

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UTILITY PATENT APPLICATION TRANSMITTAL <i>(Only for new nonprovisional applications under 37 CFR 1.53(b))</i>	Attorney Docket No.	T9047-22090US02; IMM631C1
	First Inventor	Srivatsav VENKATESAN
	Title	POSITION CONTROL ... HAPTIC OUTPUT DEVICE
	Express Mail Label No.	

APPLICATION ELEMENTS <i>See MPEP chapter 600 concerning utility patent application contents.</i>	ADDRESS TO: Commissioner for Patents P.O. Box 1450 Alexandria VA 22313-1450
1. ☐ Fee Transmittal Form. (PTO/SB/17 or equivalent) 2. ☐ Applicant claims small entity status. See 37 CFR 1.27. 3. ☒ Specification. [Total Pages <u>29</u>] Both the claims and abstract must start on a new page (For information on the preferred arrangement, see MPEP § 608.01(a)) 4. ☒ Drawing(s). (35 U.S.C. 113) [Total Sheets <u>10</u>] 5. Inventor's Oath or Declaration. [Total Sheets <u>6</u>] (including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e)) a. ☐ Newly executed (original or copy) b. ☒ A copy from a prior application (37 CFR 1.63(d)) 6. ☒ Application Data Sheet. *See Note below. See 37 CFR 1.76 (PTO/AIA/14 or equivalent) 7. ☐ CD-ROM or CD-R. in duplicate, large table or Computer Program (Appendix) ☐ Landscape Table on CD 8. Nucleotide and/or Amino Acid Sequence Submission. (if applicable, items a. – c. are required) a. ☐ Computer Readable Form (CRF) b. ☐ Specification Sequence Listing on: i. ☐ CD-ROM or CD-R (2 copies); or ii. ☐ Paper c. ☐ Statements verifying identity of above copies	ACCOMPANYING APPLICATION PARTS 9. ☐ Assignment Papers. (cover sheet & document(s)) Name of Assignee _____ 10. ☐ 37 CFR 3.73(c) Statement. ☒ Power of Attorney. (when there is an assignee) 11. ☐ English Translation Document. (if applicable) 12. ☒ Information Disclosure Statement. (PTO/SB/08 or PTO-1449) ☐ Copies of citations attached 13. ☐ Preliminary Amendment. 14. ☐ Return Receipt Postcard. (MPEP § 503) (Should be specifically itemized) 15. ☐ Certified Copy of Priority Document(s). (if foreign priority is claimed) 16. ☐ Nonpublication Request. Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent. 17. ☐ Other: _____
*Note: (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 must be included in an Application Data Sheet (ADS). (2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).	

18. CORRESPONDENCE ADDRESS					
☒ The address associated with Customer Number: <u>95000</u> OR ☐ Correspondence address below					
Name					
Address					
City	State	Zip Code			
Country	Telephone	Email			
Signature	/Andrew W. Wahba/		Date	2018-08-08	
Name (Print/Type)	Andrew W. Wahba		Registration No. (Attorney/Agent)	73661	

This collection of information is required by 37 CFR 1.53(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA/82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	
Filing Date	August 8, 2018
First Named Inventor	Srivatsav VENKATESAN
Title	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
Art Unit	
Examiner Name	
Attorney Docket Number	T9047-22090US02; IMM631C1

SIGNATURE of Applicant or Patent Practitioner

Signature	/Andrew W. Wahba/	Date (Optional)	2018-08-08
Name	Andrew W. Wahba	Registration Number	73661
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			
NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.			
☐ *Total of _____ forms are submitted.			

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Doc Code: PA..

Document Description: Power of Attorney

PTO/AIA/82B (07-13)

Approved for use through 11/30/2014. OMB 0651-0051
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

POWER OF ATTORNEY BY APPLICANTI hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number

Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)



I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above:

95000

OR



I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:



The address associated with the above-mentioned Customer Number

OR



The address associated with Customer Number: 95000

OR

Firm or
Individual Name

Address

City

State

Zip

Country

Telephone

Email

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

Immersion Corporation



Inventor or Joint Inventor (title not required below)



Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)



Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)



Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature

Date (Optional)

Name

Catherine Meresh

Title

Senior IP Patent Counsel, Immersion Corporation

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

Total of forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	T9047-22090US02; IMM631C1
		Application Number	
Title of Invention	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor	1				Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Srivatsav		VENKATESAN			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	Sunnyvale	State/Province	CA	Country of Residence	US	
Mailing Address of Inventor:						
Address 1	229 Velvetlake Drive					
Address 2						
City	Sunnyvale	State/Province	CA			
Postal Code	94089	Country	US			
Inventor	2				Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Kaniyalal		SHAH			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	Fremont	State/Province	CA	Country of Residence	US	
Mailing Address of Inventor:						
Address 1	4394 Rustica Circle					
Address 2						
City	Fremont	State/Province	CA			
Postal Code	94536	Country	US			
Inventor	3				Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Douglas	George	BILLINGTON			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						

Application Data Sheet 37 CFR 1.76		Attorney Docket Number		T9047-22090US02; IMM631C1	
		Application Number			
Title of Invention		POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE			

City	Campbell	State/Province	CA	Country of Residence ⁱ	US
------	----------	----------------	----	-----------------------------------	----

Mailing Address of Inventor:

Address 1		1206 Erin Way			
Address 2					
City	Campbell	State/Province	CA		
Postal Code	95008	Country ⁱ	US		
Inventor	4				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Aaron		KAPELUS		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Jamaica Plain	State/Province	MA	Country of Residence ⁱ	US

Mailing Address of Inventor:

Address 1		100 Wyman Street, Apt. #3			
Address 2					
City	Jamaica Plain	State/Province	MA		
Postal Code	02130	Country ⁱ	US		
Inventor	5				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Stephen		RANK		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	San Jose	State/Province	CA	Country of Residence ⁱ	US

Mailing Address of Inventor:

Address 1		201 Bahia Court			
Address 2					
City	San Jose	State/Province	CA		
Postal Code	95119	Country ⁱ	US		
Inventor	6				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Daniel		PARKER		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	San Jose	State/Province	CA	Country of Residence ⁱ	US

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number		T9047-22090US02; IMM631C1	
		Application Number			
Title of Invention	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE				
Mailing Address of Inventor:					
Address 1	1658 Fairorchard Avenue				
Address 2					
City	San Jose	State/Province	CA		
Postal Code	95125	Country	US		
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.					Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).			
☐ An Address is being provided for the correspondence information of this application.			
Customer Number	95000		
Email Address	ipdocketing@milestockbridge.com	Add Email	Remove Email

Application Information:

Title of the Invention	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE		
Attorney Docket Number	T9047-22090US02; IMM631C1	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	10	Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐ Request Not to Publish. I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	T9047-22090US02; IMM631C1
		Application Number	
Title of Invention	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE		

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	95000		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	14979321	2015-12-22
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14979321	Claims benefit of provisional	62096251	2014-12-23
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove
			Access Code ^j (if applicable)

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	T9047-22090US02; IMM631C1
		Application Number	
Title of Invention	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE		

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	T9047-22090US02; IMM631C1
		Application Number	
Title of Invention	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	T9047-22090US02; IMM631C1
		Application Number	
Title of Invention	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.			
Applicant	1		Remove
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.			
		Clear	
☒ Assignee	Legal Representative under 35 U.S.C. 117		Joint Inventor
Person to whom the inventor is obligated to assign.		Person who shows sufficient proprietary interest	
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:			
Name of the Deceased or Legally Incapacitated Inventor:			
If the Applicant is an Organization check here. ☒			
Organization Name	Immersion Corporation		
Mailing Address Information For Applicant:			
Address 1	50 Rio Robles		
Address 2			
City	San Jose	State/Province	CA
Country	US	Postal Code	95134
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button.			Add

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	T9047-22090US02; IMM631C1
		Application Number	
Title of Invention	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE		

Assignee 1				
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
				Remove
If the Assignee or Non-Applicant Assignee is an Organization check here.				☐
Prefix	Given Name	Middle Name	Family Name	Suffix
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1				
Address 2				
City		State/Province		
Country i		Postal Code		
Phone Number		Fax Number		
Email Address				
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.				Add

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Andrew W. Wahba/		Date (YYYY-MM-DD)	2018-08-08
First Name	Andrew	Last Name	Wahba	Registration Number
				73661
Additional Signature may be generated within this form by selecting the Add button.				Add

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	T9047-22090US02; IMM631C1
		Application Number	
Title of Invention	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IMM631

PTO/AIA/01 (08-12)

Approved for use through 5/15/2014 OMB 0951-0032

U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
As the below named inventor, I hereby declare that: This declaration is directed to: ☒ The attached application, or ☐ United States application or PCT international application number _____ filed on: _____ The above-identified application was made or authorized to be made by me. I believe that I am the original inventor or an original joint inventor of a claimed invention in the application. I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both. WARNING: Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.	
LEGAL NAME OF INVENTOR	
Inventor:	Srivatsav VENKATESAN
Signature:	<i>S. Venkatesan</i>
Date (Optional):	12/21/2015
Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA/01 form for each additional inventor.	

The collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEE OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-6195 and select option 2.

IMM631

PTO/AIA/01 (06-12)

Approved for use through 01/31/2014 OMB 1651-0032

U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

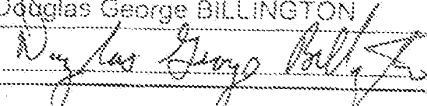
**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN
APPLICATION DATA SHEET (37 CFR 1.76)**

Title of Invention	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
As the below named inventor, I hereby declare that: This declaration is directed to: ☒ The attached application, or ☐ United States application or PCT international application number _____ filed on _____ The above-identified application was made or authorized to be made by me. I believe that I am the original inventor or an original joint inventor of a claimed invention in the application. I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both. WARNING: Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.	
LEGAL NAME OF INVENTOR	
Inventor: <u>Kaniyal SHAH</u> Date (Optional): _____ Signature: <u>[Signature]</u>	
Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA/01 form for each additional inventor.	

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to be used by the USPTO in processing an application. Confidentiality is preserved by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO 9199 and select option 2.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
As the below named inventor, I hereby declare that: This declaration is directed to: ☒ The attached application, or ☐ United States application or PCT international application number _____ filed on _____ The above-identified application was made or authorized to be made by me. I believe that I am the original inventor or an original joint inventor of a claimed invention in the application. I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both. WARNING: Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.	
LEGAL NAME OF INVENTOR	
Inventor: Douglas George BILLINGTON	
Signature:  Date (Optional): _____	
Note: An application data sheet (PTO/AIA/BI or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA/BI form for each additional inventor.	

This collection of information is required by 35 U.S.C. 116 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing this form, call 1-800-PTO-0198 and select option 2.

IMM631

PTO/AIA/1 (06-12)

Approved for use through 01/31/2014. OMB 0851-0052

U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
As the below named inventor, I hereby declare that: This declaration is directed to: ☒ The attached application, or ☐ United States application or PCT international application number _____ filed on _____ The above-identified application was made or authorized to be made by me. I believe that I am the original inventor or an original joint inventor of a claimed invention in this application. I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both. WARNING: Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identify them. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.	
LEGAL NAME OF INVENTOR	
Inventor: Aaron KAPELUS	
Date (Optional): 12/22/2013	
Signature: <i>Aaron Kapelus</i>	
Note: An application data sheet (PTO/AIA/1 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/AIA/1 form for each additional inventor.	

This collection of information is required by 35 U.S.C. 118 and 37 CFR 1.63. The information is required to obtain or retain a patent by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete the form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1480, Alexandria, VA 22313-1480, DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1480, Alexandria, VA 22313-1480.

If you need assistance in completing the form, call 1-800-PTO-5118 and select option 2.

IMM631

PTO/AIA/D1 (08-12)
 Approved for use through 01/31/2014. OMB B061-0032
 U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
 Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN
 APPLICATION DATA SHEET (37 CFR 1.76)**

Title of Invention	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
-----------------------	--

As the below named inventor, I hereby declare that:

This declaration is directed to: ☒ The attached application, or
☐ United States application or PCT international application number _____
 filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Stephen RANK Date (Optional): 12/21/2015
 Signature: *Stephen Rank*

Note: An application data sheet (PTO/AIA/D1 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/AIA/D1 form for each additional inventor.

This collection of information is required by 35 U.S.C. 118 and 37 CFR 1.53. The information is required to obtain or retain a benefit by the public which is to be (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1480, Alexandria, VA 22313-1480. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-6198 and select option 2.

EX1002-19

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
As the below named inventor, I hereby declare that:	
This declaration is directed to: ☒ The attached application, or	
☐ United States application or PCT international application number _____	
Filed on _____	
The above-identified application was made or authorized to be made by me.	
I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.	
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.	
WARNING:	
Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.	
LEGAL NAME OF INVENTOR	
Inventor: <u>Daniel PARKER</u>	Date (Optional): <u>12/22/15</u>
Signature: <u>[Signature]</u>	
Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA/1 form for each additional inventor.	

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1460, Alexandria, VA 22313-1460. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1460, Alexandria, VA 22313-1460.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

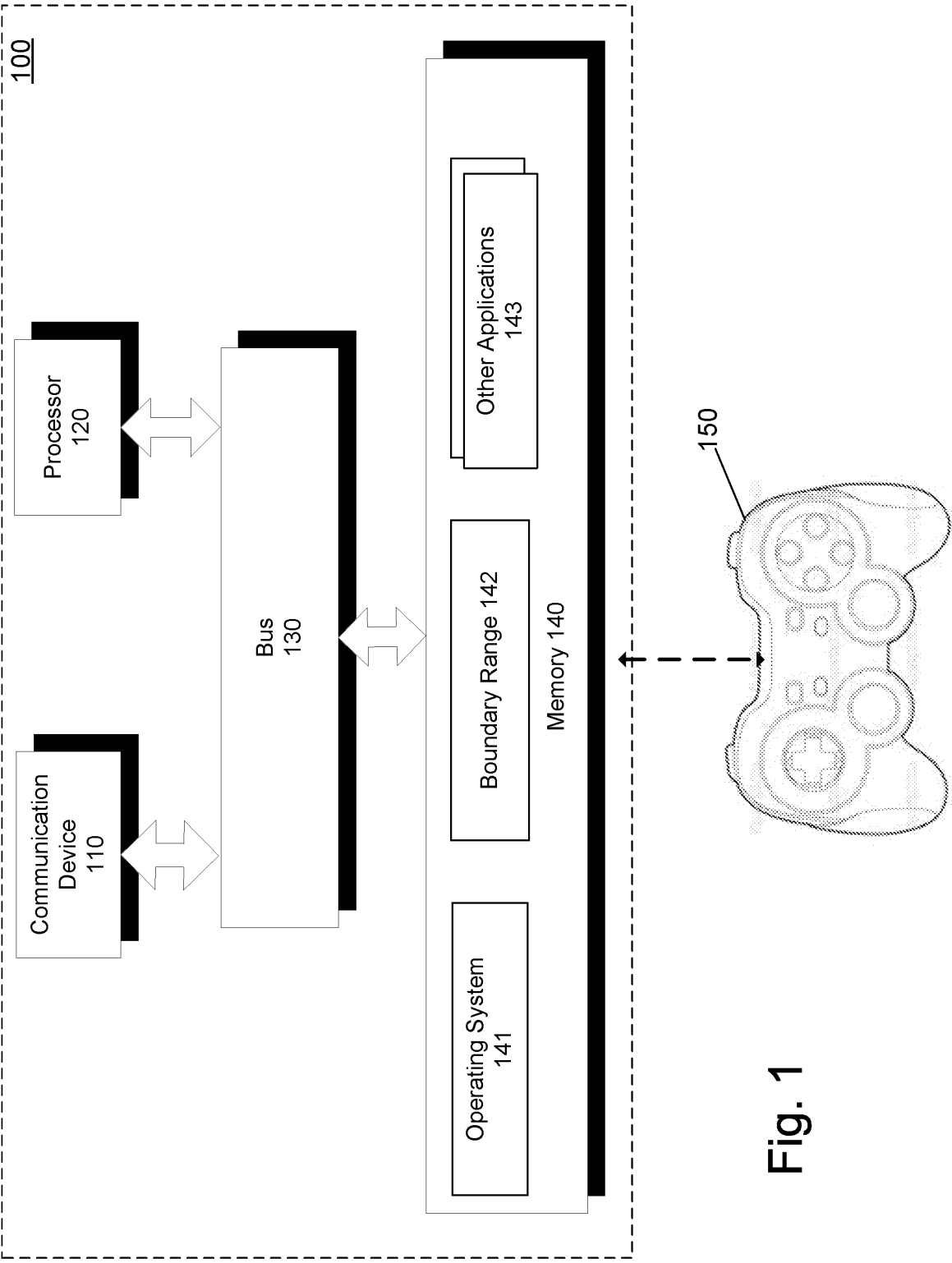
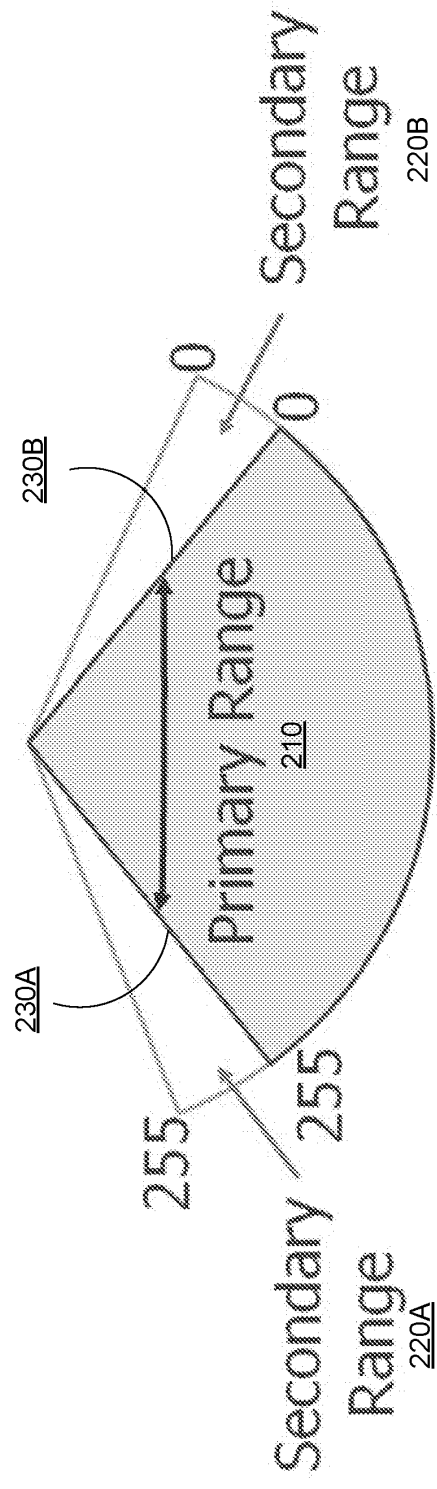


Fig. 1

Fig. 2



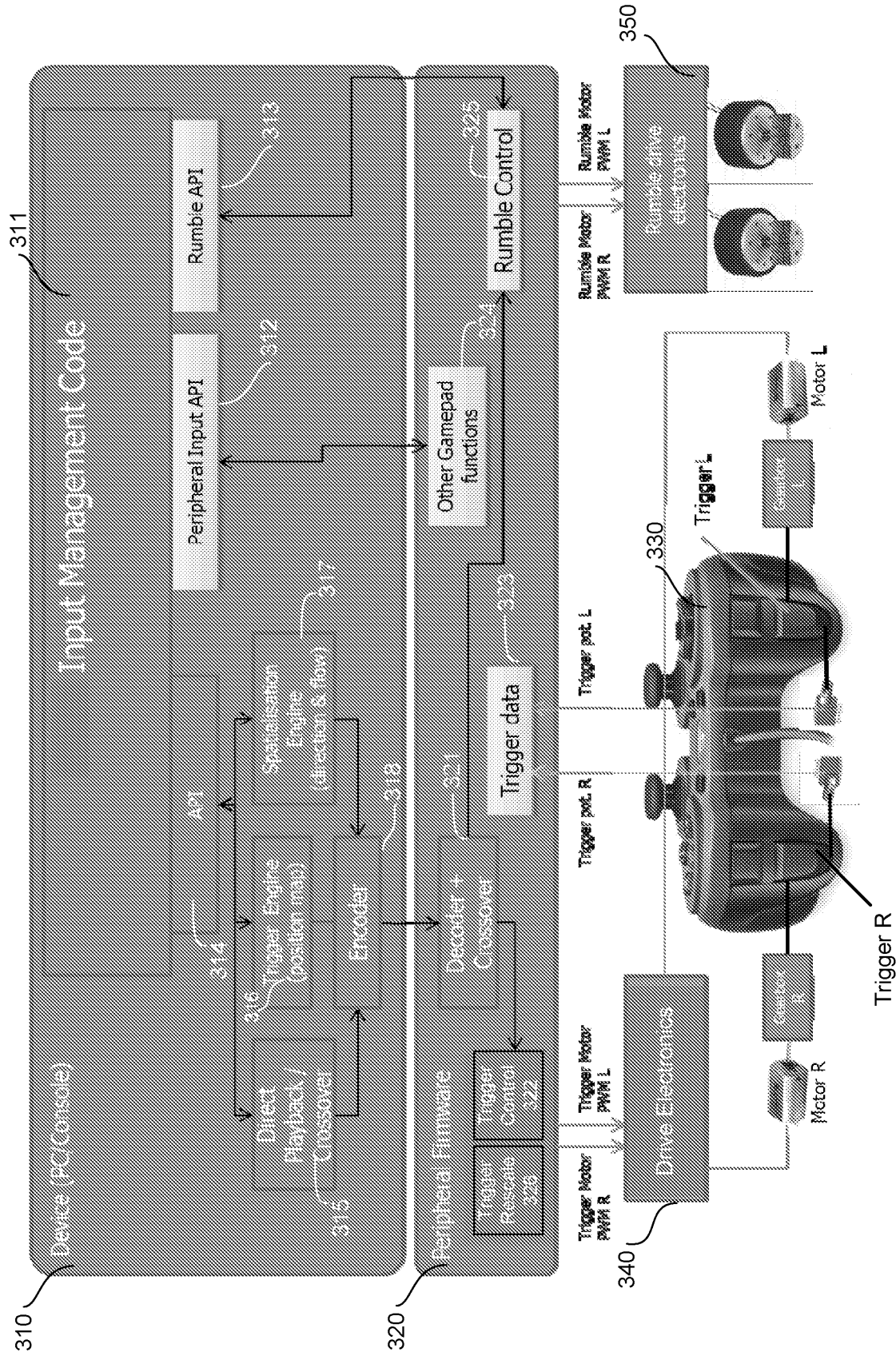


Fig. 3
300

Fig. 4
400

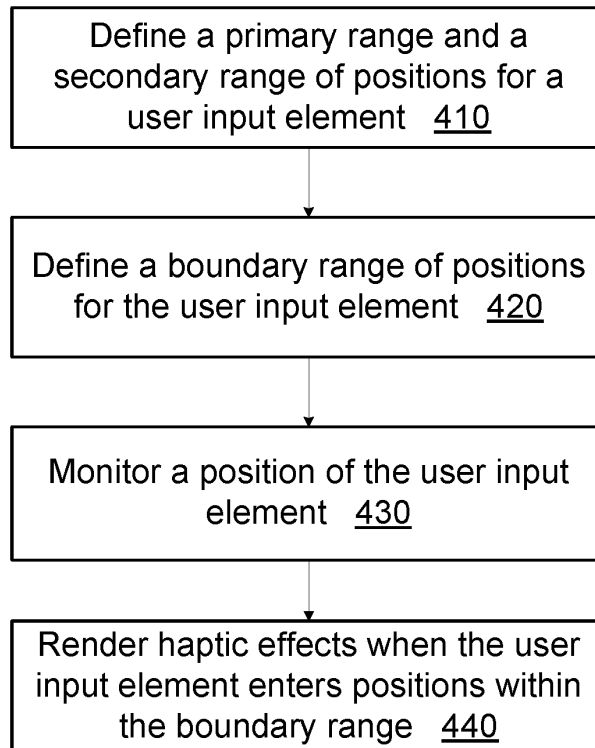
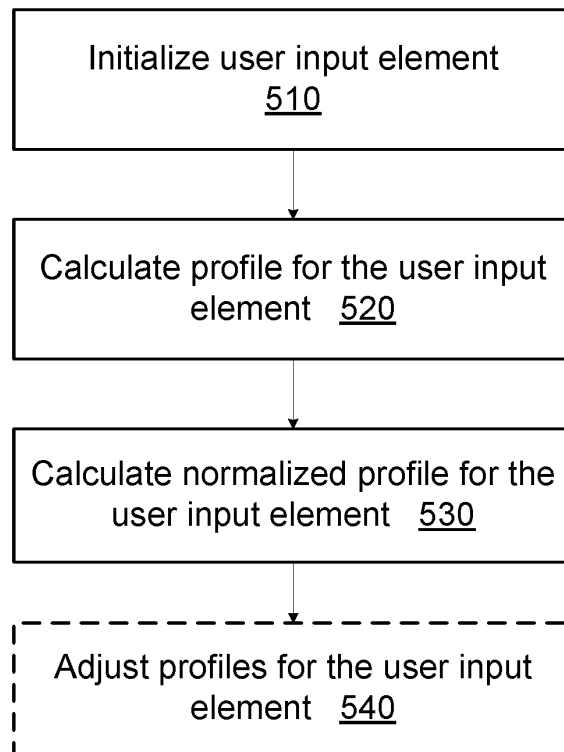
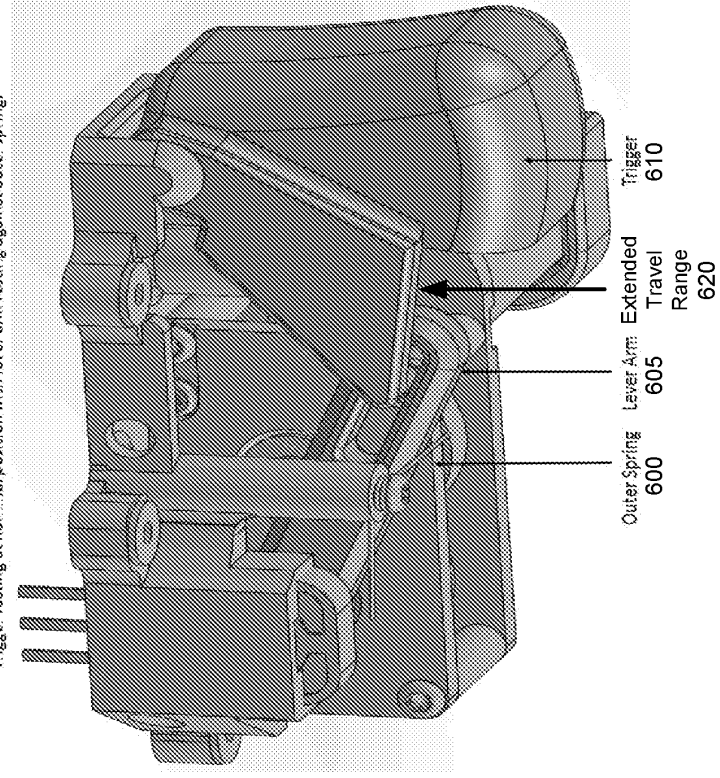


Fig. 5
500



601

Trigger resting at nominal position with lever arm resting against outer spring.



