

US007158118B2

(12) United States Patent Liberty

(10) Patent No.: US 7,158,118 B2 (45) Date of Patent: *Jan. 2, 2007

(54) 3D POINTING DEVICES WITH ORIENTATION COMPENSATION AND IMPROVED USABILITY

(75) Inventor: Matthew G. Liberty, Potomac, MD

(US)

(73) Assignee: Hillcrest Laboratories, Inc., Rockville,

MD (US)

(*) Notice: Subject to any disclaimer, the term of this

patent is extended or adjusted under 35

U.S.C. 154(b) by 0 days.

This patent is subject to a terminal dis-

claimer.

(21) Appl. No.: 11/119,719

(22) Filed: May 2, 2005

(65) Prior Publication Data

US 2005/0243062 A1 Nov. 3, 2005

Related U.S. Application Data

- (60) Provisional application No. 60/641,410, filed on Jan. 5, 2005, provisional application No. 60/566,444, filed on Apr. 30, 2004, provisional application No. 60/612, 571, filed on Sep. 23, 2004.
- (51) Int. Cl. G09G 5/00 (2006.01) G09G 5/08 (2006.01)
- (58) **Field of Classification Search** 345/156–169, 345/173–179; 178/18.01–18.07, 19.01–19.06 See application file for complete search history.

(56) References Cited

U.S. PATENT DOCUMENTS

4,787,051 A 11/1988 Olson

4,839,838	4		6/1989	LaBiche et al.
5,045,843	4		9/1991	Hansen
5,138,154	4		8/1992	Hotelling
5,181,181	4	*	1/1993	Glynn 702/141
5,359,348	4		10/1994	Pilcher et al.
5,440,326	A		8/1995	Quinn
5,506,605	4	擊	4/1996	Paley 345/163
5,698,784	4		12/1997	Hotelling et al.
5,703,623	4		12/1997	Hall et al.
5,825,350	4		10/1998	Case, Jr. et al.
5,835,156	4		11/1998	Blonstein et al.
5,898,421	4		4/1999	Quinn
5,912,612	4		6/1999	DeVolpi
5,955,988	4		9/1999	Blonstein et al.
6,002,394	4		12/1999	Schein et al.
6,016,144	4		1/2000	Blonstein et al.
6,049,823	4		4/2000	Hwang
6,115,028	4	101	9/2000	Balakrishnan et al 345/157
6,164,808	4	*	12/2000	Shibata et al 700/85

(Continued)

OTHER PUBLICATIONS

Navarrete, P., et al., "Eigensapce-based Recognition of Faces: Comparisons and a new Approach," Image Analysis and Processing, 2001, pp. 1-6.

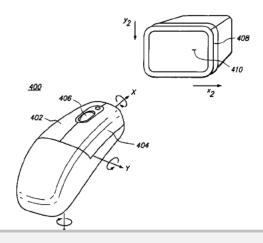
(Continued)

Primary Examiner—Vijay Shankar (74) Attorney, Agent, or Firm—Potomac Patent Group PLLC

(57) ABSTRACT

Systems and methods according to the present invention describe 3D pointing devices which enhance usability by transforming sensed motion data from a first frame of reference (e.g., the body of the 3D pointing device) into a second frame of reference (e.g., a user's frame of reference). One exemplary embodiment of the present invention removes effects associated with a tilt orientation in which the 3D pointing device is held by a user.

17 Claims, 9 Drawing Sheets





US 7,158,118 B2Page 2

U.S. PATENT DOCUMENTS	2006/0092133 A1* 5/2006 Touma et al 345/158
6,466,831 B1* 10/2002 Shibata et al 700/85	OTHER PUBLICATIONS
6,492,981 B1 12/2002 Stork et al.	Jakubowski, J., et al., "Higher Order Statistics and Neural Network
6,753,849 B1 6/2004 Curran et al.	for Tremor Recognition," IEEE Transactions on Biomedical Engi-
6,757,446 B1 * 6/2004 Li et al	neering, vol. 49, No. 2, Feb. 2002, pp. 152-159.
6,933,923 B1 8/2005 Feinstein	Liu, C., et al., "Enhanced Fisher Linear Discriminant Models for
6,990,639 B1 1/2006 Wilson	Face Recognition," Proc. 14th International Conference on Pattern
6,998,966 B1 2/2006 Pedersen et al.	Recognition, Queensland, Australia, Aug. 17-20, 1998, pp. 1-5.
2003/0107551 A1 6/2003 Dunker	International Search Report for PCT/US05/15096, mailed May 16,
2004/0095317 A1 5/2004 Zhang et al.	2006.
2004/0239626 A1 12/2004 Noguera	Written Opinion for PCT/US05/15096, mailed May 15, 2006.
2004/0268393 A1 12/2004 Hunleth et al.	International Search Report for PCT/US04/35369, mailed May 11,
2005/0174324 A1 8/2005 Liberty et al.	2006.
2005/0212767 A1 9/2005 Marvit et al.	Written Opinion for PCT/US04/35369, mailed May 11, 2006.
2005/0243061 A1 11/2005 Liberty et al.	Green, J., et al., "New iMEMS Angular-Rate-Sensing Gyroscope,"
2005/0253806 A1 11/2005 Liberty et al.	Analog Dialogue, 37-03 (2003), pp. 1-4.
2006/0028446 A1 2/2006 Liberty et al.	* cited by examiner

