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**Brown et al.**

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(54) **SYSTEM AND METHOD FOR GENERATING A VIEWABLE VIDEO INDEX FOR LOW BANDWIDTH APPLICATIONS**

5,969,755 A \* 10/1999 Courtney ..... 348/143  
6,026,183 A 2/2000 Talluri et al. .... 382/194  
6,169,573 B1 1/2001 Sampath-Kumar et al. .. 348/169  
6,173,317 B1 \* 1/2001 Chaddha et al. .... 709/219

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(Continued)

**OTHER PUBLICATIONS**

Kompatsiaris et al., "Spatiotemporal Segmentation and Tracking of Objects for Visualization of Videoconference Image Sequences", IEEE Transactions on Circuits and Systems for Video Technology, Ieee Inc., New York, vol. 10, No. 8, Dec. 2000, pp. 1388-1402.

(Continued)

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(57) **ABSTRACT**

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(51) **Int. Cl.**

**G06K 9/00** (2006.01)

**H04N 5/225** (2006.01)

(52) **U.S. Cl.** ..... **382/103**; 348/169

(58) **Field of Classification Search** ..... 382/103, 382/107, 154, 194, 224, 243, 142; 348/143, 348/169, 700; 375/241.1, E7.004, E7.011, 375/E7.012, E7.076, E7.078; 380/212

See application file for complete search history.

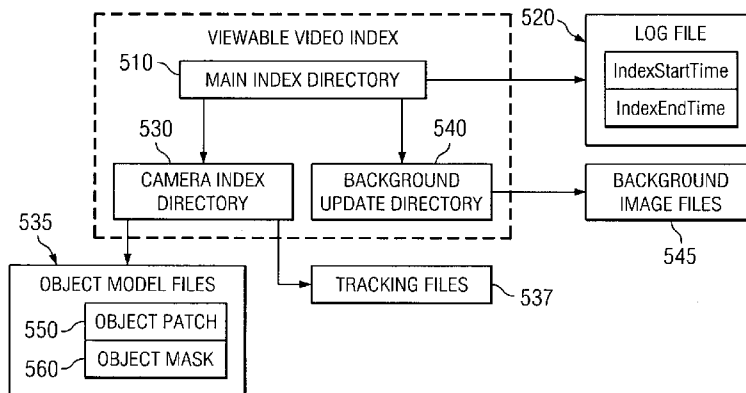
(56) **References Cited**

**U.S. PATENT DOCUMENTS**

5,521,841 A 5/1996 Arman et al. .... 364/514 A  
5,923,365 A \* 7/1999 Tamir et al. .... 348/169  
5,933,535 A 8/1999 Lee et al. .... 382/243

A system and method for generating a viewable video index for low bandwidth applications are provided. The exemplary aspects of the present invention solve the problems with the prior art systems by incorporating information for generating a viewable representation of the video data into the index, thus generating a viewable video index. The viewable video index contains information for generating a visual representation of moving objects in the video data, a visual representation of the background of the video capture area, i.e. the scene, a representation of the object trajectory, a representation of the object attributes, and a representation of detected events. The result is that the viewable video index may be transmitted to a low bandwidth application on a client device and may be used along with associated object and background models to generate a representation of the actual video data without requiring that the original video data itself be streamed to the client device.

**26 Claims, 4 Drawing Sheets**



U.S. PATENT DOCUMENTS

6,185,314	B1 *	2/2001	Crabtree et al. ....	382/103
6,271,892	B1 *	8/2001	Gibbon et al. ....	348/700
6,366,296	B1	4/2002	Boreczky et al. ....	345/719
6,385,772	B1	5/2002	Courtney .....	725/105
6,389,168	B2	5/2002	Altunbasak et al. ....	382/224
6,400,831	B2 *	6/2002	Lee et al. ....	382/103
6,424,370	B1	7/2002	Courtney .....	348/143
6,560,281	B1	5/2003	Black et al. ....	375/240
6,614,847	B1	9/2003	Das et al. ....	375/240.16
2001/0035907	A1	11/2001	Broemmelsiek .....	348/169
2002/0008758	A1	1/2002	Broemmelsiek et al. ....	348/143
2003/0044045	A1	3/2003	Schoepflin et al. ....	382/103
2003/0081564	A1	5/2003	Chan .....	370/328
2003/0123850	A1	7/2003	Jun et al. ....	386/68
2003/0185434	A1	10/2003	Lee et al. ....	382/154

OTHER PUBLICATIONS

Wren et al., "Pfinder: Real-Time Tracking of the Human Body", IEEE Transactions on Pattern Analysis and Machine Intelligence, IEEE Inc., New York, vol. 19, No. 7, Jul. 1997, pp. 780-785.