602

Trigger pushing against outer spring to move to its maximum outward position.

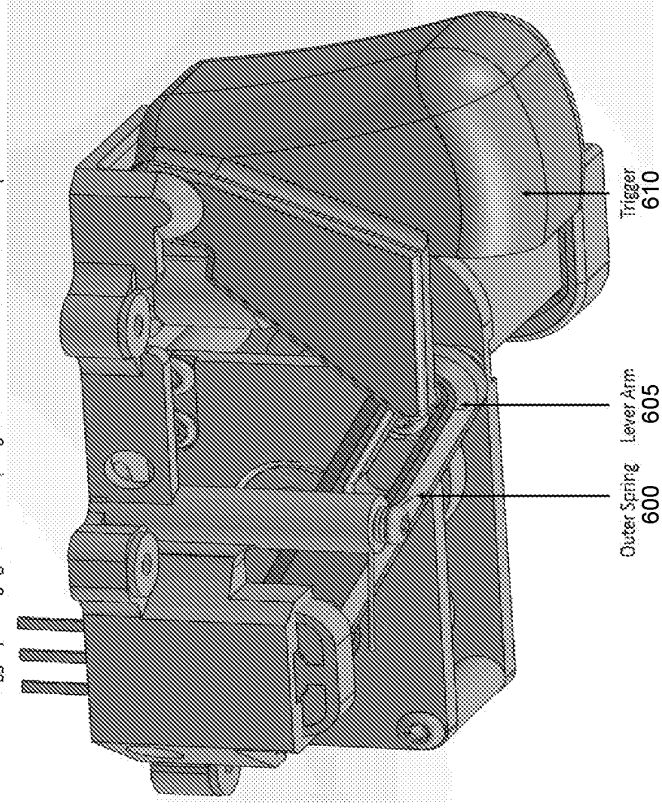
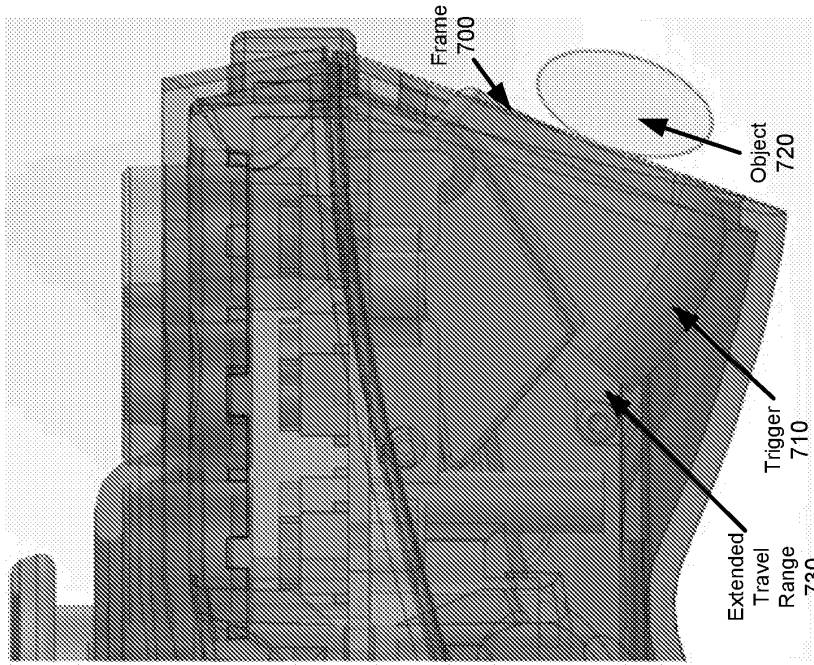


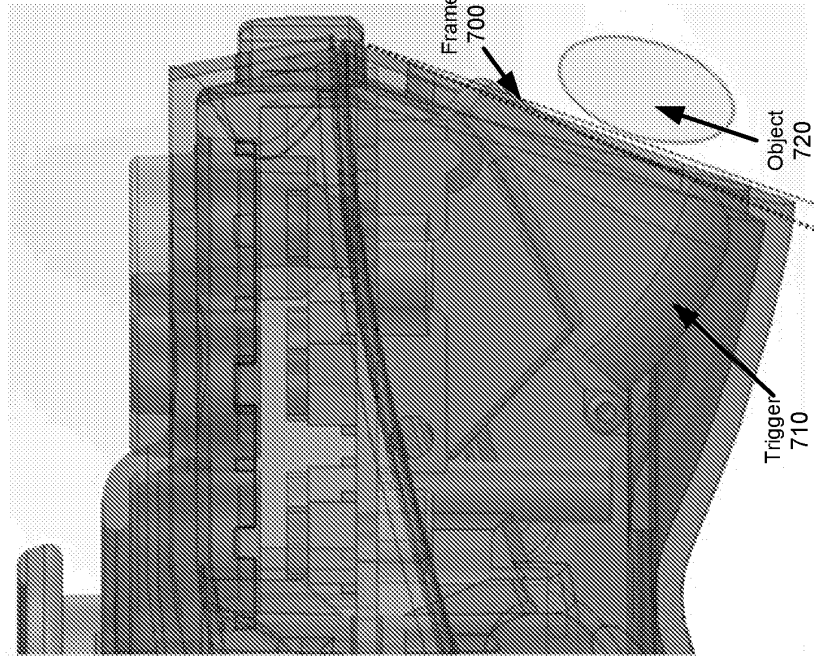
Fig. 6

701



View of trigger with user's finger bottoming out on the housing. The trigger can still rotate into the housing.

702



View of trigger with user's finger bottoming out on the housing and trigger bottoming out inside the casing.

Fig. 7

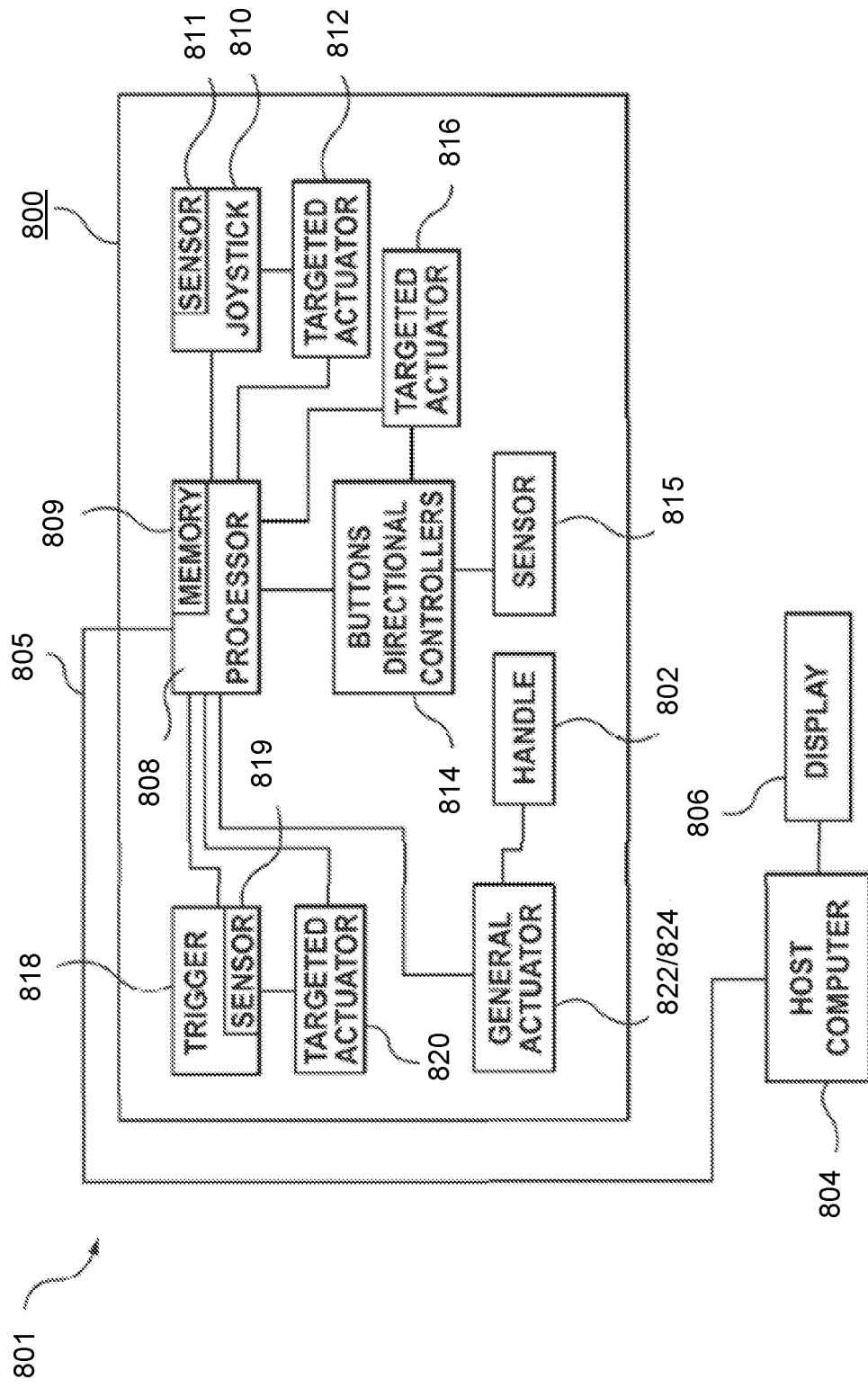


Fig. 8

Fig. 9A

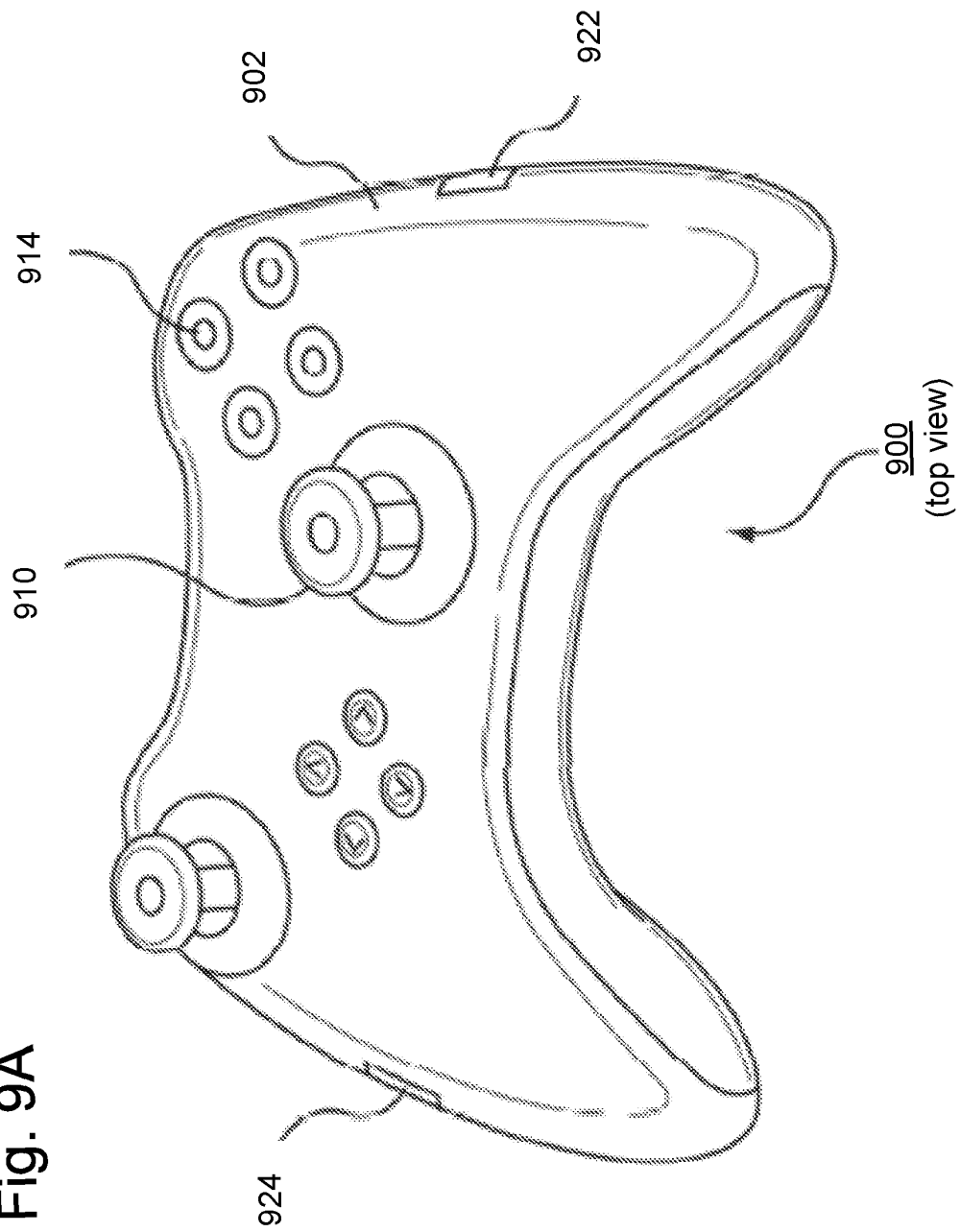
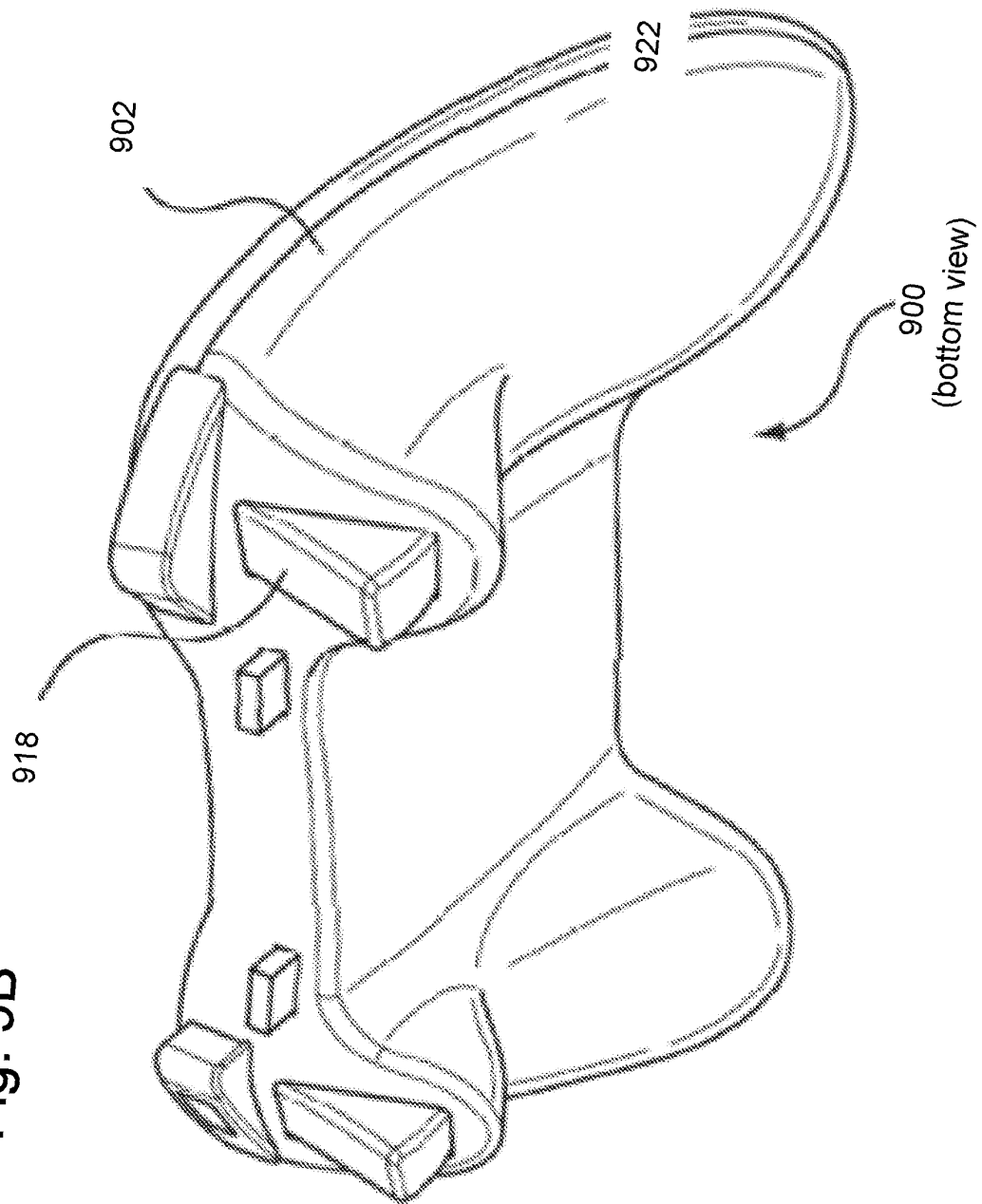


Fig. 9B



**Attorney Docket No.
T9047-22090US02; IMM631C1**

UNITED STATES PATENT APPLICATION

FOR

**POSITION CONTROL OF A USER INPUT ELEMENT
ASSOCIATED WITH A HAPTIC OUTPUT DEVICE**

INVENTORS:

**SRIVATSAV VENKATESAN
KANIYALAL SHAH
DOUGLAS GEORGE BILLINGTON
STEPHEN RANK
DANIEL PARKER
AARON KAPELUS**

PREPARED BY:

MILES & STOCKBRIDGE P.C.

ASSIGNEE: **IMMERSION CORPORATION
50 RIO ROBLES
SAN JOSE, CA 95134**

**POSITION CONTROL OF A USER INPUT ELEMENT
ASSOCIATED WITH A HAPTIC OUTPUT DEVICE**

PRIORITY APPLICATION

[0001] This application is a continuation of U.S. Patent Application No. 14/979,321, filed on December 22, 2015, which claims the benefit of U.S. Provisional Patent Application No. 62/096,251, filed on December 23, 2014, both of which have been incorporated herein by reference in their entirety.

FIELD OF INVENTION

[0002] The embodiments are generally directed to electronic devices, and more particularly, to electronic devices that produce haptic effects.

BACKGROUND

[0003] Video games and video game systems have become extremely popular. Video game devices or controllers typically use visual and auditory cues to provide feedback to a user. In some interface devices, kinesthetic feedback (e.g., active and resistive force feedback) and/or tactile feedback (e.g., vibration, texture, temperature variation, and the like) may be provided to the user. In general, such feedback is collectively known as “haptic feedback” or “haptic effects.” Haptic feedback provides cues that enhance and simplify a user’s interaction with a video game controller, or other electronic device. For example, haptic effects may provide cues to users of video game controllers or other electronic devices to alert the user to specific events, or

provide realistic feedback to create greater sensory immersion within a simulated or virtual environment.

[0004] Other devices in which a user interacts with a user input element to cause an action also may benefit from haptic feedback or haptic effects. For example, such devices may include medical devices, automotive controls, remote controls, and other similar devices.

SUMMARY OF THE INVENTION

[0005] Embodiments of the present invention are directed toward electronic devices configured to produce haptic effects that substantially improve upon the related art.

[0006] Features and advantages of the embodiments are set forth in the description which follows, or will be apparent from the description, or may be learned by practice of the invention.

[0007] In one example, functionality for rendering a haptic effect at a user input element associated with a haptic output device is provided. A primary range and a secondary range of positions are defined for the user input element associated with the haptic output device. In addition, a boundary range of positions is defined for the user input element associated with the haptic output device, the boundary range partially overlapping each of the primary and secondary ranges. A position of the user input element is monitored, and the haptic effect is rendered in response to an entry of the user input element to positions within the boundary range.

[0008] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are not intended to limit the invention to the described examples.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Further embodiments, details, advantages, and modifications will become apparent from the following detailed description of the preferred embodiments, which is to be taken in conjunction with the accompanying drawings.

[0010] Fig. 1 illustrates a block diagram of a system according to an example embodiment of the present invention.

[0011] Fig. 2 is a simplified schematic illustrating a range of motion for a user input element according to an example embodiment of the present invention.

[0012] Fig. 3 illustrates a block diagram of a haptic effect software stack according to an example embodiment of the present invention.

[0013] Fig. 4 illustrates a flow diagram of functionality for controlling a user input element associated with a haptic output device according to an example embodiment of the present invention.

[0014] Fig. 5 illustrates a flow diagram of functionality for controlling a user input element associated with a haptic output device according to another example embodiment of the present invention.

[0015] Fig. 6 illustrates a controller that includes an outer spring that creates an open extended travel range for a trigger to move within when the trigger is in a maximum

open position outside of the open extended travel range, according to an example embodiment of the present invention.

[0016] Fig. 7 illustrates a controller that includes an extended frame that creates a closed extended travel range for a trigger to move within when the trigger is in a maximum closed position outside of the closed extended travel range, according to an example embodiment of the invention.

[0017] Fig. 8 illustrates a functional block diagram of a controller suitable for use with the embodiments of the present invention.

[0018] Figs. 9A and 9B illustrate different views of a controller suitable for use with the embodiments of the present invention.

DETAILED DESCRIPTION:

[0019] Example embodiments are directed toward systems and methods for controlling a boundary range of a user input element associated with a haptic output device. For example, a haptic effect may be rendered when the user input element is positioned in the boundary range. The boundary range of positions is defined for the user input element so as to partially overlap each of a primary and secondary range of positions. As the position of the user input element is monitored, the haptic effect may be rendered in response the user input element entering positions within the boundary range.

[0020] In the various embodiments, a variety of user interfaces and methods for using a device are described. In some embodiments, the device is a portable electronic device (e.g., a game controller, console, mobile phone, smartphone, tablet, etc.). It

should be understood, however, that the user interfaces and associated methods may be applied to numerous other devices, such as personal computers, medical devices, laptops, and the like that may include one or more other physical user-interface devices, such as a keyboard, mouse, trackball and the like.

[0021] Fig. 1 illustrates a block diagram of a system 100 according to an example embodiment of the present invention.

[0022] System 100 may include a communication device 110 configured to transmit and/or receive data from remote sources. Communication device 110 may enable connectivity between a processor 120 and other devices by encoding data to be sent from processor 120 to another device over a network (not shown) and decoding data received from another system over the network for processor 120.

[0023] For example, communication device 110 may include a network interface card that is configured to provide wireless network communications. A variety of wireless communication techniques may be used including infrared, radio, Bluetooth, Wi-Fi, and/or cellular communications. Alternatively, communication device 110 may be configured to provide wired network connection(s), such as an Ethernet connection.

[0024] Processor 120 may comprise one or more general or specific purpose processors to perform computation and control functions of system 100. Processor 120 may include a single integrated circuit, such as a micro-processing device, or may include multiple integrated circuit devices and/or circuit boards working in cooperation to accomplish the functions of processor 120. In addition, processor 120 may execute computer programs, such as an operating system 141, boundary range module 142, and other applications 143, stored within memory 140.

[0025] System 100 may include memory 140 for storing information and instructions for execution by processor 120. Memory 140 may contain various components for retrieving, presenting, modifying, and storing data. For example, memory 140 may store software modules that provide functionality when executed by processor 120. The modules may include operating system 141 that provides operating system functionality for system 100. The modules may further include the boundary range module 142 that controls the boundary range of user input elements of controller 150. For example, boundary range module 142 may monitor the position of user input elements and render haptic effects in response the user input elements entering positions within respective boundary ranges. System 100 also may include one or more additional application modules 143 that include additional functionality, such as peripheral firmware configured to provide control functionality for a peripheral device, such as controller 150 (e.g., a gamepad, wearable device, etc.).

[0026] Non-transitory memory 140 may include a variety of computer-readable media that may be accessed by processor 120. In the various embodiments, memory 140 may include volatile and nonvolatile media, removable and non-removable media. For example, memory 140 may include any combination of random access memory ("RAM"), dynamic RAM ("DRAM"), static RAM ("SRAM"), read only memory ("ROM"), flash memory, cache memory, and/or any other type of non-transitory computer-readable media. Alternatively, or additionally, memory 140 may include one or more network or cloud accessible storage media.

[0027] Although shown as a single system, the functionality of system 100 may be implemented as a distributed system. For example, memory 140 and processor 120

may be distributed across multiple different computers that collectively comprise system 100. In one embodiment, system 100 may be part of a device (e.g., personal computer, console, video game console, etc.), and system 100 provides haptic effect functionality for the device. In another embodiment, system 100 may be separate from the device, and may remotely provide the aforementioned functionality for the device.

[0028] System 100 may be operably connected to controller 150. Controller 150 may be a peripheral device configured to provide input to the system 100. Controller 150 may be operably connected to system 100 using either a wireless connection or a wired connection. Controller 150 also may include a local processor configured to communicate with system 100 using either a wireless connection or a wired connection. Alternatively, controller 150 may be configured to not include a local processor, and all input signals and/or output signals associated with controller 150 may be processed by the components of system 100. In embodiments in which controller 150 has a local processor, additional functionality, such as boundary range modules and peripheral firmware configured to provide control functionality may reside within controller 150.

[0029] Controller 150 may further include one or more digital buttons, one or more analog buttons, one or more bumpers, one or more directional pads, one or more analog or digital sticks, one or more driving wheels, and/or one or more user input elements that can be interacted with by a user, and that can provide input to system 100. Controller 150 may also include one or more analog or digital trigger buttons (or “triggers”) that can further be interacted with by the user, and that can further provide input to system 100. As is described below in greater detail, controller 150 can further

include a motor, or another type of actuator or haptic output device, configured to exert a bi-directional push/pull force on at least one trigger of controller 150.

