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Hsu et al.

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- (54) **FLEXIBLE TRANSPARENT TOUCH SENSING SYSTEM FOR ELECTRONIC DEVICES**
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5,305,017 A	4/1994	Gerpheide	345/174
5,381,160 A	1/1995	Landmeier	
5,386,219 A *	1/1995	Greanias et al.	345/174
5,457,289 A	10/1995	Huang et al.	178/20
5,543,588 A	8/1996	Bisset et al.	
5,559,504 A	9/1996	Itsumi et al.	
5,844,506 A	12/1998	Binstead	341/34
5,880,411 A	3/1999	Gillespie et al.	
5,909,211 A *	6/1999	Combs et al.	345/172
5,942,733 A	8/1999	Allen et al.	179/1
5,952,998 A *	9/1999	Clancy et al.	345/173
6,016,140 A *	1/2000	Blouin et al.	345/178
6,137,427 A	10/2000	Binstead	341/33

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(51) **Int. Cl.**
G09G 5/08 (2006.01)

(52) **U.S. Cl.** **345/173; 345/179; 178/18.06**

(58) **Field of Classification Search** **345/173, 345/172, 156, 179, 174, 18.05, 18.06, 176; 178/18.01, 18.09, 19.01, 20.01, 18.04, 18.05, 178/18.06; 341/33, 34; 200/211; 463/37; 173/18.01**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,757,322 A	9/1973	Barkan et al.	340/365 C
4,484,038 A	11/1984	Dorman et al.	200/5 A
4,686,332 A	8/1987	Greanias et al.	178/19
4,733,222 A	3/1988	Evans	340/365 C
4,806,709 A	2/1989	Evans	178/19
4,931,782 A *	6/1990	Jackson	345/174
4,945,348 A	7/1990	Ibamoto et al.	340/784
4,954,823 A	9/1990	Binstead	341/26
5,021,640 A *	6/1991	Muroi	235/462
5,122,787 A *	6/1992	Fujita et al.	345/97
5,149,919 A *	9/1992	Greanias et al.	178/19

(Continued)

FOREIGN PATENT DOCUMENTS

EP 0 185 671 B1 12/1991

(Continued)

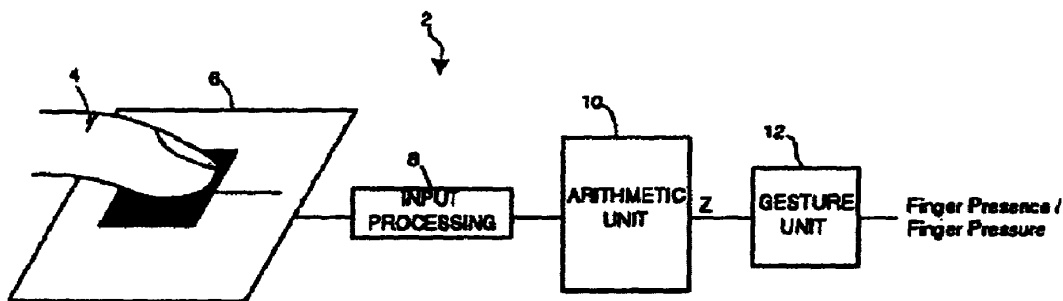
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(57) **ABSTRACT**

A transparent, capacitive sensing system particularly well suited for input to electronic devices is described. The sensing system can be used to emulate physical buttons or slider switches that are either displayed on an active display device or printed on an underlying surface. The capacitive sensor can further be used as an input device for a graphical user interface, especially if overlaid on top of an active display device like an LCD screen to sense finger position (X/Y position) and contact area (Z) over the display. In addition, the sensor can be made with flexible material for touch sensing on a three-dimensional surface. Because the sensor is substantially transparent, the underlying surface can be viewed through the sensor. This allows the underlying area to be used for alternative applications that may not necessarily be related to the sensing system. Examples include advertising, an additional user interface display, or apparatus such as a camera or a biometric security device.

30 Claims, 5 Drawing Sheets



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U.S. PATENT DOCUMENTS

6,163,313	A *	12/2000	Aroyan et al.	345/173
6,222,528	B1 *	4/2001	Gerpheide et al.	345/173
6,262,717	B1 *	7/2001	Donohue et al.	345/156
6,297,811	B1 *	10/2001	Kent et al.	345/173
6,411,344	B1 *	6/2002	Fujii et al.	349/12
6,414,671	B1 *	7/2002	Gillespie et al.	345/157
6,504,530	B1 *	1/2003	Wilson et al.	345/173
6,686,546	B1 *	2/2004	Chiu	178/18.01
6,704,068	B1 *	3/2004	Murade	349/44

FOREIGN PATENT DOCUMENTS

EP	0 754 370	B1	10/2002
GB	2 161 935	A	1/1986
GB	2 223 986	A	4/1990
WO	WO 85/04994	A1	11/1985
WO	WO 88/05577	A1	7/1988
WO	WO 95/27334	A1	10/1995

