must be stored. The IPP3000 generates the encoded data that is stored in the Reference RAM at update intervals determined by the platform. When the platform directs update of this RAM, a first tilt position is selected. The platform must pan from one extreme position to the other while loading the RAM. A second tilt position is selected; the platform is panned in the reverse direction while loading the RAM. A third tilt position is selected. The platform is panned in the same direction as was done for the first tilt selection while loading the RAM. Once the Reference RAM is loaded, the current encoded data generated (at 30 field scans per second) is compared to the Reference RAM data.

OPERATION: One of the three tilt selections must be accurately maintained during panning. The platform may be panned in any pattern at any pan rate (either direction) up to the maximum rate. When transitioning from one tilt position to another, motion data and alarm status must be ignored.

ASSUMPTIONS

1) The camera provides interlaced operation and provides 15 degree horizontal viewing.
2) The platform pans over a 60 degree range.
3) The maximum panning rate is 20 degrees/second.
4) The platform will support three fixed tilt positions (while providing motion detection).
5) The targeted camera has 320 x 240 pixels resolution.
6) The digitized data would be of the same resolution as the camera.

CALCULATIONS

1) If there are 320 horizontal pixels located over a 15 degree viewing area, then the angular pixel spacing is 320/15 = 21.3 pixels/degree. Since there are 4 pixels/cell, the cell spacing would be 5.33 cells/degree.
2) The horizontal panoramic viewing range would be the panning range plus the camera horizontal viewing range = 60 + 15 = 75 degrees. Therefore, the number of cells in the panoramic viewing range would be 5.33 cells/degree x 75 degrees = 400 cells.
3) If the interlaced camera provides 240 pixels resolution in the vertical direction, it would provide 120 pixels resolution-per-field. This would result in 120 pixels-per-field / 4 pixels/cell = 30 cells/field.
4) A Reference RAM is needed to store three (different tilt angles) panoramic views of data encoded by the IPP3000. The Reference RAM requires only 1-bit-per-cell. A single panoramic view would be a matrix of x-y positioned cells. The matrix would be 400 horizontal x 30 vertical = 12,000 cells. There would be three of these matrices required.
5) The Reference RAM addressing requirements would be as follows:

Horizontal	:	9 bits
Vertical	:	5 bits
Tilt Selection	:	2 bits
TOTAL	:	16 bits (64K x 1 bit)

6) The Mask RAM would be exactly the same size as the Reference RAM.