[0030] Controller 150 can also include one or more actuators, or other types of haptic output devices. The local processor of controller 150, or processor 120 in embodiments where controller 150 does not include a local processor, may transmit a haptic signal associated with a haptic effect to at least one actuator of controller 150. The actuator, in turn, outputs haptic effects such as vibrotactile haptic effects, kinesthetic haptic effects, or deformation haptic effects, in response to the haptic signal. The haptic effects can be experienced at a user input element (*e.g.*, a digital button, analog button, bumper, directional pad, analog or digital stick, driving wheel, or trigger) of controller 150. Alternatively, the haptic effects can be experienced at an outer surface of controller 150.

[0031] An actuator is an example of a haptic output device, where a haptic output device is a device configured to output haptic effects, such as vibrotactile haptic effects, electrostatic friction haptic effects, temperature variation, and/or deformation haptic effects, in response to a drive signal. In alternate embodiments, the one or more actuators within controller 150 can be replaced by some other type of haptic output device. The haptic output device may be, for example, an electric motor, an electro-magnetic actuator, a voice coil, a shape memory alloy, an electro-active polymer, a solenoid, an eccentric rotating mass motor ("ERM"), a harmonic ERM motor ("HERM"), a linear resonant actuator ("LRA"), a piezoelectric actuator, a high bandwidth actuator, an electroactive polymer ("EAP") actuator, an electrostatic friction display, or an ultrasonic vibration generator. In some instances, the haptic output device may include

haptic output drive circuit. In some embodiments, the haptic output device may be unidirectional or bidirectional.

[0032] Controller 150 may further include one or more speakers. The local processor of controller 150, or processor 120 in embodiments where controller 150 does not include a local processor, may transmit an audio signal to at least one speaker of controller 150, which in turn outputs audio effects. The speaker may be, for example, a dynamic loudspeaker, an electrodynamic loudspeaker, a piezoelectric loudspeaker, a magnetostrictive loudspeaker, an electrostatic loudspeaker, a ribbon and planar magnetic loudspeaker, a bending wave loudspeaker, a flat panel loudspeaker, a heil air motion transducer, a plasma arc speaker, and a digital loudspeaker.

[0033] Controller 150 can further include one or more sensors. A sensor may be configured to detect a form of energy, or other physical property, such as, but not limited to, sound, movement, acceleration, bio signals, distance, flow, force/pressure/strain/bend, humidity, linear position, orientation/inclination, radio frequency, rotary position, rotary velocity, manipulation of a switch, temperature, vibration, or visible light intensity. The sensor may further be configured to convert the detected energy, or other physical property, into an electrical signal, or any signal that represents virtual sensor information, and controller 150 can send the converted signal to the local processor of controller 150, or processor 120 in embodiments where controller 150 does not include a local processor.

[0034] Fig. 2 is a simplified schematic illustrating a range of motion 200 for a user input element according to an example embodiment of the present invention. Although

range of motion 200 relates to a trigger input element, the embodiments of the invention may be readily applied to a variety of user input element types.

[0035] As shown in Fig. 2, range of motion 200 may include a primary range 210 and secondary ranges 220A, 220B. In addition, boundary ranges 230A, 230B may be defined so as to partially overlap primary range 210 and secondary ranges 220A, 220B. In some instances, primary range 210 may be extended to render haptic effects within secondary ranges 220A, 220B and/or boundary ranges 230A, 230B. For example, the user input elements may be pulled further in and/or pushed further out while haptic output devices render the haptic effects.

[0036] In some embodiments, primary range 210 and secondary ranges 220A, 220B may be fixed or variable. For example, secondary range 220A may have a range of motion of 7 degrees from a maximum outward position to a nominal position, primary range 210 may have a range of motion of 29 degrees from the nominal position to a finger grounding position, and secondary range 220B may have a range of motion of 3 degrees from the finger grounding position to a trigger grounding position. In this example, range of motion 200 may total 39 degrees (7+29+3).

[0037] When no haptic effect is being applied, movement of the user input element may be limited to primary range 210. However, when haptic effects are applied, movement of the user input element may be extended to secondary ranges 220A, 220B and/or boundary ranges 230A, 230B. In either case, the position of the user input element may be represented as analog to digital conversion ("ADC") data, such as 8 bit ADC data having a range of values between 0 and 255. Although 8 bit position data is

provided as an example, the embodiments are not so limited. Higher resolution position data, such as 16 bit position data, may also be used.

[0038] Fig. 3 illustrates a block diagram of a haptic effect software stack 300 according to an example embodiment of the present invention. As shown in Fig. 3, software stack 300 includes device modules 310, peripheral firmware modules 320, controller modules 330, drive modules 340, and rumble drive modules 350. Haptic effect software stack 300 is implemented on a system, such as system 100 of Fig. 1.

[0039] Device modules 310 may include a variety of modules such as input management code 311, peripheral input application programming interface ("API") 312, rumble API 313, haptic effect API 314, direct playback/crossover 315, trigger engine 316, spatialization engine 317, and encoder 318.

[0040] Input management code 311 may include a set of computer-readable instructions that manage input provided by controller 330 in the context of a game application, or other type of application, executed within a device.

[0041] Peripheral input API 312 may include a set of computer-readable functions or routines that enable game input management code 311 to interact with peripheral firmware 320 in order to receive and manage input provided by controller 330.

[0042] Rumble API 313 may include a set of computer-readable functions or routines that enable input management code 311 to interact with peripheral firmware 320 in order to transmit rumble instructions to one or more rumble motors or rumble actuators of controller 330 (e.g., rumble motors L and R of Fig. 3). In addition, a rumble instruction may cause a rumble motor or rumble actuator of controller 330 to produce a general or rumble haptic effect.

[0043] Haptic effect API 314 (identified in Fig. 3 as “API”) may include a set of computer-readable functions or routines that are accessible to input management code 311, and that enable input management code 311 to interact with peripheral firmware 320 in order to transmit haptic instructions to controller 330. In addition, a haptic instruction may cause one or more targeted motors or targeted actuators of controller 330 to produce a haptic effect at one or more user input elements of controller 330.

[0044] Haptic effect API 314 also may store one or more haptic effect definitions. A haptic effect definition is a data structure that includes haptic data, such as a haptic signal, that is pre-defined and that can be stored within a storage, such as a haptic file or haptic stream, and that can be sent to one or more rumble motors, rumble actuators, targeted motors, or targeted actuators, to produce a haptic effect at a component, or user input element, of controller 330. The haptic data can include one or more attributes of the corresponding haptic effect, where the attributes can be stored as parameters. Example parameters of a haptic effect definition may include an amplitude parameter, a frequency parameter, a waveform parameter, an envelope parameter, a magnitude (or strength) parameter, and a duration parameter.

[0045] Haptic effect API 314 may enable game input management code 311 to interact with direct playback/crossover 315, trigger engine 316, and spatialization engine 317, and may further manage direct playback/crossover 315, trigger engine 316, and spatialization engine 317 according to requests invoked by game input management code 311. Further, haptic effect API 314 may store data used for communication with peripheral firmware 320, and used for generation of one or more haptic effects.

[0046] Direct playback/crossover 315 may receive haptic data as input, produce haptic data as output, and transmit haptic data to one or more targeted motors, or targeted actuators, of controller 330 (e.g., motors L and R of Fig. 3). In some embodiments, direct playback/crossover 315 may output the input haptic data directly, without modifying a format of the input haptic data. This results in an “as-is” playback of the input haptic data. In other embodiments, direct playback/crossover 315 may convert the haptic data that is input from a first format to a second format, and can further output the converted haptic data. Depending on the type of playback, direct playback/crossover 315 may optionally use a programmable crossover to convert the haptic data. By converting the haptic data, device modules may deconstruct the haptic effect and playback the haptic effect at multiple actuators.

[0047] The format of the haptic data may be a haptic elementary stream (“HES”) format. A HES format is a file or data format for representing haptic data that may be streamed to a device. The haptic data can be represented in a manner that is identical or similar to how uncompressed sound is represented, although the haptic data can be encrypted within the HES format.

[0048] Trigger engine 316 may receive haptic data, such as a haptic effect definition, and may modify the haptic data based on user input data, such as trigger data 323. Trigger data is data that includes one or more parameters that indicate a position and/or range of one or more triggers of controller 330 (e.g., triggers L and R of Fig. 3). Trigger engine 316 may further transmit haptic instructions to controller 330. For example, trigger engine 316 may transmit haptic instructions to a variety of user-input elements of controller 330. As previously described, a haptic instruction may cause one or more

targeted motors or targeted actuators of controller 330 to produce a haptic effect at one or more user-input elements of controller 330.

[0049] Spatialization engine 317 may receive haptic data and may modify the haptic data based on spatialization data. Spatialization data may include data that indicates a desired direction and/or flow of a haptic effect, such as an ordering of haptic effects on respective user input elements. In certain embodiments, spatialization engine 317 may receive spatialization data that includes a direction and/or flow from input management code 311.

[0050] Spatialization engine 317 may modify the haptic data so that a haptic effect, such as a trigger haptic effect, is scaled for one or more rumble motors, or rumble actuators, of controller 330 (*e.g.*, rumble motors L and R of Fig. 3), and that the haptic effect is also scaled for one or more targeted motors, or targeted actuators, of controller 330 (*e.g.*, motors L and R, as illustrated in Fig. 3). In other words, spatialization engine 317 may modify the haptic data that is sent to each motor or actuator, and thus, modify the haptic effect that is experienced at each motor or actuator, in order to convey a sense of direction and flow of an overall haptic effect. For example, in order to emphasize a haptic effect experienced at a motor or actuator, spatialization engine 317 may scale one or more portions of the haptic effect. For example, spatialization engine 317 may scale haptic data that is sent to the motor or actuator that causes the haptic effect to be experienced, causing the haptic effect to be more pronounced (*e.g.*, increased magnitude, duration, etc.). Additionally, spatialization engine 317 may scale haptic data that is sent to other motors or actuators, causing other haptic effects that are experienced at those motors or actuators to be less pronounced (*e.g.*, decreased

magnitude, duration, etc.). In some embodiments, spatialization engine 317 may modify the haptic data in real-time or substantially in real time. Further, in some embodiments, spatialization engine 317 may have non-linear relationships between inputs and motor, or actuator, outputs in order to exaggerate an overall haptic effect.

[0051] Encoder 318 encodes haptic data received from direct playback/crossover 315, trigger engine 316, and/or spatialization engine 317 into a format. In one embodiment, the format may be an HES format. Encoder 318 may transmit the encoded haptic data to peripheral firmware 320.

[0052] Peripheral firmware 320 is firmware for one or more peripheral devices (e.g., controllers). Peripheral firmware 320 may include a variety of modules such as decoder and crossover 321, trigger control 322, trigger data 323, other functions 324, and rumble control 325.

[0053] Decoder and crossover 321 may receive the encoded haptic data from encoder 318 and decodes the encoded haptic data. In some embodiments, decoder and crossover 321 computes a programmable crossover in order to decode the encoded haptic data. Decoder and crossover 321 may compute the programmable crossover in real-time.

[0054] Trigger control 322 is a low-level control API for one or more targeted motors or targeted actuators of controller 330 (e.g., motors L and R of Fig. 3). Trigger control 322 may receive a trigger instruction and may convert the trigger instruction into a low-level trigger instruction for a specified targeted motor or targeted actuator of controller 330, and may transmit the low-level trigger instruction to the specified targeted motor or targeted actuator of controller 330. The low-level trigger instruction may cause the

specified targeted motor or targeted actuator to produce a trigger haptic effect at a specified trigger of controller 330.

[0055] Trigger data 323, as previously described, is data that includes one or more parameters that indicate a position and/or range of one or more triggers of controller 330 (e.g., triggers L and R of Fig. 3). Trigger data 323 may be received from controller 330 by peripheral firmware 320. Peripheral firmware 320 may further store trigger data 323, and may further transmit trigger data 323 to device modules 310.

[0056] Other gamepad functions 324 may be functions of controller 330 managed by peripheral firmware 320. Such functions may include such functions as wired/wireless communications, input reporting, protocol implementation, power management, etc.

[0057] Rumble control 325 is a low-level control API for one or more rumble motors or rumble actuators of controller 330 (e.g., rumble motors L and R of Fig. 3). Rumble control 325 may receive a rumble instruction, may convert the rumble instruction into a low-level rumble instruction for a specified rumble motor or rumble actuator of controller 330, and may transmit the low-level trigger instruction to the specified rumble motor or rumble actuator of controller 330.

[0058] Trigger rescale module 326 is a modular firmware module that monitors the positions of user input elements and the status of their respective haptic output devices in controller 330. For example, trigger rescale module 326 rescales the user inputs to a range expected by the host device. In some instances, trigger rescale module 326 may rescale the user inputs to a range [0,127]. In other instances, trigger rescale module 326 may rescale the user inputs to a range [0,255]. In the various configurations, trigger rescale module 326 may be applied to any analog input. In some instances,

sections of firmware that are hardware independent may be separated from the sections that are hardware dependent. Here, hardware independent firmware may interact with the hardware dependent firmware by using function pointers.

[0059] Controller 330 may include triggers L and R. Controller 330 may further include gear boxes L and R and motors L and R. Motor L and gearbox L are operably coupled to trigger L within controller 330. Likewise, motor R and gearbox R are operably coupled to trigger R within controller 330. When motor L receives a trigger instruction, motor L and gearbox L may collectively cause a trigger haptic effect to be experienced at trigger L. Likewise, when motor R receives a trigger instruction, motor R and gearbox R may collectively cause a trigger haptic effect to be experienced at trigger R. Peripheral firmware 320 may send trigger instructions to motors L and R of controller 330 using drive electronics 340.

[0060] Controller 330 may further include potentiometers L and R. Potentiometer L may detect a position and/or range of trigger L, and may further send the detected position and/or range of trigger L to peripheral firmware 320 as trigger data. Likewise, potentiometer R may detect a position and/or range of trigger R, and may further send the detected position and/or range of trigger R to peripheral firmware 320 as trigger data.

[0061] Controller 330 may further include rumble motors L and R. When rumble motor L receives a rumble instruction, rumble motor L causes a haptic effect to be experienced along a left component of controller 330. Likewise, when rumble motor R receives a rumble instruction, rumble motor R causes a haptic effect to be experienced

along a right component of controller 330. Peripheral firmware 320 may send rumble instructions to rumble motors L and R using rumble drive electronics 350.

[0062] Fig. 4 illustrates a flow diagram of functionality 400 for controlling a user input element associated with a haptic output device according to an example embodiment of the present invention. In some instances, the functionality of the flow diagram of Fig. 4 (and Fig. 5 below) may be implemented by software stored in memory or other computer readable or tangible media, and executed by a processor. In other embodiments, the functionality may be performed by hardware (e.g., through the use of an application specific integrated circuit ("ASIC"), a programmable gate array ("PGA"), a field programmable gate array ("FPGA"), etc.), or any combination of hardware and software.

[0063] At the outset, functionality 400 may define a primary range and a secondary range of positions for the user input element associated with the haptic output device, at 410. Next, at 420, functionality 400 may define a boundary range of positions for the user input element associated with the haptic output device, the boundary range partially overlapping each of the primary and secondary ranges. After the various ranges are defined, functionality 400 monitors the position of the user input element, at 430. Lastly, haptic effect(s) may be rendered when the user input element enters positions within the boundary range, at 440. Here, the haptic effect(s) may extend the position of the user input element into one of the secondary ranges. In addition, haptic instructions to render the haptic effect(s) may be generated by a software application, such as a gaming application. By employing functionality 400, the range and

capabilities of the user input elements are extended, and a wider range of haptic effects can be experienced by an end user.

[0064] Fig. 5 illustrates a flow diagram of functionality 500 for controlling a user input element associated with a haptic output device according to another example embodiment of the present invention.

[0065] At the outset, the user input elements of the controller may be initialized, at 510. Here, functionality 500 may initially set position and range information for the user input elements. For example, primary range, secondary range(s), and boundary range(s) may be initially set. In some instances, these values may be calculated based on the movement of the user input device from the maximum out position to the grounding position.

[0066] Next, functionality 500 calculates profiles for the user input elements, at 520. The calculated profiles may map each position of the user input device to an ADC value. For example, the calculated profiles of 520 may map each position of the user input device to an ADC value between 0 and 255.

[0067] The calculated profiles may utilize either an increasing or a decreasing profile. For example, an increasing profile will produce a value [0,255] when the position of the user input value is read from 8 bit ADC data. Similarly, a decreasing profile will produce a value [255,0] when read from 8 bit ADC data.

[0068] Subsequently, at 530, functionality 500 calculates a normalized profile. The normalized profile may be calculated by removing secondary and/or boundary ranges from the ADC data. For example, the calculated normalized profile of 530 may map

each position of the user input device, excluding secondary and/or boundary positions, to an ADC value between 0 and 255.

[0069] In some instances, the resting position of the user input elements may vary at different times. For example, after use of the various user input devices, some of the user input devices may not return to the same resting position when the user interaction is removed. In such instances, functionality 500 may adjust the calculated profile and the calculated normalized profiles for such user input elements, at 540. Accordingly, the changed resting position(s) may be accounted for while monitoring the position of the user input elements.

[0070] Fig. 6 illustrates a controller that includes an outer spring 600 that creates an open extended travel range 620 for a trigger 610 to move within when trigger 610 is in a maximum open position outside of open extended travel range 620, according to an embodiment of the invention. More specifically, Fig. 6 illustrates a controller that includes outer spring 600 that holds trigger 610 in a maximum open position outside of open extended travel range 620. When a force is applied to trigger 610, outer spring 600 can allow trigger 610 to rotate, or otherwise move, to open extended travel range 620. Fig. 6 includes views 601 and 602. In view 601, trigger 610 is in a maximum open position outside of open extended travel range 620, as trigger 610 can be pulled or pushed along an axis that is perpendicular to the illustrated plane of Fig. 6. In view 602, trigger 610 is in a maximum open position that is inside open extended travel range 620, where trigger 610 is further extended within open extended travel range 620, as trigger 610 can be pulled back in, but cannot be pushed out further along an axis that is perpendicular to the illustrated plane of Fig. 6. In the illustrated embodiment, outer

spring 600 is an example of a haptic diminishment prevention component, and is positioned between trigger 610 and an outer rotational hard stop, or an outer portion of a housing of the controller. A maximum open position outside of an extended travel range can be important for spatialization as a user can be lightly resting their fingers on triggers of a controller when receiving spatialization haptic effects. In order to increase a magnitude of a trigger haptic effect when a trigger (such as trigger 610) is in a maximum open position outside of an open extended travel range (such as open extended travel range 620), the trigger can be offset with an outer spring (such as outer spring 600) so that, when in the maximum open position outside of an open extended travel range, the trigger is able to move within the extended travel range in response to a force that is applied to the trigger.

[0071] View 601 is a view of the controller where outer spring 600 holds trigger 610 in a position such that trigger 610 is not resting at, or otherwise making contact with, an outer rotational hard stop, or an outer portion of a housing of the controller, when trigger 610 is in a maximum open position outside of open extended travel range 620. In other words, outer spring 600 creates open extended travel range 620, where open extended travel range 620 is a range that trigger 610 can rotate, or otherwise move, within, in response to a force that is produced by a targeted motor or actuator and applied to trigger 610. By creating open extended travel range 620, outer spring 600 can prevent trigger 610 from grounding on the outer rotational hard stop, or the outer portion of the housing, when trigger 610 rotates, or otherwise moves, in response to the force that is applied to trigger 610. This can increase a magnitude of a trigger haptic effect (e.g., kinesthetic haptic effect) experienced at trigger 610. In the illustrated embodiment,

outer spring 600 is a cantilever spring that includes lever arm 605, where lever arm 605 pushes against, or otherwise makes contact with, trigger 610 to hold trigger 610 in the aforementioned position. In an alternate embodiment, outer spring 600 can be a compression spring, bias spring, or some other type of spring, that pushes against, or otherwise makes contact with, trigger 610. Although various spring types may be used, the embodiments are not so limited, and other deformation mechanisms may be used.

[0072] View 602 is a view of the controller where a targeted motor or actuator applies a force to trigger 610, and trigger 610 rotates, or otherwise moves, in response to the force. As illustrated in view 602 of Fig. 6, trigger 610 rotates, or otherwise moves, into open extended travel range 620, and occupies at least a portion of open extended travel range 620. In the illustrated embodiment, trigger 610 pushes against, or otherwise makes contact with, lever arm 605. This moves lever arm 605 so that trigger 610 can rotate, or otherwise move, into extended travel range 620. In an alternate embodiment where outer spring 600 is a compression spring, bias spring, or another type of spring, trigger 610 can push against, or otherwise make contact with, outer spring 600, which can move outer spring 600 so that trigger 610 can rotate, or otherwise move, into open extended travel range 620.

[0073] In an alternate embodiment, outer spring 600 can be replaced with an inner spring. The inner spring can be positioned between trigger 610 and an inner rotational hard stop, or an inner portion of a housing of the controller. Further, the inner spring can pull trigger 610 such that trigger 610 is not resting at, or otherwise making contact with, an outer rotational hard stop, or an outer portion of a housing of the controller (i.e., such that extended travel range 620 is created). In this alternate embodiment, a

stiffness of inner spring can be calculated in order to avoid pulling trigger 610 so that trigger 610 is resting at, or otherwise making contact with, an inner rotational hard stop, or an inner portion of a housing of the controller.

[0074] Fig. 7 illustrates a controller that includes an extended frame 700 that creates a closed extended travel range 730 for a trigger 710 to move within when trigger 710 is in a maximum closed position outside of closed extended travel range 730, according to an embodiment of the invention. In the illustrated embodiment, extended frame 700 is an example of a haptic diminishment prevention component, and is an extension of an outer portion of a housing of the controller. As previously described, in a standard trigger design, a trigger haptic effect can be greatly diminished when a trigger (such as trigger 710) is in a maximum closed position (e.g., when a user fully presses the trigger so that the trigger is grounded to an inner portion of a housing). In order to increase a magnitude of a trigger haptic effect when the trigger is in a maximum closed position outside of a closed extended travel range, an extended frame (such as extended frame 700) can be used as grounding for an object (such as object 720) that moves the trigger. In this situation, even when the trigger has fully moved to a maximum closed position outside of the closed extended travel range, the trigger can still move against the object and a significant haptic feedback sensation can be generated at the trigger.

[0075] Fig. 7 includes views 701 and 702. View 701 is a view of the controller where object 720 (e.g., a user's finger) has pushed, pulled, or otherwise moved trigger 710, and where object 720 is grounded (i.e., bottomed out) on extended frame 700. Because object 720 is grounded on extended frame 700, trigger 710 is not resting at, or otherwise making contact with, an inner rotational hard stop, or an inner portion of a

housing of the controller, when trigger 710 is in a maximum closed position outside of closed extended travel range 730. In other words, extended frame 700 creates closed extended travel range 730, where closed extended travel range 730 is a range that trigger 710 can rotate, or otherwise move, within, in response to a force that is produced by a targeted motor or actuator and applied to trigger 710. By creating closed extended travel range 730, extended frame 700 can prevent trigger 710 from grounding on the inner rotational hard stop, or the inner portion of the housing, when trigger 710 rotates, or otherwise moves, in response to the force that is applied to trigger 710. This can increase a magnitude of a trigger haptic effect (e.g., kinesthetic haptic effect) experienced at trigger 710.

[0076] View 702 is a view of the controller where a targeted motor or actuator applies a force to trigger 710, and trigger 710 rotates, or otherwise moves, in response to the force. As illustrated in view 702 of Fig. 7, trigger 710 rotates, or otherwise moves, into closed extended travel range 730, and occupies at least a portion of closed extended travel range 730.

[0077] In an alternate embodiment, extended frame 700 can be replaced with an inner spring. The inner spring can be positioned between trigger 710 and an inner rotational hard stop, or an inner portion of a housing of the controller. Further, the inner spring can push trigger 710 where object 720 has pushed, pulled, or otherwise moved trigger 710 such that trigger 710 is not resting at, or otherwise making contact with, an inner rotational hard stop, or an inner portion of a housing of the controller (i.e., such that closed extended travel range 730 is created). In this alternate embodiment, a stiffness of inner spring can be calculated in order to provide sufficient resistance to

prevent trigger 710 from resting at, or otherwise making contact with, an inner rotational hard stop, or an inner portion of a housing of the controller.

[0078] Fig. 8 illustrates a functional block diagram of a controller 800 suitable for use with the embodiments of the present invention.

[0079] As illustrated in Fig. 8, controller 800 may include one or more of a variety of user input elements. A user input element may refer to any interface device manipulated by the user to interact with host computer 804. Example user input elements include analog or digital joy stick 810, button 814, trigger 818, and the like. As understood by one of ordinary skill in the art, one or more of each user input element may be included on controller 800. For example, the present description of trigger 818 does not limit controller 800 to a single trigger. Similarly, those skilled in the art understand that multiple analog or digital sticks, buttons, and other user input elements may be used.

[0080] Controller 800 may include local processor 808. Local processor 808 may exchange commands and data with host computer 804 via connection 805. Connection 805 may be a wired or wireless connection using one or more communication protocols known to those skilled in the art. In some instances, controller 800 may be alternatively configured to not include local processor 808. Here, input/output signals from controller 800 may be handled and processed directly by host computer 804. Host computer 804 may be a gaming device console and display device 806 may be screen which is operably coupled to the gaming device console. In some instances, host computer 804 and display device 806 may be combined into a single device.