* cited by examiner

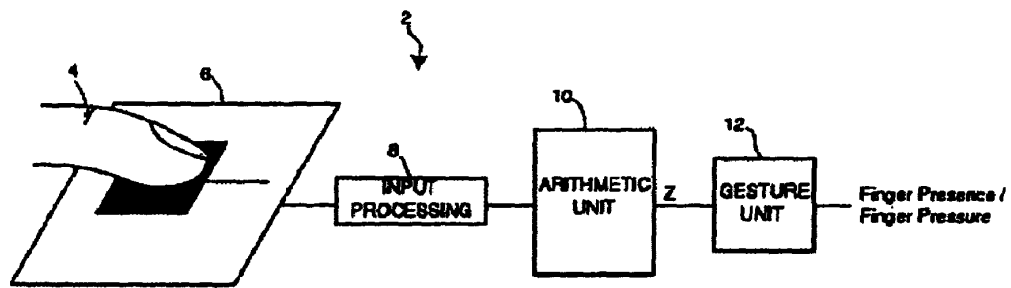


Figure 1

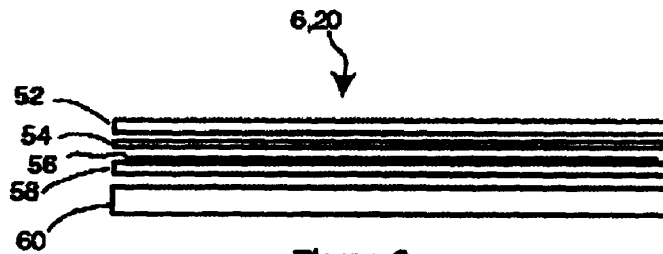


Figure 2

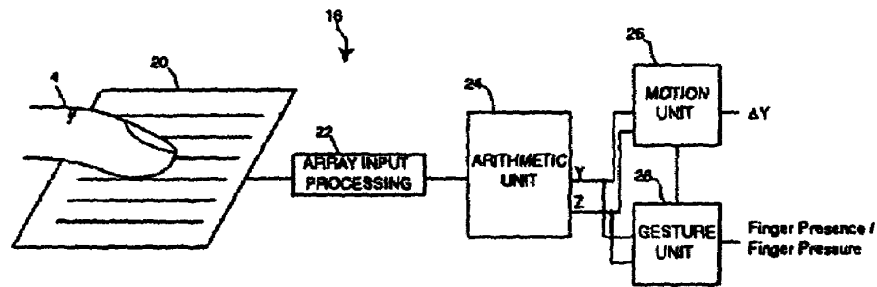


Figure 3

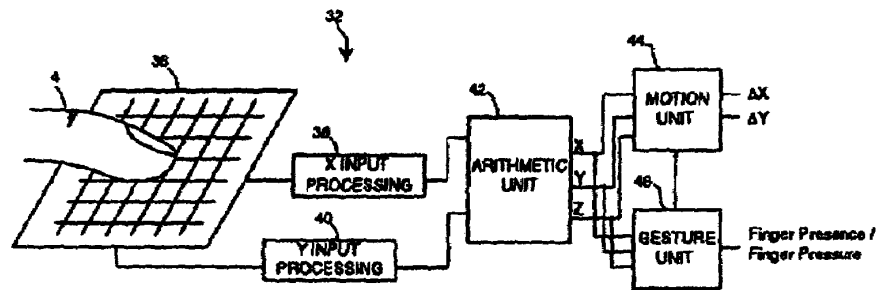


Figure 4

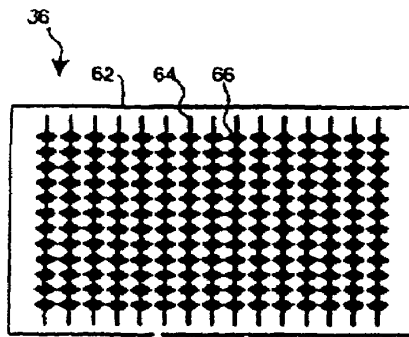


Figure 5A

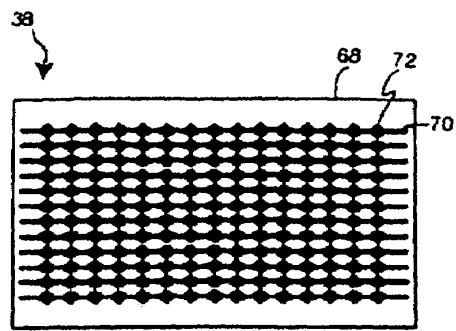


Figure 5B

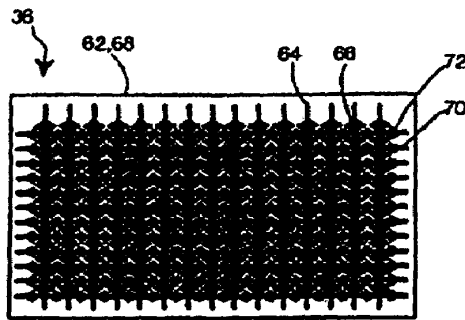


Figure 5C

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