Collins et al., "Algorithms for cooperative multisensor surveillance", Proceedings of the IEEE, vol. 89, No. 10, Oct. 2001, pp. 1456-1477.

Regazzoni et al., "3D pose estimation and shape coding of moving objects based on statistical morphological skeleton", Proceedings of the International Conference on Image Processing (ICIP), Washington Oct. 23-26, 1995, IEEE Comp. Soc. Press, vol. 3, Oct. 1995, pp. 612-615.

Foresti et al., "Statistical Morphological Skeleton for Representing and Coding Noisy Shapes", IEEE Proceedings: Vision, Image and Signal Processing, Institution of Electrical Engineers, GB, vol. 146, No. 2, Apr. 1999, pp. 85-92.

Senior et al., "Appearance Models for Occlusion Handling", Proceedings of the Second International Workshop on Performance Evaluation of Tracking and Surveillance Systems in Conjunction with CVPR'01, Dec. 2001, 8 pgs.

"Real-Time Articulated Human Body Tracking using Silhouette Information", IEEE Workshop on Performance Evaluation of Tracking and Surveillance, Nice, France, Oct. 2003, pp. 1-8.

\* cited by examiner

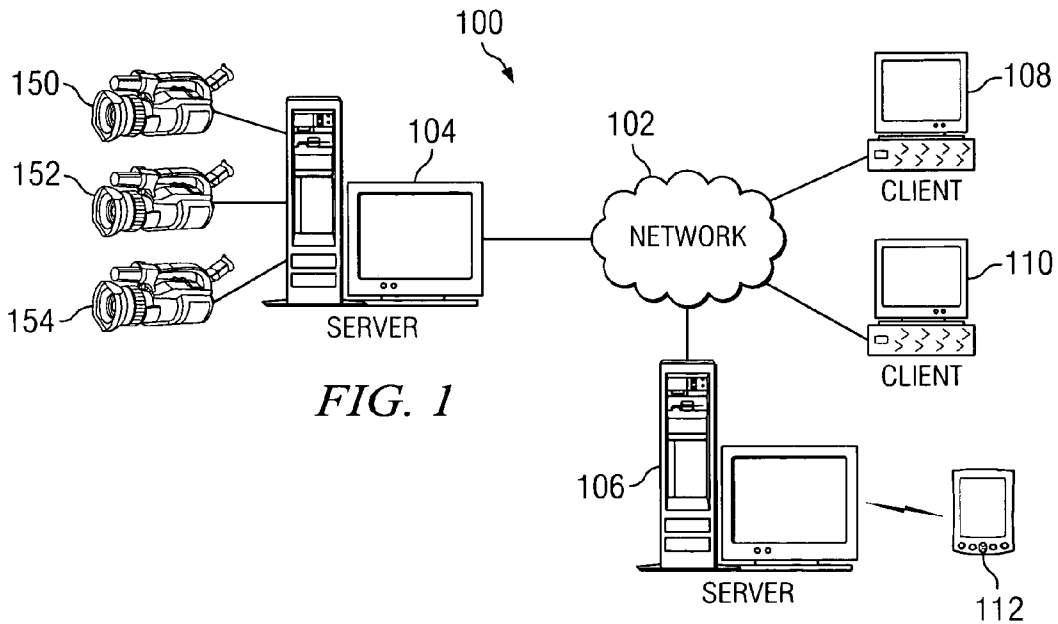


FIG. 1

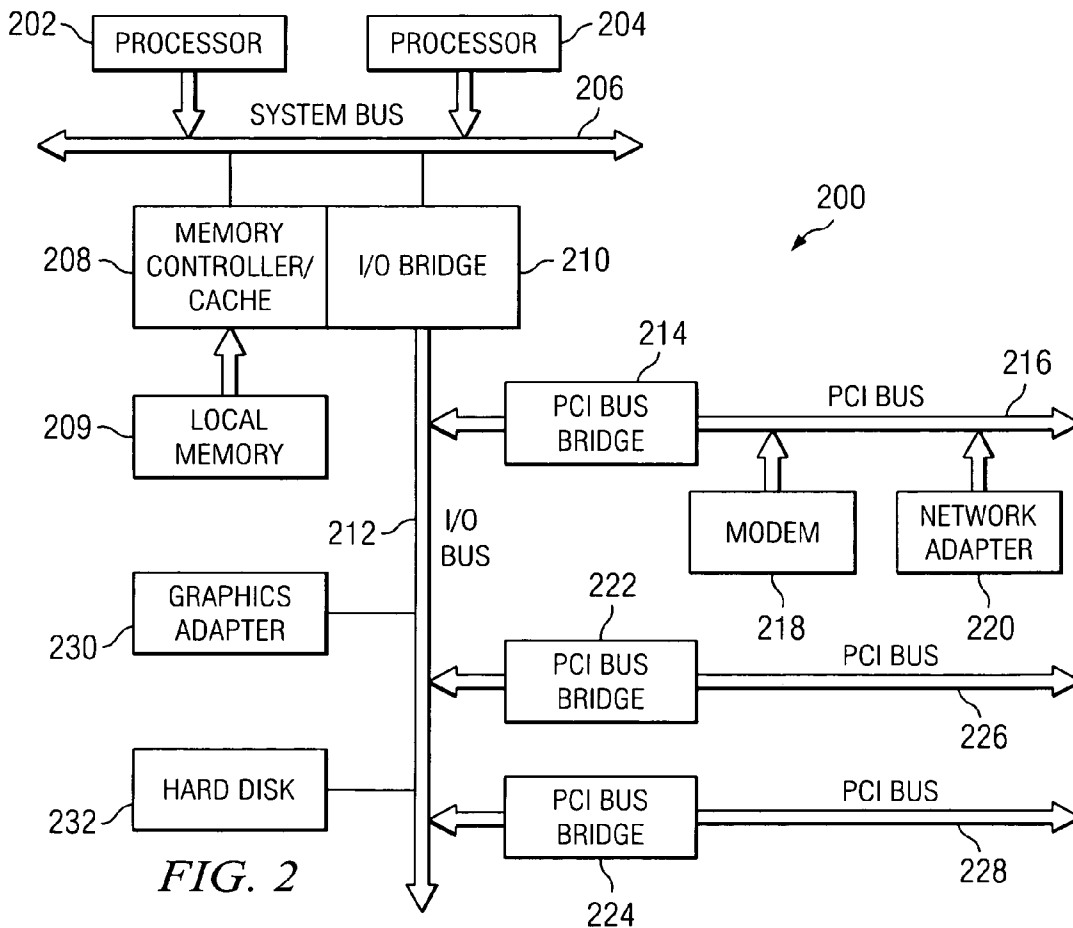
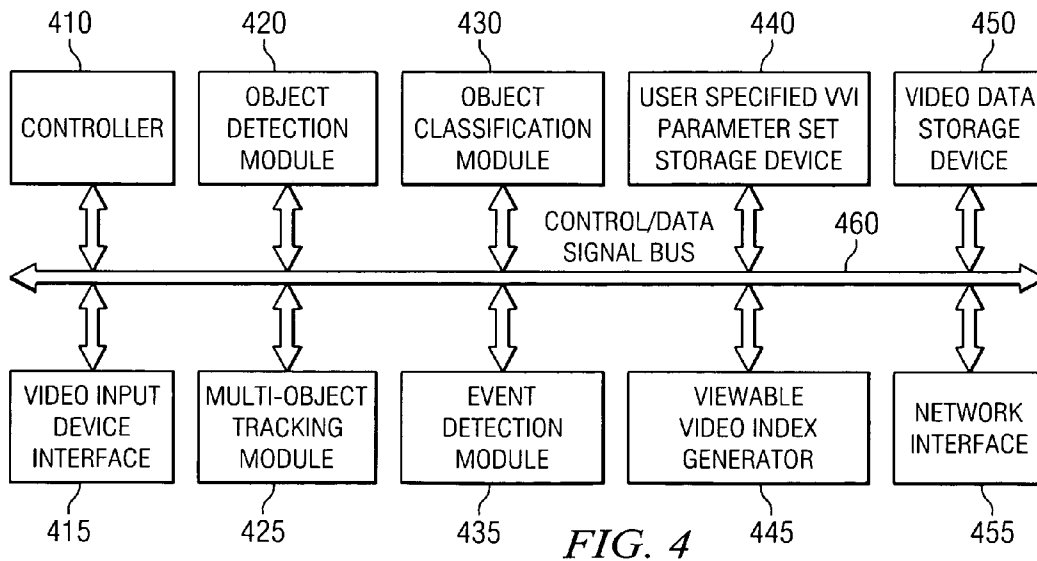
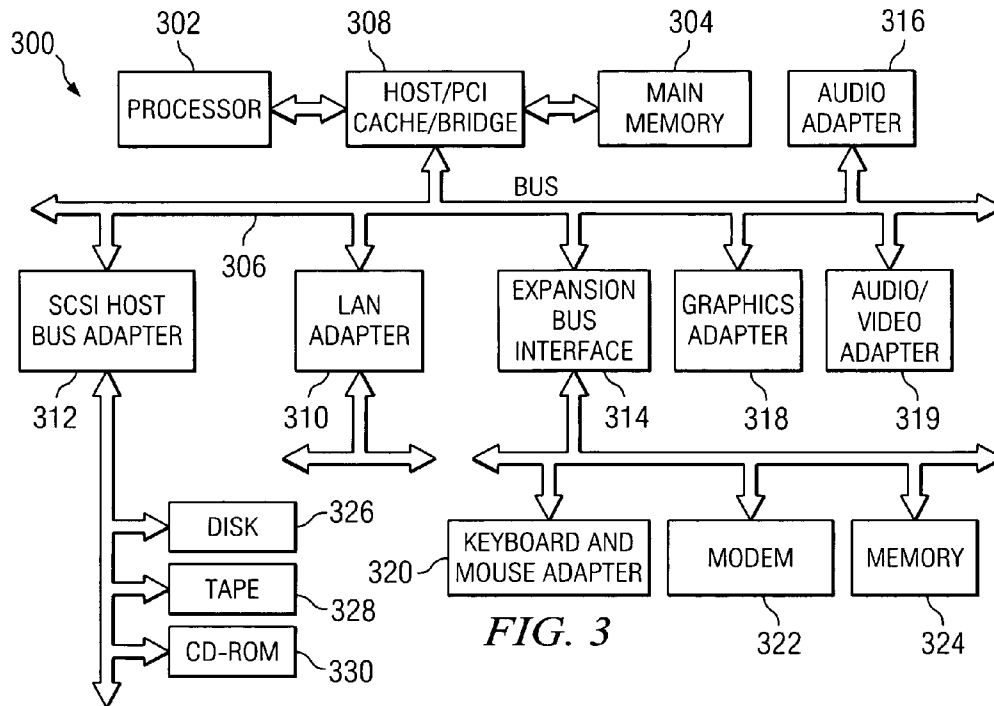