[0081] Controller 800 may include targeted actuators 812, 816, 820 (e.g., motors) to directly drive each of the user input elements thereof as well as one or more general or rumble actuators 822, 824 operably coupled to housing 802 in a location where a hand of the user is generally located. More particularly, analog or digital stick 810 includes a targeted actuator or motor 812 operably coupled thereto, button 814 includes a targeted actuator or motor 816 operably coupled thereto, and trigger 818 includes a targeted actuator or motor 820 operably coupled thereto. In addition to a plurality of targeted actuators, controller 800 includes a position sensor operably coupled to each of the user input elements thereof. More particularly, analog or digital stick 810 includes a position sensor 811 operably coupled thereto, button 814 includes a position sensor 815 operably coupled thereto, and trigger 818 includes a position sensor 819 operably coupled thereto. Local processor 808 is operably coupled to targeted actuators 812, 816, 820 as well as position sensors 811, 815, 819 of analog or digital stick 810, button 814, and trigger 818, respectively. In response to signals received from position sensors 811, 815, 819, local processor 808 instructs targeted actuators 812, 816, 820 to provide directed or targeted kinesthetic effects directly to analog or digital stick 810, button 814, and trigger 818, respectively. Such targeted kinesthetic effects are discernible or distinguishable from general or rumble haptic effects produced by general actuators 822, 824 along the entire body of the controller. The collective haptic effects provide the user with a greater sense of immersion to the game as multiple modalities are being simultaneously engaged (e.g., video, audio, and haptics).

[0082] Figs. 9A and 9B illustrate different views of a controller 900 suitable for use with the embodiments of the present invention. As shown in Figs. 9A and Fig. 9B,

controller 900 may include a variety of components such as housing 902, analog or digital joy stick 910, button(s) 914, trigger 918, and rumble actuators 922 and 924.

[0083] Housing 902 is shaped to easily accommodate user gripping of controller 900. Controller 900 is an example embodiment of a controller, and the embodiments of the invention may be readily applied to other controller shapes.

[0084] Accordingly, the embodiments of the present invention extend the range and capabilities of user input elements. In addition, a wider range of haptic effects can be achieved by rendering the haptic effects at definable positions of the user input elements.

[0085] One having ordinary skill in the art will readily understand that the invention as discussed above may be practiced with steps in a different order, and/or with elements in configurations which are different than those which are disclosed.

Therefore, although the invention has been described based upon these preferred embodiments, it would be apparent to those of skill in the art that certain modifications, variations, and alternative constructions would be apparent, while remaining within the spirit and scope of the invention. In order to determine the metes and bounds of the invention, therefore, reference should be made to the appended claims.

WE CLAIM:

1. A method for rendering a haptic effect at a user input element associated with a haptic output device, the method comprising:
 - defining a primary range and a secondary range of positions for the user input element associated with the haptic output device;
 - defining a boundary range of positions for the user input element associated with the haptic output device, the boundary range partially overlapping each of the primary and secondary ranges;
 - monitoring a position of the user input element; and
 - rendering the haptic effect in response to an entry of the user input element to positions within the boundary range.

ABSTRACT

Systems and methods for rendering a haptic effect at a user input element associated with a haptic output device are provided. A primary range and a secondary range of positions are defined for the user input element associated with the haptic output device. In addition, a boundary range of positions is defined for the user input element associated with the haptic output device, the boundary range partially overlapping each of the primary and secondary ranges. A position of the user input element is monitored, and the haptic effect rendered in response to an entry of the user input element to positions within the boundary range.

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	
	Filing Date	2018-08-08
	First Named Inventor	Srivatsav VENKATESAN
	Art Unit	
	Examiner Name	
	Attorney Docket Number	T9047-22090US02; IMM631C1

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6020876		2000-02-01	Rosenberg et al.	
	2	6184868	B1	2001-02-06	Shahoian et al.	
	3	7490530	B2	2009-02-17	Ishikawa et al.	

If you wish to add additional U.S. Patent citation information please click the Add button.

Add

U.S.PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20050156892	A1	2005-07-21	Grant	
	2	20060142657	A1	2006-06-29	Quaid et al.	
	3	20060290662	A1	2006-12-28	Houston et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number			
	Filing Date		2018-08-08	
	First Named Inventor	Srivatsav VENKATESAN		
	Art Unit			
	Examiner Name			
	Attorney Docket Number	T9047-22090US02; IMM631C1		

	4	20110118032	A1	2011-05-19	Zalewski	
	5	20110260990	A1	2011-10-27	Ali et al.	
	6	20140043228	A1	2014-02-13	Grant et al.	
	7	20140315642	A1	2014-10-23	Grant et al.	
	8	20150130706	A1	2015-05-14	Lacroix et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	2008000345	JP	A	2008-01-10	Nintendo Co., Ltd.		

If you wish to add additional Foreign Patent Document citation information please click the Add button.

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1	Anonymous: "Getting Started With XInput", December 16, 2014 (12-16-2014), XP055458537, retrieved from the Internet: URL: https://web.archive.org/web/20141216120515/http://msdn.microsoft.com:80/en-us/library/windows/desktop/ee417001(v=vs.85).aspx [retrieved on 3-12-2018] page 1-3.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		2018-08-08
	First Named Inventor	Srivatsav VENKATESAN	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		T9047-22090US02; IMM631C1

	2	Any copies of information that are not included with this Information Disclosure Statement can be found in U.S. Application Serial No. 14/979,321.
--	---	--

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	
--------------------	--	-----------------	--

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		2018-08-08
	First Named Inventor	Srivatsav VENKATESAN	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	T9047-22090US02; IMM631C1	

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Andrew W. Wahba/	Date (YYYY-MM-DD)	2018-08-08
Name/Print	Andrew W. Wahba	Registration Number	73661

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt	
EFS ID:	33405824
Application Number:	16058399
International Application Number:	
Confirmation Number:	2869
Title of Invention:	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
First Named Inventor/Applicant Name:	Srivatsav VENKATESAN
Customer Number:	95000
Filer:	Andrew Wadie Wahba/Hilary Shannon
Filer Authorized By:	Andrew Wadie Wahba
Attorney Docket Number:	T9047-22090US02; IMM631C1
Receipt Date:	08-AUG-2018
Filing Date:	
Time Stamp:	15:32:25
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no				
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal of New Application	T9047-22090US02-Utility_Application_Transmittal.pdf	138215 b00b007f9a19d12576274b0142c64eb3c6c a7e69	no	2
Warnings:					

Information:					
2	Power of Attorney	T9047-22090US02-POAFILE.pdf	1052640	no	2
			f060fa5af415a67ad6342963c65a33537717bb4f		
Warnings:					
Information:					
3	Application Data Sheet	T9047-22090US02-ADS.pdf	1823631	no	10
			20f487e97e7af4f4560334c76e8a864d9f1401bc		
Warnings:					
Information:					
4	Oath or Declaration filed	T9047-22090US02-DECLARATIONfile.pdf	5115885	no	6
			ad6cdd47e6a692941c4a7cd0619bfa7976bb9f17		
Warnings:					
Information:					
5	Drawings-other than black and white line drawings	T9047-22090US02-DRAWINGS.pdf	935239	no	10
			9eca2ec5518d7f62cb39ffc932ade1a00d8302be		
Warnings:					
Information:					
6		T9047-22090US02SPECIFICATION.pdf	149163	yes	30
			acd5c7680d7927cc1504f6b1ffc9d4a7d5dea46c		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	28	
	Claims		29	29	
	Abstract		30	30	
Warnings:					
Information:					
7	Information Disclosure Statement (IDS) Form (SB08)	T9047-22090US02-Information_Disclosure_Statement.pdf	613086	no	5
			fd6f6f33ea1fa4c409bbae16a6c1b4b884f443cb		

Warnings:	
Information:	
Total Files Size (in bytes):	9827859
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.	

SCORE Placeholder Sheet for IFW Content

Application Number: 16058399

Document Date: 08/08/2018

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded in PALM, and no paper documents or physical media exist. The TIFF images in the IFW record were created from the original documents that are stored in SCORE.

- Drawing

At the time of document entry (noted above):

- USPTO employees may access SCORE content via eDAN using the Supplemental Content tab, or via the SCORE web page.
- External customers may access SCORE content via PAIR using the Supplemental Content tab.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
16/058,399	08/08/2018		0.00	T9047-22090US02; IMM631C1	1	1

CONFIRMATION NO. 2869

FILING RECEIPT



0000000101903144

95000
MILES & STOCKBRIDGE P.C.
Immersion Corporation
1751 Pinnacle Drive
Suite 1500
Tysons Corner, VA 22102-3833

Date Mailed: 08/29/2018

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Srivatsav VENKATESAN, Sunnyvale, CA;
Kaniyalal SHAH, Fremont, CA;
Douglas George BILLINGTON, Campbell, CA;
Aaron KAPELUS, Jamaica Plain, MA;
Stephen RANK, San Jose, CA;
Daniel PARKER, San Jose, CA;

Applicant(s)

Immersion Corporation, San Jose, CA;

Power of Attorney: The patent practitioners associated with Customer Number 95000

Domestic Priority data as claimed by applicant

This application is a CON of 14/979,321 12/22/2015 PAT 10073523
which claims benefit of 62/096,251 12/23/2014

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 08/28/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/058,399**

Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

Early Publication Request: No

Title

POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT
DEVICE

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop

technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/058,399	08/08/2018	Srivatsav VENKATESAN	T9047-22090US02; IMM631C1

CONFIRMATION NO. 2869

FORMALITIES LETTER



95000
MILES & STOCKBRIDGE P.C.
Immersion Corporation
1751 Pinnacle Drive
Suite 1500
Tysons Corner, VA 22102-3833

Date Mailed: 08/29/2018

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
- The application search fee must be submitted.
- The application examination fee must be submitted.
- Surcharge as set forth in 37 CFR 1.16(f) must be submitted.

The surcharge is due for any one of:

- late submission of the basic filing fee, search fee, or examination fee,
- late submission of inventor's oath or declaration,
- filing an application that does not contain at least one claim on filing, or
- submission of an application filed by reference to a previously filed application.

SUMMARY OF FEES DUE:

The fee(s) required within **TWO MONTHS** from the date of this Notice to avoid abandonment is/are itemized below. No entity status discount is in effect. If applicant is qualified for small entity status, a written assertion of small entity status must be submitted to establish small entity status. (See 37 CFR 1.27). If applicant is qualified for micro entity status, an acceptable Certification of Micro Entity Status must be submitted to establish micro entity status. (See 37 CFR 1.29 and forms PTO/SB/15A and 15B.)

- \$ **300** basic filing fee.
- \$ **160** surcharge.
- \$ **660** search fee.
- \$ **760** examination fee.
- \$(**0**) previous unapplied payment amount.
- \$ **1880** TOTAL FEE BALANCE DUE.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice".
<https://portal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at 1-866-217-9197 or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/tnguyen/

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/058,399				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300			
SEARCH FEE (37 CFR 1.16(k), (j), or (m))	N/A	N/A	N/A			N/A	660			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760			
TOTAL CLAIMS (37 CFR 1.16(i))	1	minus 20 = *				x 100 =	0.00			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1	minus 3 = *				x 460 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1720			
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=		x	=
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
					TOTAL ADD'L FEE				TOTAL ADD'L FEE	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=		x	=
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
					TOTAL ADD'L FEE				TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.										



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/058,399	08/08/2018	Srivatsav VENKATESAN	T9047-22090US02; IMM631C1

CONFIRMATION NO. 2869

95000
MILES & STOCKBRIDGE P.C.
Immersion Corporation
1751 Pinnacle Drive
Suite 1500
Tysons Corner, VA 22102-3833

FORMALITIES LETTER



Date Mailed: 08/29/2018

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
- The application search fee must be submitted.
- The application examination fee must be submitted.
- Surcharge as set forth in 37 CFR 1.16(f) must be submitted.

The surcharge is due for any one of:

- late submission of the basic filing fee, search fee, or examination fee,
- late submission of inventor's oath or declaration,
- filing an application that does not contain at least one claim on filing, or
- submission of an application filed by reference to a previously filed application.

SUMMARY OF FEES DUE:

The fee(s) required within **TWO MONTHS** from the date of this Notice to avoid abandonment is/are itemized below. No entity status discount is in effect. If applicant is qualified for small entity status, a written assertion of small entity status must be submitted to establish small entity status. (See 37 CFR 1.27). If applicant is qualified for micro entity status, an acceptable Certification of Micro Entity Status must be submitted to establish micro entity status. (See 37 CFR 1.29 and forms PTO/SB/15A and 15B.)

- \$ **300** basic filing fee.
- \$ **160** surcharge.
- \$ **660** search fee.
- \$ **760** examination fee.
- \$(**0**) previous unapplied payment amount.
- \$ **1880** TOTAL FEE BALANCE DUE.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice".
<https://portal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at 1-866-217-9197 or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/tnguyen/

Electronic Patent Application Fee Transmittal				
Application Number:		16058399		
Filing Date:		08-Aug-2018		
Title of Invention:		POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE		
First Named Inventor/Applicant Name:		Srivatsav VENKATESAN		
Filer:		Andrew Wadie Wahba/Hilary Shannon		
Attorney Docket Number:		T9047-22090US02; IMM631C1		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
Pages:				
Claims:				
Miscellaneous-Filing:				
LATE FILING FEE FOR OATH OR DECLARATION	1051	1	160	160
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1880

Electronic Acknowledgement Receipt	
EFS ID:	34123501
Application Number:	16058399
International Application Number:	
Confirmation Number:	2869
Title of Invention:	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
First Named Inventor/Applicant Name:	Srivatsav VENKATESAN
Customer Number:	95000
Filer:	Andrew Wadie Wahba/Hilary Shannon
Filer Authorized By:	Andrew Wadie Wahba
Attorney Docket Number:	T9047-22090US02; IMM631C1
Receipt Date:	26-OCT-2018
Filing Date:	08-AUG-2018
Time Stamp:	14:33:03
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$1880
RAM confirmation Number	102918INTEFSW00001047501165
Deposit Account	501165
Authorized User	Hilary Shannon
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)
 37 CFR 1.20 (Post Issuance fees)
 37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Response to Pre-Exam Formalities Notice	T9047-22090US02-NTFMP.pdf	83676	no	2
			980d69f2a56863a8e5841b77a06802b0fa5936e57		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	37320	no	2
			93cfe7d5b876943418e9cb9ff468a980a3230e00e		

Warnings:

Information:

Total Files Size (in bytes): 120996

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO.	TOT CLAIMS	IND CLAIMS
16/058,399	08/08/2018		1880	T9047-22090US02; IMM631C1	1	1

CONFIRMATION NO. 2869

UPDATED FILING RECEIPT



95000
MILES & STOCKBRIDGE P.C.
Immersion Corporation
1751 Pinnacle Drive
Suite 1500
Tysons Corner, VA 22102-3833

Date Mailed: 10/30/2018

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Srivatsav VENKATESAN, Sunnyvale, CA;
Kaniyalal SHAH, Fremont, CA;
Douglas George BILLINGTON, Campbell, CA;
Aaron KAPELUS, Jamaica Plain, MA;
Stephen RANK, San Jose, CA;
Daniel PARKER, San Jose, CA;

Applicant(s)

Immersion Corporation, San Jose, CA;

Power of Attorney: The patent practitioners associated with Customer Number 95000

Domestic Priority data as claimed by applicant

This application is a CON of 14/979,321 12/22/2015 PAT 10073523
which claims benefit of 62/096,251 12/23/2014

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 08/28/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/058,399**

Projected Publication Date: 02/07/2019

Non-Publication Request: No

Early Publication Request: No

Title

POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop

technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/058,399	
APPLICATION AS FILED - PART I							
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300
SEARCH FEE (37 CFR 1.16(k), (j), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	1	minus 20 = *			OR	x 100 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1	minus 3 = *				x 460 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL		TOTAL	1720
APPLICATION AS AMENDED - PART II							
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=
	Application Size Fee (37 CFR 1.16(s))						
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	
(Column 1)		(Column 2)		(Column 3)		OTHER THAN SMALL ENTITY	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=
	Application Size Fee (37 CFR 1.16(s))						
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.							



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/058,399	08/08/2018	Srivatsav VENKATESAN	T9047-22090US02; IMM631C1

CONFIRMATION NO. 2869

95000

MILES & STOCKBRIDGE P.C.

Immersion Corporation

1751 Pinnacle Drive

Suite 1500

Tysons Corner, VA 22102-3833

PUBLICATION NOTICE



OC000000105709515

Title:POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE

Publication No.US-2019-0041990-A1

Publication Date:02/07/2019

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <https://portal.uspto.gov/pair/PublicPair>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/058,399		Filing Date 08/08/2018		☐ To be Mailed		
ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO										
APPLICATION AS FILED - PART I										
		(Column 1)	(Column 2)							
FOR		NUMBER FILED	NUMBER EXTRA	RATE (\$)		FEE (\$)				
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A	N/A	N/A						
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))		N/A	N/A	N/A						
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A	N/A	N/A						
TOTAL CLAIMS (37 CFR 1.16(j))		minus 20 =	*	x \$100 =						
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 =	*	x \$460 =						
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).								
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL						
APPLICATION AS AMENDED - PART II										
		(Column 1)	(Column 2)	(Column 3)						
AMENDMENT	07/22/2019	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	x \$100 =		0		
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0	x \$460 =		0		
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
					TOTAL ADD'L FEE		0			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(i))	*	Minus	**	=	x \$0 =				
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x \$0 =				
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
					TOTAL ADD'L FEE					
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.					LIE					
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".					/BRENDA V HARRISON/					
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".										
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.										

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

IN THE U.S. PATENT AND TRADEMARK OFFICE

Application No.: 16/058,399	Confirmation No.: 2869
Application of: Srivatsav VENKATESAN et al.	Group Art Unit: 3715
Filing Date: August 8, 2018	Examiner: Paul Anthony D'AGOSTINO
Title: POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE	Docket No.: T9047-22090US02; IMM631C1 Customer No.: 95000

PRELIMINARY AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

Preliminary to examination, please amend the above-identified application as follows.

Amendments to the Claims are reflected in the listing of the claims which begin on page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.

Amendments to the Claims:

The listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. A method for ~~rendering a haptic effect at~~ controlling a user input element associated with a haptic output device, the method comprising:
defining position and range information ~~a primary range and a secondary range of positions~~ for the user input element associated with the haptic output device,
including a primary range of positions, a secondary range of positions, and a boundary range of positions, wherein the boundary range of positions partially overlaps each of the primary range of positions and the secondary range of positions; and
~~defining a boundary range of positions for the user input element associated with the haptic output device, the boundary range partially overlapping each of the primary and secondary ranges;~~
~~monitoring a position of the user input element; and~~
rendering ~~[[the]]~~ a haptic effect in response to an entry of the user input element to one or more positions within the boundary range of positions.
2. (New) The method of claim 1, wherein one of the primary range of positions, the secondary range of positions, and the boundary range of positions is calculated based on a movement of the user input element from a maximum out position to a grounding position.
3. (New) The method of claim 1, wherein a profile for the user input element is calculated by mapping each position of the user input element to an analog to digital conversion value.
4. (New) The method of claim 3, wherein the profile for the user input element is an increasing profile or a decreasing profile.

5. (New) The method of claim 1, wherein a normalized profile for the user input element is calculated by removing at least one of the secondary range of positions or the boundary range of positions from mapped analog to digital conversion values.

6. (New) The method of claim 1, further comprising monitoring a position of the user input element.

7. (New) The method of claim 6, further comprising adjusting a profile and a normalized profile of the user input element to adjust for a change to a resting position of the user input element.

8. (New) A non-transitory computer readable storage medium storing a program configured to be executed by a processor, the program comprising instructions for:

defining position and range information a user input element associated with the haptic output device, including a primary range of positions, a secondary range of positions, and a boundary range of positions, wherein the boundary range of positions partially overlaps each of the primary range of positions and the secondary range of positions; and

rendering a haptic effect in response to an entry of the user input element to one or more positions within the boundary range of positions.

9. (New) The non-transitory computer readable storage medium of claim 8, wherein one of the primary range of positions, the secondary range of positions, and the boundary range of positions is calculated based on a movement of the user input element from a maximum out position to a grounding position.

10. (New) The non-transitory computer readable storage medium of claim 8, wherein a profile for the user input element is calculated by mapping each position of the user input element to an analog to digital conversion value.

11. (New) The non-transitory computer readable storage medium of claim 10, wherein the profile for the user input element is an increasing profile or a decreasing profile.

12. (New) The non-transitory computer readable storage medium of claim 8, wherein a normalized profile for the user input element is calculated by removing at least one of the secondary range of positions or the boundary range of positions from mapped analog to digital conversion values.

13. (New) The non-transitory computer readable storage medium of claim 8, further comprising instructions for monitoring a position of the user input element.

14. (New) The non-transitory computer readable storage medium of claim 13, further comprising instructions for adjusting a profile and a normalized profile of the user input element to adjust for a change to a resting position of the user input element.

15. (New) A device comprising:

a processor; and

a memory storing a program for execution by the processor, the program including instructions for:

defining position and range information a user input element associated with the haptic output device, including a primary range of positions, a secondary range of positions, and a boundary range of positions, wherein the boundary range of positions partially overlaps each of the primary range of positions and the secondary range of positions; and

rendering a haptic effect in response to an entry of the user input element to one or more positions within the boundary range of positions.

16. (New) The device of claim 15, wherein one of the primary range of positions, the secondary range of positions, and the boundary range of positions is calculated based on a movement of the user input element from a maximum out position to a grounding position.

17. (New) The device of claim 15, wherein a profile for the user input element is calculated by mapping each position of the user input element to an analog to digital conversion value.

8. (New) The device of claim 15, wherein a normalized profile for the user input element is calculated by removing at least one of the secondary range of positions or the boundary range of positions from mapped analog to digital conversion values.

19. (New) The device of claim 15, further comprising instructions for monitoring a position of the user input element.

20. (New) The device of claim 19, further comprising instructions for adjusting a profile and a normalized profile of the user input element to adjust for a change to a resting position of the user input element.

REMARKS

Claim 1 has been amended. New claims 2-20 have been added. No new matter has been introduced. Accordingly, the application now includes claims 1-20. Support for the amendments may be found in paragraphs [0064]-[0069] of the instant application.

Applicant respectfully requests that the claim amendments be entered into the record prior to examination and consideration of this application.

The Examiner is invited and urged to contact the undersigned to discuss any matter concerning this application.

No fee should be required for this submission. However, should any fee be required, the Commissioner is authorized to charge any such fee to Counsel's Deposit Account 50-1165.

Respectfully submitted,

Date: July 22, 2019

/Andrew W. Wahba/
Andrew W. Wahba
Attorney for Applicant
Registration No. 73,661

Customer No. 95000

Miles & Stockbridge P.C.
1751 Pinnacle Drive, Suite 1500
Tysons Corner, VA 22102-3833
Telephone: 703-738-0155
Email: awahba@milesstockbridge.com
AWW:has

Electronic Acknowledgement Receipt	
EFS ID:	36657079
Application Number:	16058399
International Application Number:	
Confirmation Number:	2869
Title of Invention:	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
First Named Inventor/Applicant Name:	Srivatsav VENKATESAN
Customer Number:	95000
Filer:	Andrew Wadie Wahba/Hilary Shannon
Filer Authorized By:	Andrew Wadie Wahba
Attorney Docket Number:	T9047-22090US02; IMM631C1
Receipt Date:	22-JUL-2019
Filing Date:	08-AUG-2018
Time Stamp:	19:51:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment		no			
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		T9047-22090US02preliminaryA mendment.pdf	81806	yes	6
			84ac252b4736f765a13b962c5cc36b03c47 80539		

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Preliminary Amendment	1	1
	Claims	2	5
	Applicant Arguments/Remarks Made in an Amendment	6	6
Warnings:			
Information:			
Total Files Size (in bytes):		81806	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.			



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/058,399	08/08/2018	Srivatsav VENKATESAN	T9047-22090US02; IMM631C1	2869
95000	7590	07/25/2019	EXAMINER	
MILES & STOCKBRIDGE P.C. Immersion Corporation 1751 Pinnacle Drive Suite 1500 Tysons Corner, VA 22102-3833			D'AGOSTINO, PAUL ANTHONY	
			ART UNIT	PAPER NUMBER
			3715	
			NOTIFICATION DATE	DELIVERY MODE
			07/25/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

lpdocketing@MilesStockbridge.com
awahba@milestockbridge.com
eofficeaction@apcoll.com

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale or otherwise available to the public before the effective filing date of the claimed invention.

(a)(2) the claimed invention was described in a patent issued under section 151, or in an application for patent published or deemed published under section 122(b), in which the patent or application, as the case may be, names another inventor and was effectively filed before the effective filing date of the claimed invention.

3. Claim 1 is rejected under 35 U.S.C. § 102 (a1)(a2) as being anticipated by U.S. Pat. Pub. No. 2006/0142657 to Quaid et al..

Quaid discloses a method for rendering a haptic effect at a user input element associated with a haptic output device, the method comprising:

defining a primary range and a secondary range of positions for the user input element associated with the haptic output device (Quaid discloses distances in proximity to boundaries, each distance is a range and a plurality of distances form a plurality of ranges [0179], for example any of the parts of the anatomy [0108] constitute first and second ranges relative to the boundary);

defining a boundary range of positions for the user input element associated with the haptic output device, the boundary range partially overlapping each of the primary and secondary ranges (among the distances is a haptic boundary [0179]);

monitoring a position of the user input element [0179]; and rendering the haptic effect in response to an entry of the user input element to positions within the boundary range (Quaid discloses that as a tool 50 approaches or contacts the haptic boundary, the haptic device 30 will exert a force [0179]).

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure is in the Notice of References Cited.
5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Paul A. D'Agostino whose telephone number is (571) 270-1992.
6. Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.
7. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dmitry Suhol can be reached on (571) 272-4430. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.
8. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Application/Control Number: 16/058,399
Art Unit: 3715

Page 4

/PAUL A D'AGOSTINO/
Primary Examiner, Art Unit 3715

<i>Notice of References Cited</i>	Application/Control No. 16/058,399		Applicant(s)/Patent Under Reexamination VENKATESAN et al.	
	Examiner PAUL A D'AGOSTINO		Art Unit 3715	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-6020876-A	02-2000	Rosenberg; Louis B.	G06F3/011	345/157
*	B	US-20110260990-A1	10-2011	Ali; Yassir	G06F3/016	345/173
*	C	US-20060290662-A1	12-2006	Houston; John	A63F13/06	345/156
*	D	US-6184868-B1	02-2001	Shahoian; Erik J.	A63F13/06	345/161
*	E	US-20060142657-A1	06-2006	Quaid; Arthur	A61B17/1703	600/424
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<i>Search Notes</i> 	Application/Control No. 16/058,399	Applicant(s)/Patent Under Reexamination VENKATESAN et al.
	Examiner PAUL A D'AGOSTINO	Art Unit 3715

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
see east search history	07/21/2019	pd

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

--	--

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	
	Filing Date	2018-08-08
	First Named Inventor	Srivatsav VENKATESAN
	Art Unit	
	Examiner Name	
	Attorney Docket Number	T9047-22090US02; IMM631C1

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6020876		2000-02-01	Rosenberg et al.	
	2	6184868	B1	2001-02-06	Shahoian et al.	
	3	7490530	B2	2009-02-17	Ishikawa et al.	