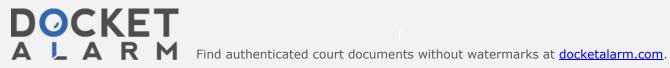
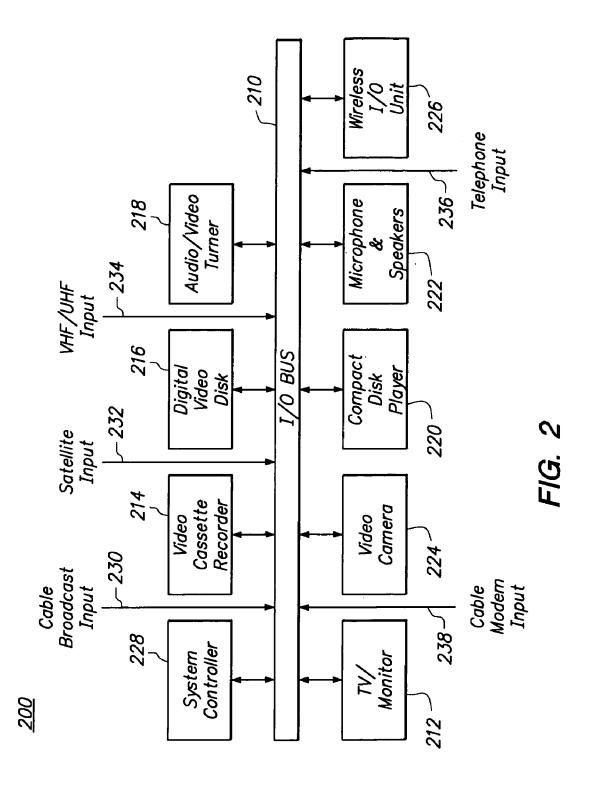
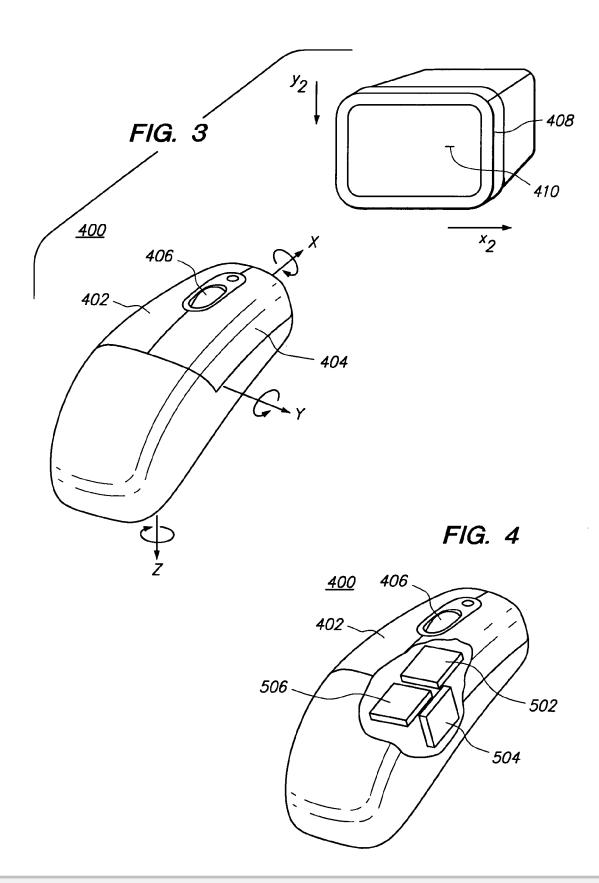


FIG. 1 (Prior Art)

POWER	DSS
CABLE TV	033
	(())
FUNCTION	
CABLE TV	DSS
CODE SET F	AVORITE
TV/VIDEO TV/DSS	JUMP
) (
(1)(2)	(3)
4 (5)	(6)
(7) (8)	9
DISPLAY (0)	ENTER
	GUIDE
EXIT MENU	GOIDE
₩	
	1/2/1
	ן נודקני
₹ ₹	
VOL	CH CH
	+)
	\preceq $ $
I II—]] ((-	—)/
	/
DSS	つ .
\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	~ <i> </i>









DOCKET A L A R M

Explore Litigation Insights



Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time** alerts and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.