FIG. 2



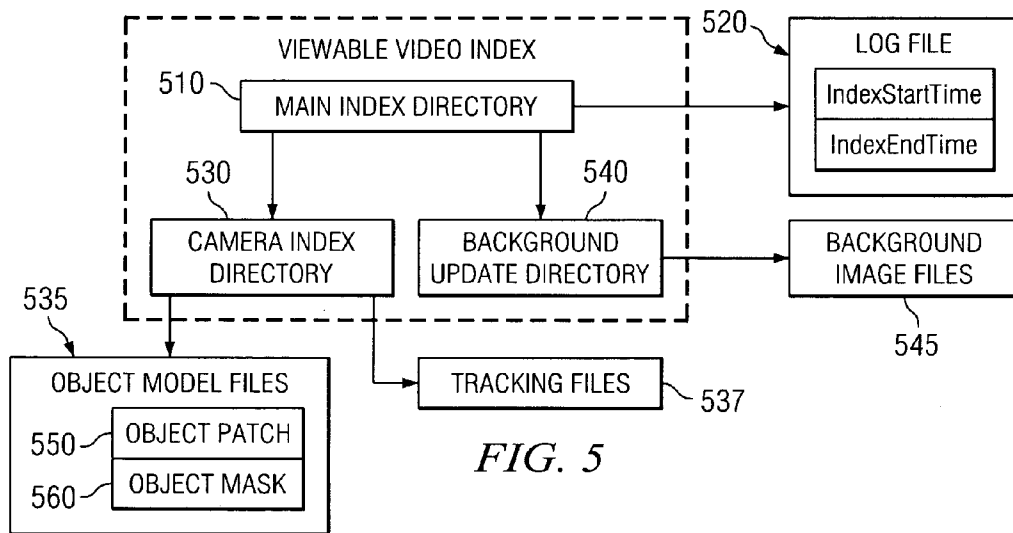
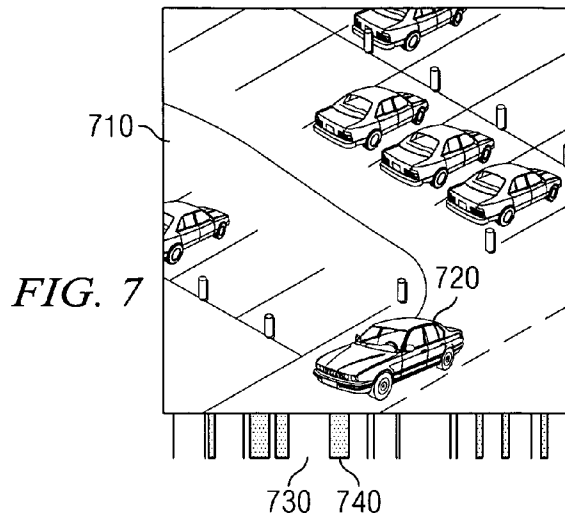


FIG. 5

FIG. 6

Index Data per Frame	
610	StartFrame
615	History
620	TimeStamp 0000000073-2003-09-08-21-16-41-819 73
630	Centroid 71.8 181.1
640	Area 328.0
650	Bounding Box 62 85 23 22
660	Missing Pixel Count 0
670	OcclusionFraction 0.000000
680	Class -1 UnKnown
690	ModelFollows 0
695	EndFrame

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