If you wish to add additional U.S. Patent citation information please click the Add button.

Add

U.S.PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20050156892	A1	2005-07-21	Grant	
	2	20060142657	A1	2006-06-29	Quaid et al.	
	3	20060290662	A1	2006-12-28	Houston et al.	

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		
Filing Date		2018-08-08
First Named Inventor	Srivatsav VENKATESAN	
Art Unit		
Examiner Name		
Attorney Docket Number		T9047-22090US02; IMM631C1

4	20110118032	A1	2011-05-19	Zalewski	
5	20110260990	A1	2011-10-27	Ali et al.	
6	20140043228	A1	2014-02-13	Grant et al.	
7	20140315642	A1	2014-10-23	Grant et al.	
8	20150130706	A1	2015-05-14	Lacroix et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ^{2]}	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	2008000345	JP	A	2008-01-10	Nintendo Co., Ltd.		

If you wish to add additional Foreign Patent Document citation information please click the Add button.

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1	Anonymous: "Getting Started With XInput", December 16, 2014 (12-16-2014), XP055458537, retrieved from the Internet: URL: https://web.archive.org/web/20141216120515/http://msdn.microsoft.com:80/en-us/library/windows/desktop/ee417001(v=vs.85).aspx [retrieved on 3-12-2018] page 1-3.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		2018-08-08
	First Named Inventor	Srivatsav VENKATESAN	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		T9047-22090US02; IMM631C1

2	Any copies of information that are not included with this Information Disclosure Statement can be found in U.S. Application Serial No. 14/979,321.
---	--

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature	/PAUL A D'AGOSTINO/	Date Considered	07/21/2019
--------------------	---------------------	-----------------	------------

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	2018-08-08
First Named Inventor	Srivatsav VENKATESAN
Art Unit	
Examiner Name	
Attorney Docket Number	T9047-22090US02; IMM631C1

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Andrew W. Wahba/	Date (YYYY-MM-DD)	2018-08-08
Name/Print	Andrew W. Wahba	Registration Number	73661

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /P.A.D/

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	18	("20050156892" "20060142657" "20060290662" "20110118032" "20110260990" "20140043228" "20140315642" "20150130706" "6020876" "6184868" "7490530").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	OFF	2019/07/21 18:17
S1	171418	(G07F17/\$\$ or A63F13/\$\$).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/06 08:35
S2	652273	(G06F17/\$\$ or A63F13/\$\$).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/06 08:35
S3	171418	(G07F17/\$\$ or A63F13/\$\$).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/06 08:44
S4	321	"6020876"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:23
S5	4	"6020876".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:23
S6	2	controller and haptic with actuator with (ID identifier) and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:34
S7	0	(A63F13/\$\$ or G07F17/\$\$).cpc. and controller and haptic with actuator with (ID identifier) and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:39
S8	16	(A63F13/\$\$ or G07F17/\$\$).cpc. and controller and haptic with actuator and (ID identifier) and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:39
S9	10	(A63F13/\$\$ or G07F17/\$\$).cpc. and controller and haptic same (ID identifier) and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2017/09/08 20:41

			EPO; JPO			
S10	1	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic.ti. and signal same (ID identifier) and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:43
S11	130	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic.ti. and actuator and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:44
S12	5	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic.ti. and actuator same identif\$4 and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:45
S13	0	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic.ti. same packet and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 21:28
S14	9	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic same packet and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 21:28
S15	17	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic same clock and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 22:01
S16	10983	haptic and range and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 23:07
S17	5994	controller and haptic and range and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 23:08
S18	123	controller and haptic and boundary with range and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 23:08
S19	19	controller and haptic same boundary with range and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 23:09
S20	121	"463".clas. and haptic with (joystick)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2018/01/08 13:06
S21	73	"463".clas. and haptic with (joystick) and @py<"2012"	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2018/01/08 13:06

			EPO; JPO			
--	--	--	----------	--	--	--

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S22	8	(haptic effect trigger first second range positions).clm.	US-PGPUB; USPAT	AND	ON	2018/04/15:10:19
S23	2	(haptic effect trigger first scal\$4 second range positions).clm.	US-PGPUB; USPAT	AND	ON	2018/04/15:10:20

7/ 21/ 2019 6:20:59 PM
C:\ Users\ pdagostino\ Documents\ EAST\ Workspaces\ 16058399.wsp



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/058,399	08/08/2018	Srivatsav VENKATESAN	T9047-22090US02; IMM631C1	2869
95000	7590	08/07/2019	EXAMINER	
MILES & STOCKBRIDGE P.C. Immersion Corporation 1751 Pinnacle Drive Suite 1500 Tysons Corner, VA 22102-3833			D'AGOSTINO, PAUL ANTHONY	
			ART UNIT	PAPER NUMBER
			3715	
			NOTIFICATION DATE	DELIVERY MODE
			08/07/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

lpdocketing@MilesStockbridge.com
awahba@milestockbridge.com
eofficeaction@apcoll.com

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record

A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) 1.133 Interviews

Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.

All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiners responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicants correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

- 1) A brief description of the nature of any exhibit shown or any demonstration conducted,-
- 2) an identification of the claims discussed,
- 3) an identification of the specific prior art discussed,
- 4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
- 5) a brief identification of the general thrust of the principal arguments presented to the examiner,
(The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
- 6) a general indication of any other pertinent matters discussed, and
- 7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicants record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiners version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, Interview Record OK on the paper recording the substance of the interview along with the date and the examiners initials.

IN THE U.S. PATENT AND TRADEMARK OFFICE

Application No.: 16/058,399	Confirmation No.: 2869
Application of: Srivatsav VENKATESAN et al.	Group Art Unit: 3715
Filing Date: August 8, 2018	Examiner: Paul Anthony D'AGOSTINO
Title: POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE	Docket No.: T9047-22090US02; IMM631C1 Customer No.: 95000

SUPPLEMENTAL AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

Preliminary to examination, and supplemental to the Preliminary Amendment
filed on July 22, 2019, please amend the above-identified application as follows.

Amendments to the Claims are reflected in the listing of the claims which begin
on page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.

Amendments to the Claims:

The listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Previously Presented) A method for controlling a user input element associated with a haptic output device, the method comprising:
defining position and range information for the user input element associated with the haptic output device, including a primary range of positions, a secondary range of positions, and a boundary range of positions, wherein the boundary range of positions partially overlaps each of the primary range of positions and the secondary range of positions; and
rendering a haptic effect in response to an entry of the user input element to one or more positions within the boundary range of positions.
2. (Previously Presented) The method of claim 1, wherein one of the primary range of positions, the secondary range of positions, and the boundary range of positions is calculated based on a movement of the user input element from a maximum out position to a grounding position.
3. (Previously Presented) The method of claim 1, wherein a profile for the user input element is calculated by mapping each position of the user input element to an analog to digital conversion value.
4. (Previously Presented) The method of claim 3, wherein the profile for the user input element is an increasing profile or a decreasing profile.
5. (Previously Presented) The method of claim 1, wherein a normalized profile for the user input element is calculated by removing at least one of the secondary

range of positions or the boundary range of positions from mapped analog to digital conversion values.

6. (Previously Presented) The method of claim 1, further comprising monitoring a position of the user input element.

7. (Currently Amended) The method of claim 6, further comprising adjusting a profile and a normalized profile of the user input element to adjust for a change to a resting position of the user input element.

8. (Previously Presented) A non-transitory computer readable storage medium storing a program configured to be executed by a processor, the program comprising instructions for:

defining position and range information a user input element associated with the haptic output device, including a primary range of positions, a secondary range of positions, and a boundary range of positions, wherein the boundary range of positions partially overlaps each of the primary range of positions and the secondary range of positions; and

rendering a haptic effect in response to an entry of the user input element to one or more positions within the boundary range of positions.

9. (Previously Presented) The non-transitory computer readable storage medium of claim 8, wherein one of the primary range of positions, the secondary range of positions, and the boundary range of positions is calculated based on a movement of the user input element from a maximum out position to a grounding position.

10. (Previously Presented) The non-transitory computer readable storage medium of claim 8, wherein a profile for the user input element is calculated by mapping each position of the user input element to an analog to digital conversion value.

11. (Previously Presented) The non-transitory computer readable storage medium of claim 10, wherein the profile for the user input element is an increasing profile or a decreasing profile.

12. (Previously Presented) The non-transitory computer readable storage medium of claim 8, wherein a normalized profile for the user input element is calculated by removing at least one of the secondary range of positions or the boundary range of positions from mapped analog to digital conversion values.

13. (Previously Presented) The non-transitory computer readable storage medium of claim 8, further comprising instructions for monitoring a position of the user input element.

14. (Previously Presented) The non-transitory computer readable storage medium of claim 13, further comprising instructions for adjusting a profile and a normalized profile of the user input element to adjust for a change to a resting position of the user input element.

15. (Previously Presented) A device comprising:
a processor; and
a memory storing a program for execution by the processor, the program including instructions for:
defining position and range information a user input element associated with the haptic output device, including a primary range of positions, a secondary range of positions, and a boundary range of positions, wherein the boundary range of positions partially overlaps each of the primary range of positions and the secondary range of positions; and
rendering a haptic effect in response to an entry of the user input element to one or more positions within the boundary range of positions.

16. (Previously Presented) The device of claim 15, wherein one of the primary range of positions, the secondary range of positions, and the boundary range of positions is calculated based on a movement of the user input element from a maximum out position to a grounding position.

17. (Previously Presented) The device of claim 15, wherein a profile for the user input element is calculated by mapping each position of the user input element to an analog to digital conversion value.

18. (Previously Presented) The device of claim 15, wherein a normalized profile for the user input element is calculated by removing at least one of the secondary range of positions or the boundary range of positions from mapped analog to digital conversion values.

19. (Previously Presented) The device of claim 15, further comprising instructions for monitoring a position of the user input element.

20. (Previously Presented) The device of claim 19, further comprising instructions for adjusting a profile and a normalized profile of the user input element to adjust for a change to a resting position of the user input element.

REMARKS

Applicant thanks the Examiner for taking the time to conduct a telephonic interview with the Applicant's representative on August 2, 2019, and agreeing to withdraw the Non-Final Office Action dated July 25, 2019.

Claim 7 has been amended to correct a minor informality. No new matter has been introduced. Accordingly, the application continues to include claims 1-20.

Applicant respectfully requests that the claim amendments be entered into the record prior to examination and consideration of this application.

The Examiner is invited and urged to contact the undersigned to discuss any matter concerning this application.

No fee should be required for this submission. However, should any fee be required, the Commissioner is authorized to charge any such fee to Counsel's Deposit Account 50-1165.

Respectfully submitted,

Date: August 30, 2019

/Andrew W. Wahba/
Andrew W. Wahba
Attorney for Applicant
Registration No. 73,661

Customer No. 95000
Miles & Stockbridge P.C.
1751 Pinnacle Drive, Suite 1500
Tysons Corner, VA 22102-3833
Telephone: 703-738-0155
Email: awahba@milesstockbridge.com
AWW:has

Electronic Acknowledgement Receipt	
EFS ID:	37035332
Application Number:	16058399
International Application Number:	
Confirmation Number:	2869
Title of Invention:	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
First Named Inventor/Applicant Name:	Srivatsav VENKATESAN
Customer Number:	95000
Filer:	Andrew Wadie Wahba/Hilary Shannon
Filer Authorized By:	Andrew Wadie Wahba
Attorney Docket Number:	T9047-22090US02; IMM631C1
Receipt Date:	30-AUG-2019
Filing Date:	08-AUG-2018
Time Stamp:	16:05:38
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment		no			
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		T9047-22090US02SupplementalAmendment.pdf	87176	yes	6
			3e9a2b79ea821f0b8d653b1c985ed49ddf3f48f5		

Multipart Description/PDF files in .zip description			
Document Description		Start	End
Supplemental Response or Supplemental Amendment		1	1
Claims		2	5
Applicant Arguments/Remarks Made in an Amendment		6	6

Warnings:

Information:

Total Files Size (in bytes):	87176
-------------------------------------	-------

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)

Approved for use through 11/30/2020. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16058399
	Filing Date	2018-08-08
	First Named Inventor	Srivatsav VENKATESAN et al.
	Art Unit	3715
	Examiner Name	Paul Anthony D'AGOSTINO
	Attorney Docket Number	T9047-22090US02; IMM631C1

U.S. PATENTS							Remove	
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
	1	8622833	B2	2014-01-07	Kake	corresponds to JP2008015679		
	2	9778743	B2	2017-10-03	Grant et al.	corresponds to JP2014216017		
If you wish to add additional U.S. Patent citation information please click the Add button.							Add	
U.S. PATENT APPLICATION PUBLICATIONS							Remove	
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
	1	20140320406	A1	2014-10-30	NISHIZAWA	corresponds to JP2014215850		
If you wish to add additional U.S. Published Application citation information please click the Add button.							Add	
FOREIGN PATENT DOCUMENTS							Remove	
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²ⁱ	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	2008015679	JP	A	2008-01-24	Sony Computer Entertainment Inc	corresponds to U.S. Patent No. 8,622,833	
	2	2014215850	JP	A	2014-11-17	Yamaha Corp	corresponds to U.S. Patent Publication No. 2014/0320406	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16058399
	Filing Date	2018-08-08
	First Named Inventor	Srivatsav VENKATESAN et al.
	Art Unit	3715
	Examiner Name	Paul Anthony D'AGOSTINO
	Attorney Docket Number	T9047-22090US02; IMM631C1

	3	2014216017	JP	A	2014-11-17	Immersion Corp	corresponds to U.S. Patent No. 9,778,743	
--	---	------------	----	---	------------	----------------	--	--

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1		

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	
--------------------	--	-----------------	--

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16058399
	Filing Date	2018-08-08
	First Named Inventor	Srivatsav VENKATESAN et al.
	Art Unit	3715
	Examiner Name	Paul Anthony D'AGOSTINO
	Attorney Docket Number	T9047-22090US02; IMM631C1

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Andrew W. Wahba/	Date (YYYY-MM-DD)	2019-09-04
Name/Print	Andrew W. Wahba	Registration Number	73,661

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



Espacenet

Bibliographic data: JP2008015679 (A) — 2008-01-24

USER INTERFACE DEVICE AND OPERATIONAL SENSITIVITY ADJUSTMENT METHOD

Inventor(s): KAKE TOMOKAZU ± (KAKE TOMOKAZU)

Applicant(s): SONY COMPUTER ENTERTAINMENT INC ± (SONY COMPUTER ENTERTAINMENT INC)

Classification: - international: A63F13/06; G06F3/033
 - cooperative: A63F13/06; A63F13/211; A63F13/22; A63F13/428;
A63F13/803; A63F2300/1018; A63F2300/105;
A63F2300/6045; A63F2300/8017

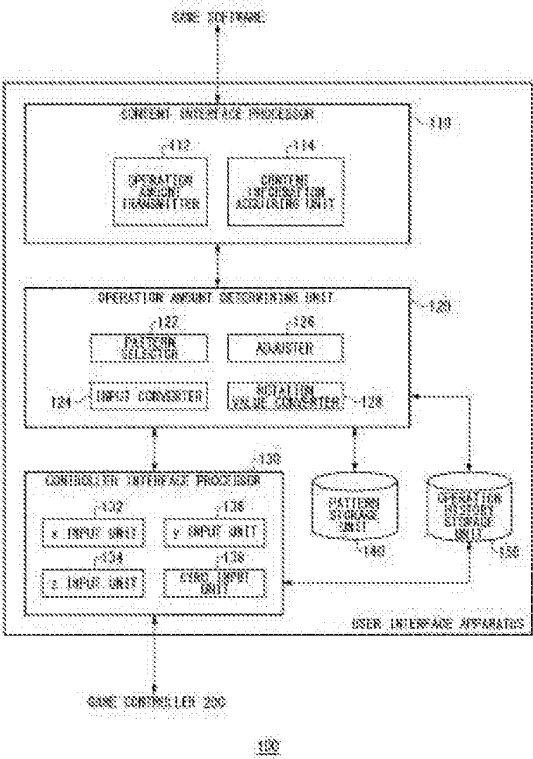
Application number: JP20060184505 20060704 Global Dossier

Priority number (s): JP20060184505 20060704

Also published as: US2008009332 (A1) US8622833 (B2)

Abstract of JP2008015679 (A)

PROBLEM TO BE SOLVED: To provide a body interface that can communicate a user's intention correctly. ;SOLUTION: A controller interface processing part 130 of a user interface processing device 100 acquires a tilt of a game controller 200 as rotation values from a sensor built in the game controller 200. An operation amount decision part 120 selects sensitivity characteristic patterns matching the ranges of such rotation values from among a plurality of sensitivity characteristic patterns different in the reaction sensitivity of operation amounts to rotation values, and decides operation amounts corresponding to the acquired rotation values by reference to the selected sensitivity characteristic patterns. ;COPYRIGHT: (C)2008,JPO&INPIT



(19) 日本国特許庁 (JP)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開2008-15679

(P2008-15679A)

(43) 公開日 平成20年1月24日 (2008.1.24)

(51) Int. Cl.	F I	テーマコード (参考)
G 0 6 F 3 / 0 3 3 (2006. 01)	G 0 6 F 3 / 0 3 3 3 1 O Y	2 C 0 0 1
A 6 3 F 1 3 / 0 6 (2006. 01)	A 6 3 F 1 3 / 0 6	5 B 0 8 7

審査請求 未請求 請求項の数 12 O L (全 21 頁)

(21) 出願番号	特願2006-184505 (P2006-184505)	(71) 出願人	395015319
(22) 出願日	平成18年7月4日 (2006. 7. 4)		株式会社ソニー・コンピュータエンタテインメント
		(74) 代理人	100105924
			弁理士 森下 賢樹
		(72) 発明者	掛 智一
			東京都港区南青山2丁目6番21号 株式会社ソニー・コンピュータエンタテインメント内
		F ターム (参考)	2C001 AA09 BA02 BC01 BC03 BC08 CA00 CA01 CB01 CB04 CB06 CC02 CC03 5B087 AA09 AB02 BC31

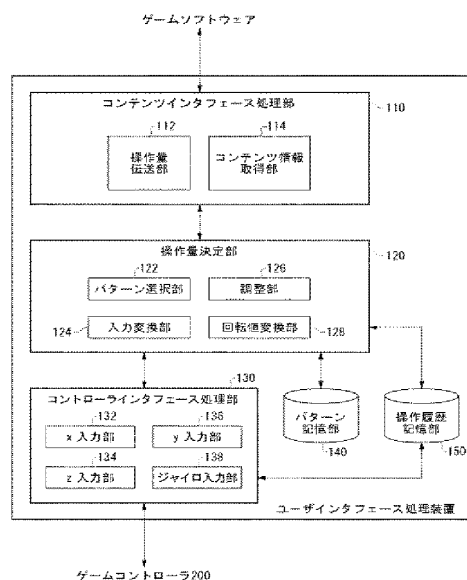
(54) 【発明の名称】 ユーザインタフェース装置および操作感度調整方法

(57) 【要約】

【課題】 ユーザの意思を正しく伝達しやすいボディインタフェースを提供する。

【解決手段】 ユーザインタフェース処理装置100のコントローラインタフェース処理部130は、ゲームコントローラ200が内蔵するセンサからゲームコントローラ200の傾きを回転値として取得する。操作量決定部120は、回転値に対する操作量の反応感度が異なる複数種類の感度特性パターンの中から、回転値の範囲の広狭に応じて感度特性パターンを選択し、選択された感度特性パターンを参照して、取得された回転値に対応する操作量を決定する。

【選択図】 図4



【特許請求の範囲】**【請求項1】**

物体の動きの大きさを検出可能なセンサを内蔵し、デバイス本体を把持するユーザの手の動きを操作量として伝達するための入力デバイスから、前記センサの検出値を取得する入力部と、

検出値に対する操作量の反応感度が異なる複数種類の感度特性パターンを記憶するパターン記憶部と、

検出値の範囲の広狭に応じて感度特性パターンを選択し、前記選択された感度特性パターンを参照して、前記取得された検出値に対応する操作量を決定する操作量決定部と、
を備えることを特徴とするユーザインタフェース装置。

【請求項2】

前記センサの検出値を所定の規則により変換する変換部、を更に備え、

前記パターン記憶部は、変換後の検出値に対する操作量を対応づけたパターンとして感度特性パターンを記憶し、

前記操作量決定部は、前記選択された感度特性パターンを参照して、変換後の検出値に対応する操作量を決定することを特徴とする請求項1に記載のユーザインタフェース装置。

【請求項3】

前記入力デバイスには、前記入力デバイスの第1の方向への動きの大きさを検出可能な第1のセンサと前記第1の方向とは異なる第2の方向への動きの大きさを検出可能な第2のセンサが内蔵されており、

前記入力部は、前記入力デバイスの第1の方向への動きの大きさを第1の検出値、前記第2の方向への動きの大きさを第2の検出値として取得し、

前記操作量決定部は、第1の検出値に対応する操作量と、第2の検出値に対応する操作量を互いに異なる感度特性パターンにより決定することを特徴とする請求項1に記載のユーザインタフェース装置。

【請求項4】

前記操作量決定部は、検出値の変化率に応じて感度特性パターンを選択することを特徴とする請求項1から3のいずれかに記載のユーザインタフェース装置。

【請求項5】

コンピュータゲーム中のグラフィックスオブジェクトの操作量を決定する場合において、

前記操作量決定部は、前記コンピュータゲームの種類に応じて感度特性パターンを選択することを特徴とする請求項1から4のいずれかに記載のユーザインタフェース装置。

【請求項6】

コンピュータゲーム中のグラフィックスオブジェクトの操作量を決定する場合において、

前記操作量決定部は、前記コンピュータゲームから発生するゲームイベントに応じて感度特性パターンを選択することを特徴とする請求項1から4のいずれかに記載のユーザインタフェース装置。

【請求項7】

コンピュータゲーム中のグラフィックスオブジェクトの操作量を決定する場合において、

前記操作量決定部は、ゲーム環境内における前記グラフィックスオブジェクトの仮想的な移動速度に応じて感度特性パターンを選択することを特徴とする請求項1から6のいずれかに記載のユーザインタフェース装置。

【請求項8】

前記操作量決定部は、検出値の変化に対して操作量が変化する割合が異なる複数種類の感度特性パターンからいずれかの感度特性パターンを選択することを特徴とする請求項1

から7のいずれかに記載のユーザインタフェース装置。

【請求項9】

前記操作量決定部は、検出値が変化しても操作量が変化しない検出の遊び範囲が異なる複数種類の感度特性パターンからいずれかの感度特性パターンを選択することを特徴とする請求項1から8のいずれかに記載のユーザインタフェース装置。

【請求項10】

前記操作量決定部は、更に、検出値の中央値に応じて、前記選択された感度特性パターンにおける検出値と操作量の対応関係を調整することを特徴とする請求項1から9のいずれかに記載のユーザインタフェース装置。

【請求項11】

ユーザが把持する入力デバイスの動きを操作量として伝達するための方法であって、
前記入力デバイスの動きの大きさを検出するステップと、
前記入力デバイスが動く範囲の広狭に応じて、前記入力デバイスの動きに対する操作感度を決定するステップと、
前記決定された操作感度に応じて前記入力デバイスについて検出された動きの大きさに対応する操作量を決定するステップと、
を備えることを特徴とする操作感度調整方法。

【請求項12】

物体の動きの大きさを検出可能なセンサを内蔵し、デバイス本体を把持するユーザの手の動きを操作量として伝達するための入力デバイスについて、前記センサの検出値と操作量とを対応づけた感度特性パターンとして、検出値に対する操作量の反応感度が異なる複数種類の感度特性パターンを記憶する機能と、

検出値の範囲の広狭に応じて感度特性パターンを選択し、選択された感度特性パターンを参照して、取得された検出値に対応する操作量を決定する機能と、

をコンピュータに発揮させることを特徴とするユーザインタフェース処理プログラム。

【発明の詳細な説明】

【技術分野】

【0001】

本発明は、ユーザインタフェース技術に関し、特に、ユーザの操作感を調整する技術に関する。

【背景技術】

【0002】

据え置き型のゲーム機器はいうに及ばず、携帯型のゲーム機器でコンピュータゲームを楽しむスタイルも定着した感がある。ユーザは、通常、複数の入力ボタンを駆使してコンピュータゲームを操作する（以下、このようなボタン入力によるユーザインタフェースのことを「ボタンインタフェース」とよぶことにする）。しかし、近年ではコンピュータゲームの高度化にともなってボタンインタフェースが複雑化しつつあり、ゲームの操作が難しくなっている。また、多くのボタンを設置するためのスペースを小さなゲームコントローラ上に確保するという問題もある。

【0003】

このようなボタンインタフェースの問題点を解決するために、ゲームコントローラや携帯型ゲーム機器本体の動きを入力とするユーザインタフェースが注目されている（以下、「ボディインタフェース」とよぶ）。たとえば、ゲームコントローラ内に内蔵される加速度センサにより、ゲームコントローラの動きを検出する。ゲームコントローラ自体の動きの大きさがゲームキャラクタの動きに反映される。ボディインタフェースは、直感的でわかりやすいというメリットがある。

【特許文献1】特開平11-099284号公報

【発明の開示】

【発明が解決しようとする課題】

【0004】

しかし、ボディインタフェースも万能ではない。ユーザの意思とゲームコントローラの

動きが一致するとは限らないからである。たとえば、右利きのユーザは、ゲームコントローラを右に傾けがちとなるかもしれない。ゲームコントローラを安定的に動かすことができるユーザもいれば、苦手なユーザもいるかもしれない。本発明者は、ユーザの動きを忠実にゲームに伝えるボディインタフェースが、必ずしもユーザの意思を正しくゲームに伝えるとは限らないという課題を発見した。

【0005】

本発明は、本発明者のこのような課題認識に基づいてなされたものであり、その主たる目的は、ユーザの意思を好適に伝達可能なボディインタフェースを実現することである。

【課題を解決するための手段】

【0006】

本発明のある態様は、物体の動きの大きさを検出可能なセンサを内蔵し、デバイス本体を把持するユーザの手の動きを操作量として伝達するための入力デバイスを介して、入力デバイスの動きを操作量に変換するユーザインタフェース装置である。

この装置は、入力デバイスからセンサの検出値を取得し、検出値に対する操作量の反応感度が異なる複数種類の感度特性パターンの中から、検出値の範囲の広狭に応じて感度特性パターンを選択し、選択された感度特性パターンを参照して、取得された検出値に対応する操作量を決定する。

【0007】

このような処理方法によれば、センサの検出値に応じて検出値を操作量に変換するための変換規則を切り換えることができる。そのため、ユーザの操作内容にあわせて操作感度を調整できる。ここでいう感度特性パターンは、検出値と操作量があらかじめ対応づけられたデータテーブルであってもよいし、検出値を操作量に変換するための公式や規則、すなわち、アルゴリズムであってもよい。

【0008】

なお、本発明を方法、システム、プログラム、記録媒体により表現したものもまた、本発明の態様として有効である。

【発明の効果】

【0009】

本発明によれば、ユーザの意思を正しく伝達しやすいボディインタフェースを提供できる。

【発明を実施するための最良の形態】

【0010】

図1は、本実施例におけるコンピュータゲームの実行環境を示す模式図である。

ゲーム装置202は、据え置き型のゲーム機器である。DVD-ROM (Digital Versatile Disk-ROM) やCD-ROMなどの記録媒体からコンピュータゲームのプログラムを読み出して実行する。モニタ204は一般的なテレビモニタでありゲーム装置202と接続される。ゲーム装置202からの画像信号を受信して、ゲーム画像を表示する。ゲームコントローラ200は、ユーザがコンピュータゲームを操作するための入力デバイスであり、ゲーム装置202に接続される。以下、レーシングゲームを題材として説明する。ユーザは、ゲームコントローラ200を介して自車であるユーザオブジェクト206を操作する。

【0011】

ゲームコントローラ200は一般的な入力ボタンを備える。また、ゲームコントローラ200自体の動きを検出するための加速度センサを内蔵している。ユーザがゲームコントローラ200を前後左右に傾けると、その加速度が操作信号としてゲーム装置202に伝送される。このように、ゲームコントローラ200はボタンインタフェース機能とボディインタフェース機能を両方備えるが、以下においてはボタンインタフェース機能を中心として説明する。

【0012】

図2は、ゲームコントローラ200を中心とした座標系を示す模式図である。

ゲームコントローラ200を中心として、x軸、y軸、z軸からなる直交座標系が仮想的に設定されている。この直交座標系は、ゲームコントローラ200の動きに応じて向きが変化するローカルな座標系である。以下、各軸について述べる。

〔x軸：ピッチ〕

ゲームコントローラ200を把持するユーザからみて、左から右の方向にx軸が設定される。x軸と中心として前方または後方に対する回転角のことを「ピッチ（Pitch）角」とよぶ。

〔y軸：ロール〕

ゲームコントローラ200を把持するユーザからみて、手前から前方に抜けるようにy軸が設定される。y軸と中心として右方向または左方向に対する回転角のことを「ロール（Roll）角」とよぶ。

〔z軸：ヨー〕

ゲームコントローラ200を把持するユーザからみて、下方から上方に抜けるようにz軸が設定される。z軸と中心として右方向または左方向に対する回転角のことを「ヨー（Yaw）角」とよぶ。

【0013】

ゲームコントローラ200は、3軸方向の加速度を検出するための加速度センサとz軸を中心とした回転、すなわちヨー回転の角速度を検出するためのジャイロセンサを内蔵している。加速度センサは、錘と、錘を支える梁、梁上に形成したピエゾ抵抗素子を含む。ゲームコントローラ200の動きは錘に伝達される。錘の動きによって梁が歪み、その歪みがピエゾ抵抗素子の抵抗値に変化として検出される。このような既知のピエゾ抵抗方式によりx軸、y軸、z軸のそれぞれの方向についての加速度が検出される。ジャイロセンサは、物体の回転運動を圧電振動子の電圧変化として取り出す。このように、加速度センサやジャイロセンサは既知のセンシング技術を応用した一般的なセンサである。以下、x軸方向の加速度のことを「x加速度」とよぶ。y軸、z軸についても同様であり、それぞれ「y加速度」、「z加速度」とよぶ。

【0014】

ゲームコントローラ200の内蔵センサが検出したx加速度は、0～255の範囲のデジタル値（以下、「x加速値」とよぶ）に変換され、操作信号として伝送される。x軸の正方向のx加速値は「127～255」、x軸の負方向のx加速値は「0～127」となる。y加速度、z加速度もそれぞれ同様であり、y加速値、z加速値として伝送される。また、ジャイロセンサが検出した角速度も、0～255の範囲のデジタル値（以下、「角速度値」とよぶ）に変換され、操作信号として伝送される。このように、ゲームコントローラ200のボディインタフェースに関わる情報として、x加速値、y加速値、z加速値および角速度値の4種類のデジタル値が操作信号として伝送される。

【0015】

図3は、加速度と回転角の関係を示す模式図である。

同図に示すように、ゲームコントローラ200が基本姿勢にあるときには、x加速度は0、y加速度も0、z加速度は-1Gである（Gは重力加速度を示す）。ゲームコントローラ200がロール回転すると、x加速度とz加速度が大きくなるが、y加速度は変化しない。ゲームコントローラ200のロール回転が90度を越え、裏返し方向に回転すると、x加速度は減少に転じるが、z加速度はいっそう大きくなる。

【0016】

同様の理由からピッチ角やヨー角が変化してもx方向にかかる重力は変化しない。しかし、ロール角が変化するとx軸と地面が平行でなくなるのでx加速値が大きくなる。y加速値はロール角やヨー角によって変化しないが、ピッチ回転によって変化する。z加速値はヨー回転によって変化しないが、ロール角やピッチ角によって変化する。実際には、x～z加速値からヨー角を特定するのが難しいため、ヨー角はジャイロセンサの角速度値に基づいて特定される。

【0017】

本実施例に示すレーシングゲームの場合、ロール回転により x 加速値を変化させ、ユーザオブジェクト206を左右に移動させる。ロール角がハンドルの回転角を模している。また、ピッチ角によりユーザオブジェクト206の移動速度を調整できる。ピッチ角はアクセルやブレーキの踏み込み量を模している。ゲームコントローラ200が前方に傾けられ y 加速度が大きくなると、アクセルが踏み込まれた状態となり、ユーザオブジェクト206は加速する。反対に、後方に傾けられ y 加速度が小さくなると、いいかえれば y 軸と逆方向に大きくなると、ブレーキが踏み込まれた状態となり、ユーザオブジェクト206は減速する。十字ボタンなどのボタンインタフェースやいわゆるアナログスティックは、ユーザの指の動きをユーザオブジェクト206に伝えるタイプの入力インタフェースである。これに対し、本実施例に示すボディインタフェースによれば、ユーザは手首や体全体を使ってユーザオブジェクト206を操作できる。より直感的でゲーム環境に没入しやすいユーザインタフェースとなっている。

【0018】

以下においては、 x 加速値と y 加速値を中心として説明し、 z 加速値や角速度値による制御については特に言及しない。しかし、 x 加速値や y 加速値を対象として説明する以下の制御方法と z 加速値や角速度値に対する制御方法の原理は基本的に同じである。 x 加速値や y 加速値に加えて z 加速値や角速度値を使うタイプのゲームとしてはシューティングゲームやフライトシミュレーションゲームなどが考えられる。シューティングゲームであれば x 加速値と y 加速値によりオブジェクトを前後左右に移動させ、 z 加速値や角速度値によって砲門の向きを変えろというユーザインタフェースが考えられる。また、フライトシミュレーションゲームであれば、角速度値の変化に基づきオブジェクトの位置を変えずに旋回させるというユーザインタフェースが考えられる。

【0019】

ゲームコントローラ200にて検出された x 加速値と y 加速値はゲーム装置202に対して操作信号として定期的に伝送される。これらの加速値は、ゲーム装置202内にある後述のユーザインタフェース処理装置100によって操作量に変換される。以下、 x 加速値を変換した操作量のことを「 x 操作量」とよぶ。 y 加速値、 z 加速値、角速度値は、それぞれ「 y 操作量」、「 z 操作量」、「角速度操作量」に変換される。操作量は、ゲーム環境内において、操作対象となるユーザオブジェクト206に作用する力の大きさを示すパラメータである。本実施例における操作量は、いずれも「0～255」の範囲内の数値となる。

【0020】

たとえば、ゲームコントローラ200が右方向にロール回転し、 x 加速値「+190」が検出されたとする。ユーザインタフェース処理装置100は、仮に、この x 加速値「+190」を所定の変換規則により x 操作量「+110」に変換したとする。このとき、ゲームソフトウェアは x 操作量「+110」に応じて、ユーザオブジェクト206の進行方向を決定する。このようにして、ゲームコントローラ200本体の動きがユーザオブジェクト206に伝えられる。加速値から操作量を特定するための変換規則は、図7以降に関連して詳述する「感度特性パターン」として定義される。上述の例の場合、感度特性パターンにおいて、 x 加速値「+190」が x 操作量「+110」と対応づけられていたことになる。詳しくは後述する。

【0021】

図4は、ユーザインタフェース処理装置100の機能ブロック図である。

ここに示す各ブロックは、ハードウェア的には、コンピュータのCPUをはじめとする素子や機械装置で実現でき、ソフトウェア的にはコンピュータプログラム等によって実現されるが、ここでは、それらの連携によって実現される機能ブロックを描いている。したがって、これらの機能ブロックはハードウェア、ソフトウェアの組み合わせによっていろいろなかたちで実現できることは、当業者には理解されるところである。

ここでは、主として各ブロックの発揮すべき機能について、その具体的な作用については、図5以降に関連して説明する。

【0022】

ユーザインタフェース処理装置100は、ゲームコントローラ200から各種加速値と角速度値を取得し、加速値と角速度値からそれぞれに対応する操作量を特定し、ゲームコントローラ200の制御部に対して操作量を送信するソフトウェアモジュールとして実現されてもよい。ユーザインタフェース処理装置100は、たとえば、DLL(Dynamic Link Library)のようなライブラリ形式で提供されてもよい。ユーザインタフェース処理装置100は、DVDにゲームソフトウェアの一部として格納されてもよいし、ゲーム装置202のミドルウェアとして提供されてもよい。あるいは、ゲームコントローラ200に搭載され、加速値や角速度値を操作量に変換して、操作量をゲームコントローラ200に伝送する装置であってもよい。

【0023】

本実施例のユーザインタフェース処理装置100は、ゲーム装置202のミドルウェアとして提供されるソフトウェアモジュールである。ユーザインタフェース処理装置100は、ゲームコントローラ200からゲーム装置202に送信される各種操作信号のうち、x加速値、y加速値、z加速値の各加速値と角速度値を取得する。そして、これらの加速値と角速度値を操作量に変換してゲームソフトウェアの処理用のパラメータとして提供する。

【0024】

ユーザインタフェース処理装置100は、コンテンツインタフェース処理部110、操作量決定部120、コントローラインタフェース処理部130、パターン記憶部140および操作履歴記憶部150を含む。

コンテンツインタフェース処理部110は、ゲーム装置202で実行されるゲームソフトウェアとのインタフェースを担当する。コントローラインタフェース処理部130は、ゲームコントローラ200とのインタフェースを担当する。操作量決定部120は、検出された加速値や角速度値から操作量を特定する。また、操作量決定部120は、コンテンツインタフェース処理部110、コントローラインタフェース処理部130、パターン記憶部140、および操作履歴記憶部150の間のインタフェースの役割も果たす。

パターン記憶部140は、あらかじめ用意された複数種類の感度特性パターンを格納する。操作履歴記憶部150は、ユーザの操作履歴を示す操作履歴データを保持する。

【0025】

コントローラインタフェース処理部130は、x入力部132、y入力部136、z入力部134およびジャイロ入力部138を含む。x入力部132はゲームコントローラ200から送信された操作信号からx加速値を取得する。y入力部136はy加速値を取得し、z入力部134はz加速値を取得し、ジャイロ入力部138はジャイロセンサの検出した角速度値を取得する。x入力部132、z入力部134、y入力部136、ジャイロ入力部138はそれぞれ所定の時間間隔、たとえば、0.01秒ごとに各加速値と角速度値を定期的に取得し、操作履歴記憶部150の操作履歴データに記録する。操作履歴データにおいては、過去所定時間、たとえば、過去3分間における加速値と角速度値が記録される。以下、このような期間のことを「履歴期間」とよぶ。すなわち、3分間÷0.01秒=18000より、最新の18000個の加速値や角速度値が記録される。操作履歴データとして、x加速値、y加速値、z加速値と角速度値の計4種類の検出値について、別々に変化の履歴が記録されることになる。

【0026】

操作量決定部120は、パターン選択部122、入力変換部124、調整部126および回転値変換部128を含む。パターン選択部122は、パターン記憶部140から感度特性パターンを選択する。感度特性パターンも、加速値と角速度値に対応して計4種類選択される。もちろん、ある加速値について選択される感度特性パターンと別の加速値について選択される感度特性パターンは同一であってもよい。入力変換部124は、選択された感度特性パターンを参照して、操作量を特定する。すなわち、x加速値をx操作量に、y加速値をy操作量に、z加速値をz操作量にそれぞれ変換する。また、角速度値を所定

の操作量に変換する。調整部126は、特定された操作量を調整する。操作量の調整については図11等に関連して詳述する。回転値変換部128は、各加速値と角速度値から、ヨー角、ピッチ角、ロール角を特定する。たとえば、図3を参照すると、x加速値が0.5G、z加速値が-0.5Gのときには、ロール角を30度として特定される。

【0027】

コンテンツインタフェース処理部110は、操作量伝送部112とコンテンツ情報取得部114を含む。操作量伝送部112は、操作量決定部120により特定された各操作量をゲームソフトウェアに伝達する。コンテンツ情報取得部114は、ゲームソフトウェアに関する各種情報（以下、「コンテンツ情報」とよぶ）を取得する。コンテンツ情報は、主として2種類に大別される。

【0028】

1つ目は、実行対象となるゲームソフトウェアの種類である。たとえば、アクションゲームやシューティングゲームの場合、ユーザの動きに対するユーザオブジェクト206の追従性を高めるために操作感度を高く設定する方が好ましい。一方、シミュレーションゲームやアドベンチャーゲームの場合には、操作感度の高さよりも操作の確実性が重要である。後にも詳述するが、パターン選択部122はコンピュータゲームの種類に応じて感度特性パターンを選択する。

2つ目は、実行中のコンピュータゲームから発生する情報であり、いわゆるゲームイベントなどが該当する。たとえば、ユーザオブジェクト206がヘアピンカーブにさしかかったときや移動速度が所定速度を超えたときに、ゲームソフトウェアはさまざまなゲームイベントを発生させる。ユーザオブジェクト206の移動速度が小さいときには操作感度を高め、移動速度が大きいときには操作感度を下げることによりユーザオブジェクト206の安定走行を支援してもよい。コンテンツ情報取得部114はゲームイベントを取得し、パターン選択部122はゲームイベントに応じて感度特性パターンを選択する。

【0029】

図5は、ユーザごとの加速値検出範囲の違いを説明するための模式図である。

図5(a)は、あるユーザAの操作履歴データをグラフ化した図である。横軸は時間を示し、縦軸はx加速値を示す。図5(a)から図11(b)までは、主としてx加速値について説明するが、基本的な原理はy加速値やz加速値、角速度値についても同じである。x入力部132は定期的にx加速値を取得し、操作履歴データに記録する。図5(a)によると、ユーザAはゲームコントローラ200を左右に大きく動かしていることがわかる。以下、操作履歴データにおけるx加速値の範囲のことを「x加速値検出範囲」とよぶことにする。図5(a)の場合、ユーザAのx加速値検出範囲は、ほぼ「0~255」である。

【0030】

図5(b)は、別のユーザBの操作履歴データをグラフ化した図である。図5(a)によると、ユーザBはユーザAに比べてゲームコントローラ200を左右に小さく動かしている。すなわち、ユーザBのx加速値検出範囲はユーザAのx加速値検出範囲よりも狭い。図5(a)と図5(b)が同じコンピュータゲームについて取得された操作履歴データであるとする、ユーザAとユーザBはそもそもの操作のやり方が大きく異なっているといえる。したがって、ユーザBにとっては、x加速値の小さな変化でも機敏にx操作量が変化するような操作特性が好ましい。一方、大きくx加速値を変化させるユーザAにとっては、小さなx加速値の変化によってx操作量が大きく反応するような操作特性はそぐわない。

【0031】

図6も、ユーザごとの加速値検出変化率の違いを説明するための模式図である。

図6(a)は、あるユーザCの操作履歴データをグラフ化した図である。図6(a)によると、ユーザAはゲームコントローラ200を左右に小刻みに動かしていることがわかる。以下、操作履歴データにおけるx加速値の変化率のことを「x加速値検出変化率」とよぶことにする。たとえば、履歴期間の所定時点における0.1秒あたりのx加速値の変

化量を x 加速値検出変化率として定義してもよい。図6 (b) は、別のユーザDの操作履歴データを示すグラフである。図6 (b) によると、ユーザDはゲームコントローラ200をゆったりと動かしていることがわかる。すなわち、ユーザDの x 加速値検出変化率はユーザCのそれよりも小さい。

【0032】

図7は、感度特性パターンの第1例を示す図である。

図7 (a) から図11 (b) に示す各グラフは、 x 加速値と x 操作量の対応関係を定めるさまざまな感度特性パターンを示す。図7 (a) の感度特性パターンの場合、 x 加速値と x 操作量は正比例の関係にある。 x 加速値の最大値「255」が x 操作量の最大値「255」に対応し、同様に、 x 加速値の最小値「0」が x 操作量の最小値「0」に対応している。

図7 (b) に示す感度特性パターンでも、 x 加速値と x 操作量は正比例の関係にある。ただし、 x 加速値が「191 (= 255 - 64)」以上となると、 x 操作量は最大の「255」となる。また、 x 加速値が「63 (= 127 - 64)」以下となると、 x 操作量は最小の「0」となる。以下、図7 (a) から図10 (b) までは示すような単調増加関数タイプの感度特性パターンにおいては、最小 x 操作量から最大 x 操作量までに達するときの x 加速値の範囲のことを「 x 加速値実質範囲」とよぶことにする。図7 (a) の感度特性パターンの場合、 x 加速値実質範囲は「0 ~ 255」である。図7 (b) の感度特性パターンの場合、 x 加速値実質範囲は「63 ~ 191」である。図7 (b) の方が、図7 (a) よりも x 加速値実質範囲が狭くなっている。また、感度特性パターンの傾きの大きさとして

$$\text{x 加速値実質変化率} = (\text{最大 x 操作量} - \text{最小 x 操作量}) / \text{x 加速値実質範囲}$$
を定義する。

【0033】

これら2種類の感度特性パターンを比べてみると、図7 (a) の感度特性パターンよりも図7 (b) の感度特性パターンの方が x 加速値実質変化率が高い。すなわち、操作感度が高い。

【0034】

x 加速値検出範囲が大きいユーザAには図7 (a) のような感度特性パターンの方を適用してもよい。図7 (a) の感度特性パターンの場合、 x 加速値実質範囲の広さとユーザAの x 加速値検出範囲の広さがマッチするため、より快適な操作性を提供できる。

【0035】

ユーザBにとっては図7 (b) の感度特性パターンの方を適用してもよい。図7 (b) の感度特性パターンの場合、 x 加速値実質範囲の狭さとユーザBの x 加速値検出範囲の狭さがマッチするため、より快適な操作性を提供できる。

【0036】

あるいは、別の観点から、ユーザAに対して、図7 (b) の感度特性パターンを適用してもよい。

ユーザAの様にゲームコントローラ200を大きく動かすユーザに対して、図7 (b) のように x 加速値実質範囲の狭い感度特性パターンを適用すると、ユーザAがゲームコントローラ200の動きを小さくするように導くことができる。図7 (b) の感度特性パターンによれば大きく x 加速値を変化させなくても x 操作量を変化させることができるので、ユーザAは x 加速値検出範囲を狭めるように操作方法を変更することになるからである。

また、ユーザBの様にゲームコントローラ200を小さく動かすユーザに対して、図7 (a) の感度特性パターンを適用してもよい。ユーザBは、 x 加速値を小さく変化させており、 x 操作量を細かく制御しようとしていると考えられる。したがって、図7 (a) の様に x 加速値に対して x 操作量が緩やかに変化する感度特性パターンを適用することによりユーザBの意思を操作内容に反映させやすくなる。

【0037】

パターン選択部122は、操作履歴データにおけるx加速値が所定の閾値を超えるとときには図7(a)の感度特性パターンを選択し、そうでないときには図7(b)の感度特性パターンを選択する。あるいは、x加速値検出範囲が所定の閾値を超えるか否かを選択条件としてもよい。履歴期間において、x加速値が所定の閾値を超えた回数に応じて、いずれかの感度特性パターンを選択してもよい。このように、パターン選択部122は操作履歴データにおけるx加速値検出範囲の広狭に応じて、感度特性パターンを選択する。

【0038】

ユーザCのようにx加速値検出変化率が大きいユーザCには、図7(b)の感度特性パターンの方が図7(a)の感度特性パターンよりも好ましい。小刻みにx加速値を変化させ、機敏な操作を求めるユーザCにとって、図7(a)のようなx加速値実質変化率が低い感度特性パターンよりも、図7(b)のような操作感度が高い感度特性パターンの方がユーザCにより適合した操作性を提供できる。

【0039】

x加速値をゆっくり変化させるユーザDにとっては図7(a)の感度特性パターンの方が好ましい。ユーザDは、慎重にゲームコントローラ200を操作する傾向にあるため、x加速値実質変化率が大きすぎると使いにくさを感じてしまう。したがって、図7(a)の感度特性パターンの場合、x加速値実質変化率の小ささとユーザBのx加速値検出変化率の小ささがマッチするため、より快適な操作性を提供できる。

【0040】

パターン選択部122は、操作履歴データにおけるx加速値検出変化率が所定の閾値を超えるとときには図7(b)の感度特性パターンを選択し、そうでないときには図7(a)の感度特性パターンを選択する。あるいは、履歴期間において、x加速値検出変化率が所定の閾値を超えた回数に応じて、いずれかの感度特性パターンを選択してもよい。このように、パターン選択部122は操作履歴データにおけるx加速値検出変化率の大小に応じて、感度特性パターンを選択する。

【0041】

パターン選択部122は、刻々と更新される操作履歴データを参照しながら、感度特性パターンを動的に切り換える。入力変換部124は、感度特性パターンを参照して、検出されたx加速値に対応するx操作量を特定する。

【0042】

なお、図7(a)と図7(b)のいずれも、x加速値の中央値である「127」に対して点对称のグラフとなっているが、これは感度特性パターンにとって必須の条件ではない。たとえば、右向きのx加速値(127~255)が大きく、左向きのx加速値(0~127)が小さくなりがちな操作履歴データを想定する。実際、ユーザの利き腕によっては、右向きのx加速値における操作履歴と左向きのx加速値における操作履歴は別々に扱った方が好適な場合もある。この場合、パターン選択部122は、x加速値が「127~255」のときには図7(a)の感度特性パターンを選択し、x加速値「0~127」のときには図7(b)の感度特性パターンを選択してもよい。このような選択方法によれば、利き腕などユーザの身体的な癖まで考慮して好適な感度特性パターンを選択できる。同様の理由からx加速値「127」とx操作量「127」は必ずしも対応づけられる必要はない。ゲームコントローラ200を右に動かしがちなユーザであれば、x加速値が「127」以上の所定値にあるときにx操作量が中央値「127」となるように対応づけた方が、操作性が向上する。

【0043】

図5(a)から図6(b)において、x加速度検出範囲の中央値は、いずれもほぼ「127」となっている。しかし、x加速度検出範囲の中央値が「127」以上、あるいは、「127」以下となる場合もある。調整部126は、実際に検出されたx加速値の中央値とx操作量の中央値が対応するように感度特性パターンを調整してもよい。

たとえば、調整部126は履歴期間におけるx加速値の平均値をx加速度実質検出範囲の中央値として算出する。仮に、x加速値の平均値が「150」であったとする。そして

、このx加速値の平均値「150」とx操作量の中央値「127」が一致するように、感度特性パターンを平行移動させる。このような調整によれば、x加速値の検出範囲に応じてx操作量とx加速値の対応関係を好適に追従させることができる。

【0044】

調整部126は、選択された感度特性パターンを更に調整してもよい。たとえば、履歴期間において、x加速値が「63～191」の範囲を逸脱した回数が10回以上となる場合には、パターン選択部122は図7(b)の感度特性パターンを選択し、「31～223」の範囲を逸脱した回数も10回以上となる場合には、調整部126は図7(b)のx加速値実質範囲を「63～191」から「31～223」に広げてもよい。また、これにあわせてx加速値実質変化率も調整されることになる。すなわち、x加速値が「0～31」のときにはx操作量は「0」、x加速値が「223～255」のときにはx操作量は「255」となる。そして、x加速値が「31～223」のときには、x加速値に正比例してx操作量は0から255に変化する。

【0045】

感度特性パターンが選択変更されたとき、x加速値に対するx操作量の対応関係は瞬間的に切り換えられなくてもよい。図7(a)の感度特性パターンに代えて図7(b)の感度特性パターンを選択するとする。このとき、調整部126は、図7(a)のx加速値実質範囲を徐々に狭めながら、図7(a)の感度特性パターンから図7(b)の感度特性パターンに変化させてもよい。感度特性パターンを緩やかに変化させることにより、ユーザが操作感の変化に対応しやすくなる。図8(a)以降についても同様である。

調整部126は、アプリケーションソフトウェアからの指示に応じて感度特性パターンの切り換え速度を変化させてもよい。たとえば、複雑な操作や敏捷な操作をユーザに要求する場面では、調整部126は比較的ゆっくりと感度特性パターンを切り換える。これにより、ユーザは徐々に操作感の変化になじむことができる。一方、メニュー選択画面などのいわば静的な場面では、調整部126は比較的すばやく感度特性パターンを切り換えてもよい。

感度特性パターンが加速値と操作量の対応関係をあらかじめ定めるデータテーブルではなく、加速値から操作量を特定するための計算式である場合も同様である。たとえば、 $x \text{ 操作量} = a \times x \text{ 加速値} + b$ という関係が成立しているときに、係数aや係数bの大きさを徐々に変化させることにより、ある感度特性パターンから別の感度特性パターンへと変化させてもよい。

【0046】

パターン選択部122は実行対象となるゲームソフトウェアの種類に応じて感度特性パターンを選択することもできる。たとえば、実行対象となるコンピュータゲームが高い操作感度を必要とするアクションゲームの場合、パターン選択部122は図7(b)の感度特性パターンを選択する。また、実行対象となるコンピュータゲームが操作感度よりも操作の安定性が重要なシミュレーションゲームの場合、パターン選択部122は図7(a)の感度特性パターンを選択する。実行対象となるコンピュータゲームがゲーム装置202のメモリにロードされるときに、コンテンツ情報取得部114は、ゲームソフトウェアからゲームの種類を示す情報を受信し、パターン選択部122が対応する感度特性パターンを選択する。ゲームソフトウェアがどのような感度特性パターンを選ぶべきかを明示的にコンテンツ情報取得部114に通知してもよい。

【0047】

パターン選択部122は、ゲームイベントに応じて感度特性パターンを選択してもよい。たとえば、レーシングゲームの場合、ユーザがユーザオブジェクト206のタイヤやサスペンションが交換されたとき、パターン選択部122は感度特性パターンを変更してもよい。このような選択方法によれば、ユーザオブジェクト206について選択されるスペックに応じて、操作感を変更することができる。また、ユーザオブジェクト206の移動速度が大きいときには図7(a)のように操作感度を下げ、移動速度が小さいときには図7(b)のように操作感度を上げれば、ユーザはユーザオブジェクト206を操作しやす

くなる。移動速度が大きいときはユーザオブジェクト206の直進性が重視される状況にあると考えられるため、このような選択方法によればよりユーザの意思に合致した操作性を提供できる。

【0048】

図8は、感度特性パターンの第2例を示す図である。

図8(a)の感度特性パターンの場合、x加速値が「95～159」のときx操作量は変化しない。このようなx加速値の範囲のことを「遊び範囲」とよぶ。遊び範囲を設けることにより、x操作量を中央値「127」に設定しやすくなる。図8(b)の感度特性パターンの遊び範囲は「111～143」となっており、図8(a)の感度特性パターンの遊び範囲よりも狭くなっている。

【0049】

x加速値検出範囲が広いユーザAには、図8(b)よりも図8(a)のような感度特性パターンの方が好ましい。大きな操作を好むユーザAにとって、図8(b)のような遊び範囲が狭い感度特性パターンでは、x操作量を中立的な「127」に戻すのが難しく感じられる。一方、図8(a)の感度特性パターンの場合、遊び範囲の広さとユーザAのx加速値検出範囲の広さがマッチするため、より快適な操作性を実現できる。

【0050】

ユーザBにとっては図8(b)の感度特性パターンの方が好ましい。ユーザBのx加速値検出範囲は狭いので、図8(a)のような遊び範囲が広い感度特性パターンの場合、ユーザBは反応性の悪さを感じてしまう。一方、図8(b)の感度特性パターンの場合、遊び範囲の狭さとユーザBのx加速値検出範囲の狭さがマッチするため、より快適な操作性を提供できる。図7に関連して説明したのと同様、パターン選択部122は操作履歴データにおけるx加速値検出範囲の広狭に応じて、感度特性パターンを選択する。

【0051】

ユーザCのようにx加速値検出変化率が大きいユーザCには、図8(a)の感度特性パターンの方が図8(b)の感度特性パターンよりも好ましい。小刻みにx加速値を変化させるユーザCにとって、図8(b)のような遊び範囲が狭い感度特性パターンよりも、図8(a)のような遊び範囲が広い感度特性パターンの方が操作を安定させやすく、ユーザCにより適合した操作性を提供できる。

【0052】

x加速値をゆっくり変化させるユーザDにとっては図8(b)の感度特性パターンの方が好ましい。ユーザDは、慎重にゲームコントローラ200を操作する傾向にあるため、x操作量を細かく制御することができる。そのため、遊び範囲が広いとかえって使いにくさを感じてしまう。図8(b)の感度特性パターンの場合、遊び範囲の狭さとユーザBのx加速値検出変化率の小ささがマッチするため、より快適な操作性を提供できる。図7に関連して説明したのと同様、パターン選択部122は操作履歴データにおけるx加速値検出変化率の大小に応じて、感度特性パターンを選択してもよい。

【0053】

調整部126は、選択された感度特性パターンを更に調整してもよい。たとえば、履歴期間において、x加速値が「63～191」の範囲を逸脱した回数が10回以上となる場合には、パターン選択部122は図8(a)の感度特性パターンを選択し、「31～223」の範囲を逸脱した回数も10回以上となる場合には、調整部126は図8(b)の遊び範囲を「111～143」から「63～191」に更に広げてよい。

【0054】

パターン選択部122は実行対象となるゲームソフトウェアの種類に応じて感度特性パターンを選択することもできる。たとえば、実行対象となるコンピュータゲームがアクションゲームの場合、パターン選択部122は図8(a)のような遊び範囲が大きくて操作が安定しやすい感度特性パターンを選択する。あるいは、操作感度を優先して、図8(b)のような感度特性パターンを選択するとしてもよい。

【0055】

また、図7に関連して説明したようにパターン選択部122は、ゲームイベントに応じて感度特性パターンを選択してもよい。たとえば、ユーザオブジェクト206の移動速度が大きいときに遊び範囲を広げてやれば、直進安定性を増すことができる。また、図8(a)や図8(b)においては、同じx加速値であっても、x加速値が増加する方向と減少する方向で対応するx操作量を異ならせてもよい。すなわち、ちょうどヒステリシス曲線のように対応関係を設定することにより、操作の安定性をいっそう向上させてもよい。

【0056】

図8(a)と図8(b)のいずれも、x加速値「127」となる中央値に対して点対称のグラフとなっているが、感度特性パターンにとって必須の条件でないことは図7(a)や図7(b)と同様である。遊び範囲は必ずしもx加速値「127」を中心とする必要はない。たとえば、右方向へのx加速値が大きく、左方向へのx加速値が小さくなりがちな操作履歴データを想定する。この場合、遊び範囲をたとえば、「107~171」のように右寄りにシフトした方が、操作性が向上する。調整部126は、x加速値検出範囲の広狭やx加速値検出変化率の大小により、遊び範囲の大きさや位置を決定し、動的に感度特性パターンの対応関係を調整してもよい。

【0057】

また、図7(a)、図7(b)、図8(a)、図8(b)のうちいずれか1つの感度特性パターンを選択するのではなく、いずれか2つ以上の感度特性パターンを選択して組み合わせてもよい。たとえば、パターン選択部122は、図7(b)の感度特性パターンと図8(a)の感度特性パターンを選択し、調整部126はこれら2つの感度特性パターンを重畳し、x操作量の範囲を「0~255」に正規化してもよい。このような処理方法によれば、複数の感度特性パターンの特徴を反映した新たな感度特性パターンを生成することができる。

【0058】

図9は、感度特性パターンの第3例を示す図である。

図9(a)や図9(b)に示す感度特性パターンは、図8(a)や図8(b)と異なり遊び範囲においてx操作量がわずかに変化している。遊び範囲とは、図8(a)や図8(b)のようにx加速値の変化に対してx操作量が全く変化しない範囲に限らず、図9(a)や図9(b)のようにx操作量の変化が鈍化する範囲であってもよい。

【0059】

図10は、感度特性パターンの第4例を示す図である。

図7(a)等に関連して説明したように、x加速値とx操作量は比例関係にあってもよいが、x操作量の変化率は滑らかに変化してもよい。図10(a)においてはx加速値「127」付近におけるx操作量の増加率は小さいが、図10(b)においては逆に大きくなっている。大きくx加速値を変化させるユーザAには、x操作量が緩やかに変化する図10(a)の感度特性パターン、小さくx加速値を変化させるユーザBにはx操作量が機敏に変化する図10(b)の感度特性パターンが好ましい。

【0060】

x加速値を小刻みに変化させるユーザCの場合、x操作量が緩やかに変化する図10(a)の感度特性パターンの方が好ましい。また、ゆっくりと安定的にx加速値を変化させるユーザDの場合、x操作量が機敏に変化する図10(b)の感度特性パターンの方が好ましい。くり返すまでもなく、パターン選択部122は、実行対象となるコンピュータゲームの種類やゲームイベントに応じて、図10(a)または図10(b)のいずれかの感度特性パターンを選択してもよい。

【0061】

図11は、感度特性パターンの第5例を示す図である。

図11(a)や図11(b)の感度特性パターンにおいては、x操作量とx加速値は1対1にて対応するとは限らない。図11(a)のグラフにおいては、x加速値とx操作量の対応関係が波打つような形状になっている。たとえば、小舟の上のユーザオブジェクト206を操作するようなゲーム性の場合に図11(a)の感度特性パターンを適用してもよ

い。所望のx操作量を出力するためのx加速値の設定が難しいため、ゲームコントローラ200を左右に動かしながらユーザオブジェクト206のバランスをとるような操作感を実現できる。したがって、足場の悪さをユーザにより実感させることができる。

【0062】

図11(b)においては、実線で示す感度特性パターンと点線で示す感度特性パターンが定期的に入れ替わる様子を示している。時間経過にともなって複数の感度特性パターンを動的に切り換えることによって、ユーザを翻弄するような操作感をいっそうリアルに表現できる。パターン選択部122が複数種類の感度特性パターンを適宜選択することによりこのような操作感を実現するとしてもよい。あるいは、調整部126が感度特性パターンにおける対応関係を動的に調整することによりこのような操作感を実現してもよい。たとえば、調整部126は、選択された感度特性パターンにおけるx操作量を+110%から90%の範囲で定期的増減することにより、動的に変化する操作感を実現することができる。

【0063】

なお、以上においては、x加速値とx操作量の関係を示したが、y加速値とy操作量、z加速値とz操作量の関係についてもそれぞれ感度特性パターンの選択により決定される。これら3種類の感度特性パターンは共通であってもよいし、別々に選択されてもよい。人間の手首の構造上、ピッチ角に比べてロール角の方が大きく変化させやすい。そのため、y加速値については操作感度を高く、x加速値については操作感度を低くすることにより、いっそう快適な操作感を実現できる。

【0064】

図12は、y加速値に応じてx加速値とx操作量の関係が変化する様子を示すグラフである。

図12は、さまざまなy加速値について、x加速値とx操作量の対応関係を示している。たとえば、y加速値=255の場合、x加速値=255のときx操作量=255、x加速値=0でx操作量=0となる。すなわち、x加速値実質範囲は「0~255」となっている。一方、y加速値=127の場合、x加速値=191でx操作量=255、x加速値=63でx操作量=0となる。すなわち、x加速値実質範囲は「63~191」である。このように、パターン選択部122は、y加速値に応じて、x加速値実質範囲が異なる感度特性パターンを選択してもよい。

【0065】

y加速値やx加速値が共に127付近にあるとき、すなわち、ゲームコントローラ200が基本姿勢にあるときには、ユーザはゲームコントローラ200を傾けやすい。しかし、ゲームコントローラ200を前方に大きく傾けた状態で、更にロール回転させるのは比較的 unnatural な態勢となる。そこで、y加速値が大きいときや小さいときには、x加速値実質範囲を広げることにより、ロール回転方向の操作の安定させやすくなる。

【0066】

特に、レーシングゲームの場合、y加速値が大きく、ユーザオブジェクト206の移動速度が大きくなっているときには、x加速値実質範囲を広げることで、ユーザオブジェクト206の直進安定性を操作性の面で支援している。

もちろん、これとは逆に、x加速値が「255」のときには「127」のときよりもx加速値実質範囲を広くするとしてもよい。このような処理方法によれば、unnaturalな態勢にあるときの操作感度を基本姿勢にあるときの操作感度よりも高めることができる。どのようなy加速値においてどのようなx加速値実質範囲を選択するかは、実行対象となるコンピュータゲームの種類や実行状況に応じて決定すればよい。

【0067】

3次元空間において操作対象物を移動させるアプリケーション、たとえば、飛行機や潜水艦などのように3次元航行が可能な物体を操作する場合において、ユーザがゲームコントローラ200を前方に大きく傾けているとする。このとき、ユーザの「操作対象物を直進させたい」という意思が「ゲームコントローラ200の前方への大きな傾き」として現

れているといえる。このときのユーザにとって、操作対象物の前方への動きに比べれば左右への動きは重要ではない、あるいは、好ましくないとすら考えられる。したがって、ゲームコントローラ200のピッチ角が大きいほど、ロール角に対する操作感度を下げることにより、ユーザの意思を反映した操作性を実現できる。このような処理方法によれば、第1の操作量から推測されるユーザの意思を考慮して、第2の操作量に対する操作感度を調整するという操作性を実現できる。

【0068】

以上、本実施例に示したユーザインタフェース処理装置100によれば、ボディインタフェースにおける操作性を向上させることができる。

本実施例において主たる説明の対象としたx加速値の場合、x加速値に対するx操作量の感度特性を変化させる要因としては以下のものが挙げられる。括弧内は、本明細書における関連図である。

1. x加速値検出範囲(図5(a)、図5(b))
2. x加速値検出変化率(図6(a)、図6(b))
3. 実行対象となるコンピュータゲームの種類
4. コンピュータゲームのゲームイベント
5. ユーザオブジェクト206の移動速度
6. 時間経過(図11(a)、図11(b))
7. x加速値以外の加速値(図12)

x加速値に対するx操作量の感度特性を変化内容としては以下のものが挙げられる。

1. x加速値実質範囲(図7(a)、図7(b))
2. x加速値実質変化率(図7(a)、図7(b)、図10(a)、図10(b))
3. 遊び範囲(図8(a)、図8(b)、図9(a)、図9(b))

【0069】

なお、本実施例においては、加速値から操作量を特定する処理について説明したが、本発明の適用はこれに限られるものではない。たとえば、ジャイロセンサから検出されるヨー角から操作量を特定してもよい。また、x加速値、y加速値、z加速値から、図3に関連して説明した原理にて、ロール角やピッチ角を検出することも可能である。回転値変換部128は、x加速値、y加速値、z加速値、角速度値から、ヨー角、ピッチ角、ロール角をそれぞれ「0〜255」の範囲のデジタル値に変換する。感度特性パターンは、これらの回転角と操作量との対応関係を定義するパターンであってもよい。この場合、入力変換部124は、算出された回転角と感度特性パターンを参照して、操作量を特定する。このように、ゲームコントローラ200のセンサによって検出された加速値ではなく、加速値から特定された回転角に基づいて、操作量を特定してもよい。図12の場合であれば、ピッチ回転角の大きさに応じて、ロール回転角と操作量の関係を調整してもよい。

【0070】

ジョイスティックなどのユーザインタフェースにおいて、スティックの可動範囲は物理的な制約を受ける。これに対し、ゲームコントローラ200の動きそのものを入力とするボディインタフェースの場合、実質的に物理的な制約がない。そのため、ユーザは、ゲームコントローラ200を過度に大きく動かす可能性もある。感度特性パターンの切り換えにより、ユーザに操作のためにゲームコントローラ200を動かす範囲を暗黙的に認識させることにより、ユーザの操作を好適に導くことができる。

【0071】

このようなさまざまな要素によって操作感度を調整することにより、ユーザやコンテンツの種類、実行状況にあった操作性を提供できる。また、ゲームコントローラ200に内蔵される各センサの検出精度が経年変化しても、自動的に補正することができるという副次的な効果もある。本実施例においては、ゲーム装置202に接続されるゲームコントローラ200を対象として説明したが、携帯型のゲーム機器であれば本体そのものの傾きを検出対象としてもよい。また、本実施例においては、加速値や角速度値、ひいては、ゲームコントローラ200の回転角の大きさを検出対象としたが、ボディインタフェースにお

ける入力には加速値や傾きに限る必要はない。たとえば、磁気センサにより空間内における位置を検出し、これを入力として操作量を決定する場合においても、本実施例に示した操作感度制御方法を応用可能である。

【0072】

本実施例においては、所定形状となるような感度特性パターンを中心として説明したが、変形例としてベジェ曲線やNURBS曲線のような自由曲線となる感度特性パターンにより操作感度を調整してもよい。また、自由曲線を決定する変数、たとえば、ベジェ曲線における制御点を変化させることによりその操作感度を変化させてもよい。

なお、本実施例においては、図5(a)に示す入力パターンに対しては、図7(a)に示す感度特性パターンが適合するとして説明したが、どのような入力変数に対してどのような感度特性パターンを割り当てるかは、設計方針に応じて任意に設定すればよいことはいうまでもない。

【0073】

以上、本発明を実施例をもとに説明した。この実施例はあくまで例示であり、それらの各構成要素や各処理プロセスの組み合わせにいろいろな変形例が可能なこと、またそうした変形例も本発明の範囲にあることは当業者に理解されるところである。

【0074】

請求項に記載の入力部の機能は、本実施例においてはx入力部132により実現されている。請求項に記載の検出値は、本実施例においては加速度値として表現されている。

これら請求項に記載の各構成要件が果たすべき機能は、本実施例において示された各機能ブロックの単体もしくはそれらの関係によって実現されることも当業者には理解されるところである。

【0075】

以上の実施の形態および変形例から把握される発明のいろいろな態様をすでに特許請求の範囲に記載したものも含むかたちにて以下に例示する。

【0076】

A1. 物体の動きの大きさと方向をそれぞれ検出可能なセンサを内蔵し、デバイス本体を把持するユーザの手の動きを操作量として伝達するための入力デバイスから、前記センサの第1方向への動きの大きさを示す第1検出値と前記第1方向とは異なる第2方向への動きの大きさを示す第2検出値をそれぞれ取得する入力部と、

第1検出値に対する操作量の反応感度が異なる複数種類の感度特性パターンを記憶するパターン記憶部と、

前記取得された第2検出値に応じて感度特性パターンを選択し、前記選択された感度特性パターンを参照して、前記取得された第1検出値に対応する操作量を決定する操作量決定部と、

を備えることを特徴とするユーザインタフェース装置。

【0077】

A2. 前記操作量決定部は、第1検出値の変化に対して操作量が変化する割合が異なる複数種類の感度特性パターンからいずれかの感度特性パターンを選択することを特徴とするA1に記載のユーザインタフェース装置。

【0078】

A3. 前記操作量決定部は、第1検出値が変化しても操作量が変化しない検出の遊び範囲が異なる複数種類の感度特性パターンからいずれかの感度特性パターンを選択することを特徴とするA1またはA2に記載のユーザインタフェース装置。

【0079】

A4. 前記入力デバイスが内蔵する前記センサは、前記入力デバイスの第1の所定軸を中心とした回転角の大きさと、前記入力デバイスの第2の所定軸を中心とした回転角の大きさをそれぞれ検出可能なセンサであり、

前記入力部は、前記入力デバイスの前記第1の所定軸を中心とした回転角の大きさを第1検出値、前記第2の所定軸を中心とした回転角の大きさを第2検出値として取得するこ

とを特徴とするA 1に記載のユーザインタフェース装置。

【0080】

A 5. 前記入力部は、前記入力デバイスを把持するユーザからみて前記入力デバイスが前方または後方に傾けられたときの回転角の大きさを第2検出値として取得することを特徴とするA 4に記載のユーザインタフェース装置。

【0081】

A 6. 前記操作量決定部は、前記入力デバイスが基本姿勢にあるときの第2検出値を含む所定範囲から前記取得された第2検出値が外れたときには、前記所定範囲内にあるときよりも第1検出値に対する操作量の反応感度が低い感度特性パターンを選択することを特徴とするA 4またはA 5に記載のユーザインタフェース装置。

【0082】

A 7. ユーザが把持する入力デバイスの動きを操作量として伝達するための方法であって、

前記入力デバイスの動きの大きさを所定の2方向についてそれぞれ検出するステップと、

前記2方向のうちの一方方向への動きの大きさに応じて、他方向への動きの大きさに対する前記入力デバイスの操作感度を決定するステップと、

前記決定された操作感度に応じて前記他方向への動きに対する操作量を決定するステップと、

を備えることを特徴とする操作感度調整方法。

【0083】

A 8. 物体の動きの大きさと方向をそれぞれ検出可能なセンサを内蔵し、デバイス本体を把持するユーザの手の動きを操作量として伝達するための入力デバイスから、前記センサの第1方向への動きの大きさを示す第1検出値と前記第1方向とは異なる第2方向への動きの大きさを示す第2検出値を取得する機能と、

第1検出値に対する操作量の反応感度が異なる複数種類の感度特性パターンを記憶する機能と、

前記取得された第2検出値に応じて、いずれかの感度特性パターンを選択し、前記選択された感度特性パターンを参照して、前記取得された第1検出値に対応する操作量を決定する機能と、

をコンピュータに発揮させることを特徴とするユーザインタフェース処理プログラム。

【図面の簡単な説明】

【0084】

【図1】本実施例におけるコンピュータゲームの実行環境を示す模式図である。

【図2】ゲームコントローラを中心とした座標系を示す模式図である。

【図3】加速度と回転角の関係を示す模式図である。

【図4】ユーザインタフェース処理装置の機能ブロック図である。

【図5】図5(a)は、ユーザごとのx加速値検出範囲の違いを説明するための模式図の第1例である。図5(a)は、ユーザごとのx加速値検出範囲の違いを説明するための模式図の第2例である。

【図6】図6(a)は、ユーザごとのx加速値検出変化率の違いを説明するための模式図の第1例である。図6(a)は、ユーザごとのx加速値検出変化率の違いを説明するための模式図の第2例である。

【図7】図7(a)は、感度特性パターンの第1例を示す図である。図7(b)も、感度特性パターンの第1例を示す図である。

【図8】図8(a)は、感度特性パターンの第2例を示す図である。図8(b)も、感度特性パターンの第2例を示す図である。

【図9】図9(a)は、感度特性パターンの第3例を示す図である。図9(b)も、感度特性パターンの第3例を示す図である。

【図10】図10(a)は、感度特性パターンの第4例を示す図である。図10(b)も、

感度特性パターンの第4例を示す図である。

【図11】図11(a)は、感度特性パターンの第5例を示す図である。図11(b)も、感度特性パターンの第5例を示す図である。

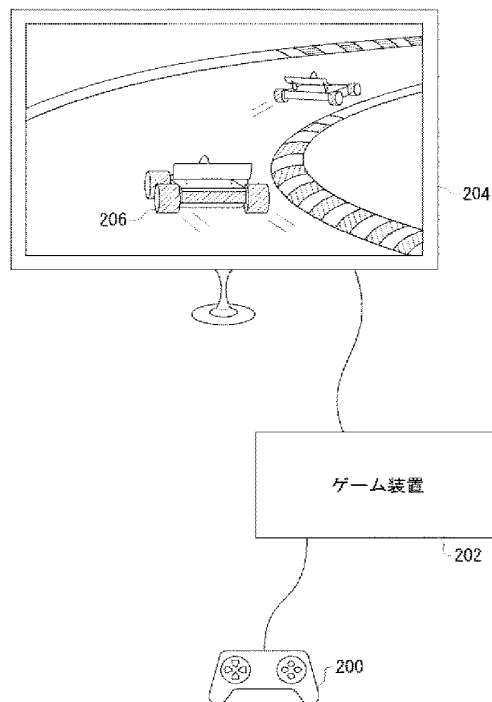
【図12】ピッチ回転値に応じてロール回転値とロール操作量の関係が変化する様子を示すグラフ図である。

【符号の説明】

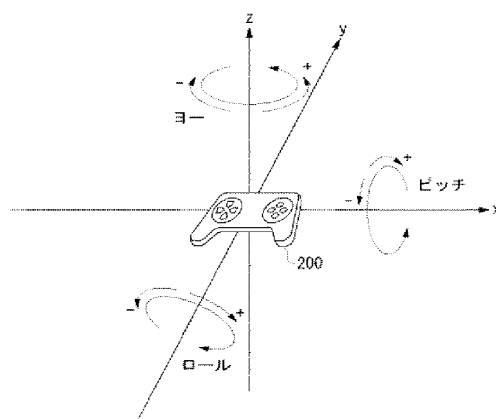
【0085】

100 ユーザインタフェース処理装置、 110 コンテンツインタフェース処理部、 112 操作量伝送部、 114 コンテンツ情報取得部、 120 操作量決定部、 122 パターン選択部、 124 入力変換部、 126 調整部、 130 コントローラインタフェース処理部、 132 x入力部、 134 z入力部、 136 y入力部、 140 パターン記憶部、 150 操作履歴記憶部、 200 ゲームコントローラ、 202 ゲーム装置、 204 モニタ、 206 ユーザオブジェクト。

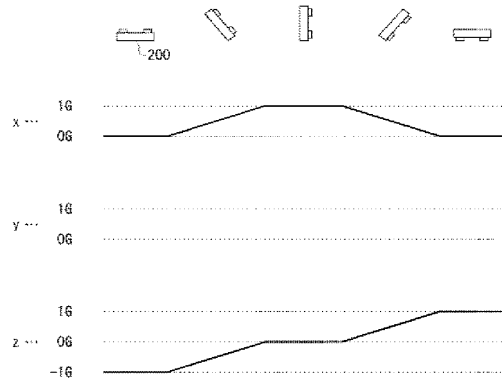
【図1】



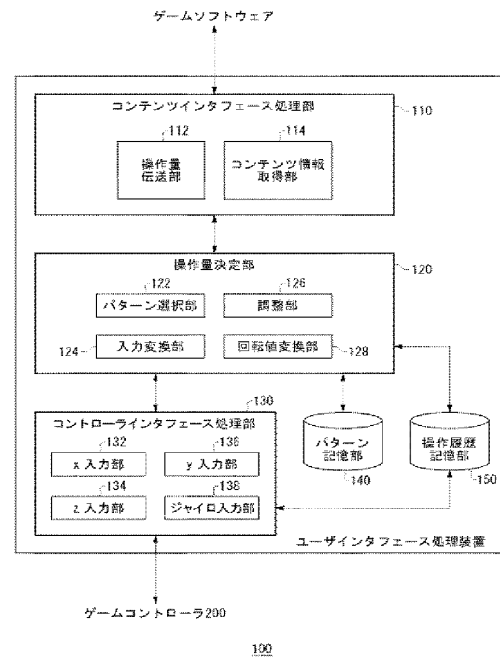
【図2】



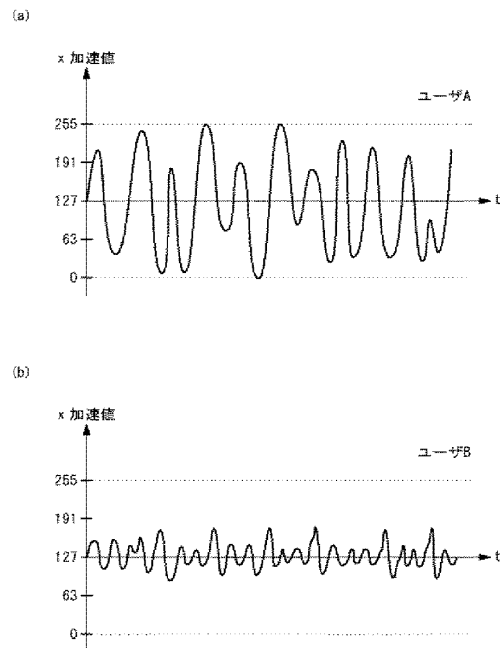
【図3】



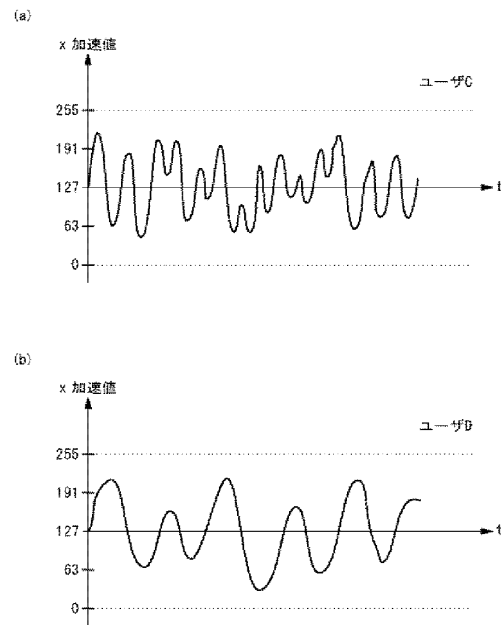
【図4】



【図5】

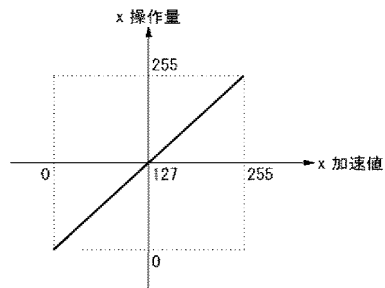


【図6】

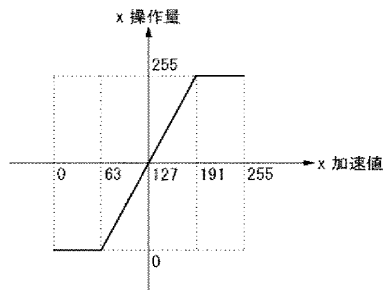


【図7】

(a)

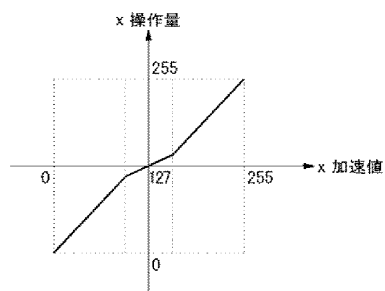


(b)

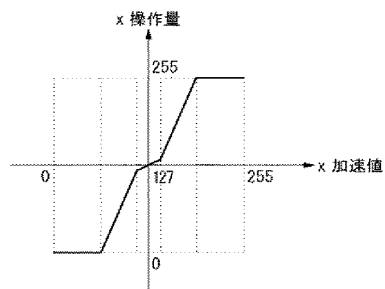


【図9】

(a)

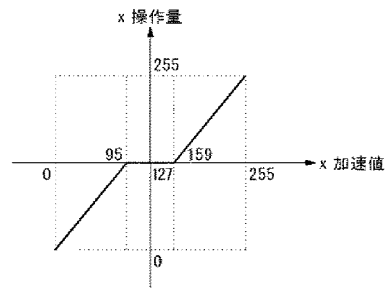


(b)

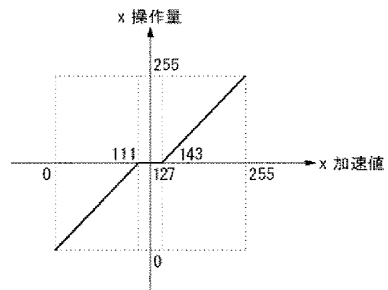


【図8】

(a)

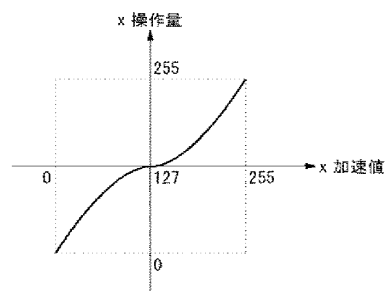


(b)

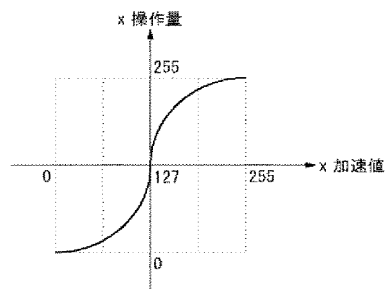


【図10】

(a)

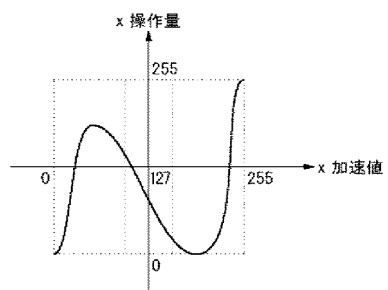


(b)

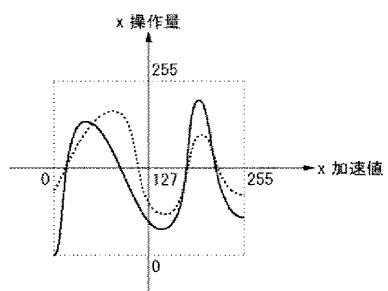


【図11】

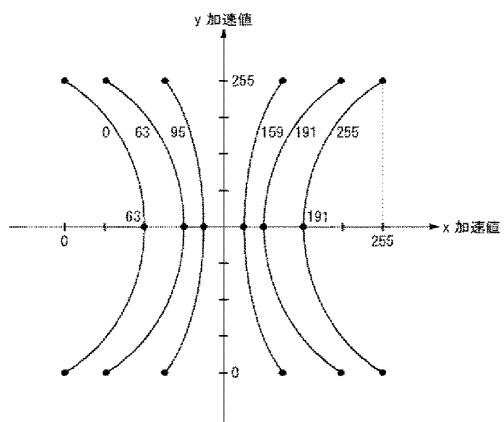
(a)



(b)



【図12】





Espacenet

Bibliographic data: JP2014215850 (A) — 2014-11-17

PARAMETER SETTING DEVICE

Inventor(s): NISHIZAWA KAZUHIKO ± (西澤 和彦)

Applicant(s): YAMAHA CORP ± (ヤマハ株式会社)

Classification: - international: G06F3/01; G06F3/0362
 - cooperative: G06F3/016; G06F3/02; G06F3/0362;
G06F3/04847

Application number: JP20130093338 20130426 Global Dossier

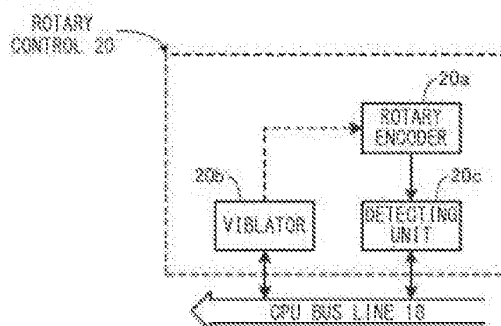
Priority number(s): JP20130093338 20130426

Also published as: CN104122993 (A) EP2796966 (A1) US2014320406 (A1)

Abstract of JP2014215850 (A)

PROBLEM TO BE SOLVED: To set parameter values in a specified range without requiring continuous watching of the screen. SOLUTION: When the knob of a handler is operated, if a parameter value takes on a specific level DV at a time point ta4, a vibration Sa1 sustained for a time length T is assigned to the knob. Also, if the parameter value whose level was the specific level DV at the time point ta4 is no longer that specific value at a time point ta5, a vibration Sa2 sustained for the time length T is assigned to the knob. As the user is given a tactile feedback in this way, he or she can sense without attentively watching the screen in which the parameter value is displayed that the parameter value has taken on the specific level DV and later it is no longer at the specific level DV.

(Fig. 1B)



(19) 日本国特許庁 (JP)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開2014-215850

(P2014-215850A)

(43) 公開日 平成26年11月17日 (2014. 11. 17)

(51) Int. Cl.		F I		テーマコード (参考)
G06F 3/01 (2006.01)		G06F 3/01	310A	5B087
G06F 3/0362 (2013.01)		G06F 3/033	461	5E555

審査請求 未請求 請求項の数 4 O L (全 13 頁)

(21) 出願番号	特願2013-93338 (P2013-93338)	(71) 出願人	000004075 ヤマハ株式会社 静岡県浜松市中区中沢町1〇番1号
(22) 出願日	平成25年4月26日 (2013. 4. 26)	(74) 代理人	100102635 弁理士 浅見 保男
		(74) 代理人	100103735 弁理士 鈴木 隆盛
		(72) 発明者	西澤 和彦 静岡県浜松市中区中沢町1〇番1号 ヤマハ株式会社内
		F ターム (参考)	5B087 AA09 AB12 BC12 BC13 BC16 5E555 AA08 BA16 BB16 BC01 CA04 CB51 CB55 CB62 DA21 DA24 DD06 EA09 FA30

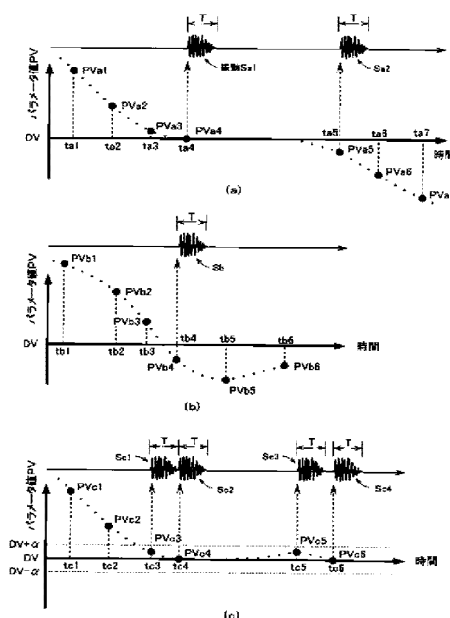
(54) 【発明の名称】 パラメータ設定装置

(57) 【要約】

【課題】 画面を注視し続けることなくパラメータ値を特定の範囲の値に設定する。

【解決手段】 操作子のノブを操作した際に、時点 $t a 4$ においてパラメータ値が特定値 $D V$ となった時は、ノブに持続時間 T の振動 $S a 1$ が付与される。また、時点 $t a 5$ において、特定値 $D V$ だったパラメータ値が該特定値でなくなった時も、ノブに持続時間 T の振動 $S a 2$ が付与される。このようにユーザに触感的フィードバックが与えられることから、パラメータ値が表示されている画面を注視することなくパラメータ値が特定値 $D V$ になったことおよび特定値 $D V$ でなくなったことを感得することができる。

【選択図】 図5



【特許請求の範囲】**【請求項 1】**

ユーザにより操作され、その操作に応じてパラメータ値を設定する操作子と、
ユーザにより前記操作子が操作されて、特定値だったパラメータ値が該特定値でなくなったことを検出した時に、所定の時間だけ、ユーザに触感的フィードバックを与えるフィードバック手段と、
を備えることを特徴とするパラメータ設定装置。

【請求項 2】

さらに、前記フィードバック手段は、
ユーザにより前記操作子が操作されて、前記特定値でなかった前記パラメータ値が前記特定値になったことを検出した時に、所定の時間だけ、ユーザに触感的フィードバックを与えることを特徴とする請求項 1 記載のパラメータ設定装置。

10

【請求項 3】

さらに、前記フィードバック手段は、
ユーザにより前記操作子が操作されて、パラメータ値が前記特定値をまたいで変化したことを検出した時に、所定の時間だけ、ユーザに触感的フィードバックを与えることを特徴とする請求項 1 または 2 記載のパラメータ設定装置。

【請求項 4】

前記特定値は、単独値、または、所定範囲の連続した複数の値であることを特徴とする請求項 1 ないし 3 のいずれかに記載のパラメータ設定装置。

20

【発明の詳細な説明】**【技術分野】****【0001】**

この発明は、ユーザによる操作子の操作により、パラメータ値が特定値に対して特別な関係となった時、所定の時間だけ、ユーザに触感的フィードバックを与えるようにしたパラメータ設定装置に関する。

【背景技術】**【0002】**

パラメータを設定する操作子として、従来からロータリーエンコーダを用いた回転操作子が知られている。このような回転操作子を操作する時は、表示部の画面に表示されたパラメータ値の変化を見ながら、ユーザが回転操作子のノブを回転させることにより、所定のパラメータ値になるよう設定している。

30

また、従来、ロータリーエンコーダの回転軸にアクチュエータを取り付けて、所定の回転状態に応じて回転軸に外力を付与し、回転操作子のノブを操作するユーザに所要の操作感触とされるクリック感を感得させることが知られている（特許文献 1 参照）。

さらに、操作子の一種であるマウスの本体に振動発生部または変形部、さらには発熱冷却部を設けて電子計算機側からの信号によりマウスを持つ手指に振動、変形または温熱の感触を与えるようにすることにより、表示装置の画面を注視しなくともマウスカーソルのおよその位置を感じ取ることができるようにして、使用者の特に目に掛かる負担を軽減することも知られている（特許文献 2 参照）。

40

【先行技術文献】**【特許文献】****【0003】**

【特許文献 1】特開 2003-29914 号公報

【特許文献 2】特許第 3280665 号公報

【発明の概要】**【発明が解決しようとする課題】****【0004】**

画面に表示されたパラメータ値を目で見ながら回転操作子等の操作子を操作する時には、画面を注視し続けなければならない、負担が大きくなる。これを解決するために、操作子

50

で設定されたパラメータ値が特定の値に達したときに、操作子のノブを介してユーザにクリック感を付与する構成とすれば、画面を注視し続けることなくパラメータ値を特定の値に設定することができる。しかしながら、この構成ではクリック感をユーザに付与するために複雑なメカニカル構造が必要になる。さらに、上限あるいは下限の境界値を超えるパラメータの設定がされないように、境界値を超えようとする時に操作子の回転をブレーキなどにより抑制させる必要があり、抑制させるために大きな電力が必要になるという問題点があった。

また、操作子で設定されたパラメータ値が特定の値になったときに、操作子のノブを介して振動をユーザに付与する構成としても、画面を注視し続けることなくパラメータ値を特定の値に設定することができる。しかしながら、この手法ではもともと特定の値であったパラメータを、他の値に変更したときにはユーザに振動が付与されず、ユーザは、それを認識することができないという問題点があった。

10

さらに、操作子で設定されたパラメータ値が所定の範囲に入っている間、操作子のノブを介して継続的に振動をユーザに付与する構成も考えられる。この構成としても、画面を注視し続けることなくパラメータ値を特定の範囲の値に設定することができる。しかしながら、この手法では振動し続けるノブを指で触るのは、操作するユーザにとっては不快感を生じるおそれがあるという問題点があった。

【0005】

そこで、本発明は、ユーザによる操作子の操作によるパラメータ値が、特定値に対して特別な関係となった時に、所定の時間だけ、ユーザに触感的フィードバックを与えるようにしたパラメータ設定装置を提供することを目的としている。

20

【課題を解決するための手段】

【0006】

上記目的を達成するために、本発明のパラメータ設定装置は、ユーザにより操作され、その操作に応じてパラメータ値を設定する操作子と、ユーザにより前記操作子が操作されて、特定値だったパラメータ値が該特定値でなくなったことを検出した時に、所定の時間だけ、ユーザに触感的フィードバックを与えるフィードバック手段とを備えることを最も主要な特徴としている。

【発明の効果】

【0007】

本発明では、ユーザにより操作子が操作されて、特定値だったパラメータ値が特定値でなくなったことを検出した時に、所定の時間だけ、操作子を操作しているユーザに振動等の触感的フィードバックが与えられることから、ユーザは、パラメータ値が表示されている画面を注視することなくパラメータ値が特定値でなくなったことを感得することができるようになる。

30

【図面の簡単な説明】

【0008】

【図1】本発明の実施例のパラメータ設定装置を備えるオーディオ装置の構成、操作子の構成の一例を示すブロック図である。

【図2】本発明にかかるパラメータ設定装置における回転操作子の構成を示す正面図および側面図である。

40

【図3】本発明にかかるパラメータ設定装置における画面上のパラメータ表示の例を示す図である。

【図4】本発明にかかるパラメータ設定装置のパラメータ変更処理の概要を示すフローチャート、ノブの操作があったときに実行される「ノブの操作ありイベント処理」のフローチャートである。

【図5】本発明にかかるパラメータ設定装置におけるユーザ操作に応じたパラメータ値の変化、および、振動の発生タイミングを示す図である。

【発明を実施するための形態】

【0009】

50

本発明の実施例のパラメータ設定装置を備えるオーディオ装置の構成を示すブロック図を図1(a)に、操作子13の構成の一例を示すブロック図を図1(b)に示す。

図1(a)に示すオーディオ装置1は、オーディオ装置1の全体の動作を制御すると共に、信号処理部16のパラメータを設定する操作子13の操作に応じたパラメータ変更処理や操作子操作ありイベント処理を実行するCPU(Central Processing Unit)10と、CPU10が実行する動作ソフトウェアが格納されている書き換え可能な不揮発性のフラッシュメモリ11と、CPU10のワークエリアや各種データ等が記憶されるRAM(Random Access Memory)12を備えている。RAM12のメモリ空間内には、オーディオ装置1の現在の動作を制御する各種パラメータを記憶するカレントメモリの領域が用意される。なお、フラッシュメモリ11に動作ソフトウェアを格納することにより、フラッシュメモリ11内の動作ソフトウェアを書き換えることで、動作ソフトウェアをバージョンアップすることができる。また、操作子13は、複数の操作子であって、回転操作子やスライダー等のパラメータ値を設定操作するノブを備える操作子、表示器14に表示されるカーソルを移動するマウス、ホイール、タッチパネル、トラックボール等とされる。表示器14は、パラメータを設定する設定画面や、調整時に変化していくパラメータ値を表示する画面が表示される液晶表示装置等からなるディスプレイである。

【0010】

オーディオ装置1には、波形入力部15から音信号が入力され、入力された音信号は信号処理部16に入力される。信号処理部16はDSP(Digital Signal Processor)を用いて構成されており、カレントメモリに記憶された各種信号処理パラメータに基づいて、CPU10の制御の基で音信号の周波数特性、振幅特性等の制御や、定位、遅延時間の調整、残響等の音響効果の付与などの音響信号処理を行っている。信号処理部16で音響信号処理が行われた音信号は、波形出力部17に出力され、音信号がスピーカやヘッドフォンに供給されたり、レコーダなどに供給される。各部はCPUバスライン18に接続されている。

【0011】

操作子13に含まれる操作子の一例として、ロータリーエンコーダおよびノブを備える回転操作子20が図1(b)に示されている。回転操作子20には、ユーザによるノブの回転操作に応じて2相パルスを発生するロータリーエンコーダ20a、および、その2相パルスに基づいて回転操作量を検出する検出部20cが内蔵されると共に、ノブに振動を与えるバイブレータ20bが設けられている。ここで、パラメータ値を調整しようとして、回転操作子20のノブをユーザが回転操作すると、ロータリーエンコーダ20aの回転方向および回転量からなる操作量が検出部20cで検出される。CPU10は、所定時間ごとに検出部20cで検出した操作量を取り込んでおり、今回取り込んだ操作量に基づいて操作の有無を判断する。その判断基準としては、例えば、今回取り込んだ操作量がゼロの場合は「ユーザ操作なし」と判断し、ゼロでない場合は「ユーザ操作あり」と判断すればよい。或いは、今回取り込んだ操作量が所定の閾値未満のとき「ユーザ操作なし」と判断し、該閾値以上のとき「ユーザ操作あり」と判断するようにしてもよい。或いは、直近に取り込んだ複数回分の操作量に基づいて、操作の有無や今回の操作量を決定するようにしてもよい。閾値を用いたり、複数回分の操作量を考慮することで、ノイズ等による誤検出を防止できる。ここで、「ユーザ操作あり」と判断した場合は、CPU10は後述する「ノブの操作ありイベント処理」を実行する。この「ノブの操作ありイベント処理」により、パラメータ値が特定値になった時には、バイブレータ20bが所定の時間だけ駆動される制御信号がCPU10から送出されて、駆動されたバイブレータ20bの振動は回転操作子20のノブを把持しているユーザに与えられる。また、特定値だったパラメータ値が該特定値でなくなった時にも、バイブレータ20bが所定の時間だけ駆動される制御信号がCPU10から送出される。これにより、パラメータ値が特定値になった時、および、特定値だったパラメータ値が該特定値から他の値に設定された時には、所定の時間だけ、振動による触感的フィードバックがノブを介して一時的にユーザに与えられるようになる。このノブに振動が与えられる「所定の時間」とは、ノブを操作しているユーザが、ノ

ブが振動していることを十分感知できる短い時間とされる。

【0012】

図2(a)(b)に回転操作子20の構成を示す。図2(a)は回転操作子20の構成を示す正面図であり、図2(b)は回転操作子20の構成を示す側面図である。

これらの図に示すように、回転操作子20は、円柱状のロータリーエンコーダ20aと、ロータリーエンコーダ20aの背面に設けられたパイプレータ20bと、ロータリーエンコーダ20aの前面のほぼ中央から突出している径の細い回転軸20dと、回転軸20dに装着されるノブ21とから構成されている。ノブ21の底部には円板状の鍔部21aが形成されており、鍔部21aから上部に向かって径が次第に小さくなるテーパ状の把持部21bが形成されている。把持部21bの周面には、滑り止め用の縦溝が複数形成されている。回転操作子20は、オーディオ装置1の図示しないパネル内に収納されるようパネルの裏面にロータリーエンコーダ20aの前面が当接されて取り付けられる。パネルのおもて面からは、回転軸20dが突出しており、この回転軸20dにノブ21が装着されている。

10

【0013】

ユーザがノブ21の把持部21bを把持して回転操作子20のノブ21を回転操作すると、所定角度回転する毎に位相が異なるA相、B相のパルスが発生され、このパルス数の計数値が回転量となり、回転軸20dの回転方向に応じてA相がB相より進むあるいは遅れる。そして、回転量と回転方向からなる操作量が検出部20cから出力され、この操作量に応じてパラメータの値が設定されるようになる。また、パイプレータ20bが駆動されると、パイプレータ20bの振動がロータリーエンコーダ20aおよび回転軸20dを介してノブ21に伝えられるようになる。なお、回転操作子20はエンドレス操作子とされてノブ21を何回転でも回すことができ、右方向に回した場合は正の値となってパラメータ値を増加させることができ、左方向に回した場合は負の値となってパラメータ値を減少させることができる。また、図2(b)においてはパイプレータ20bがロータリーエンコーダ20aの背面に設けられているが、パイプレータ20bをロータリーエンコーダ20aの横に並べて配置したり、ノブ21内にパイプレータ20bを配置してもよい。

20

【0014】

図2に示すような回転操作子20等の操作子13でパラメータ値を設定する際には、表示器14に現在のパラメータ値が画像や数値で表示される。この表示器14に表示される画面上のパラメータ表示の例を図3(a)~(e)に示す。

30

図3(a)に示す表示画像では、表示器14に表示されたノブ31によりパラメータ値が表示される。ノブ31は図2(a)に示すノブ21と同様の構成とされているが、目盛りを指し示す指示片31cを備えている。ノブ31の下の画像はパネルとされて、このパネルに円形のノブ31を取り囲むように目盛り32が記されており、ノブ31の指示片31cが指す目盛り32の位置がパラメータ値となる。本図はパラメータがパン、LRバランス、ピッチシフト、各種オフセット等の場合の例であり、目盛り32のほぼ中央位置(基準位置)に塗りつぶした逆三角形で示される特定値マーク32aが記されている。例えば、図1(b)に示す回転操作子20のノブが回転操作されると、回転操作に応じてノブ31が右回転あるいは左回転した画像に表示変更され、指示片31cで示されるパラメータ値が回転操作子20のノブの回転操作に応じて推移していく様子が、表示器14に表示されるようになる。そして、ノブ31が回転されて指示片31cが特定値マーク32aの位置を指すようになると、CPU10の制御によりパイプレータ20bが所定の時間だけ駆動されて、ユーザが操作している回転操作子20のノブを介して振動がユーザに与えられ、ユーザはパラメータ値が特定値に設定されたことを感知することができる。

40

【0015】

図3(b)に示す表示画像は、パラメータがオーディオ信号のレベルを調整するレベルパラメータの場合の例であり、特定値マーク32bの位置がさらに右方向に約90°回転された位置(ゼロデシベル位置)とされていることを除いて、図3(a)に示す例と同様とされているので、説明は省略するが、ノブ35の指示線35aが指す目盛り36の位置

50

がパラメータ値となる。

図3(c)に示す表示画像では、表示器14に表示された直線上を上下にスライドするノブ35によりレベルパラメータの値が表示される。ノブ35には目盛りを指し示す横線とされた指示線35aが設けられている。ノブ35の下はパネルとされて、このパネルに、ノブ35のスライド方向に沿ってデシベルスケールの目盛り36が記されており、ノブ35の指示線35aが指す目盛り36の位置がパラメータ値となる。図1(b)に示す回転操作子20のノブを回転操作すると、回転操作に応じてノブ35が上方方向あるいは下方方向にスライドした画像に表示変更され、指示線35aで示されるパラメータ値が回転操作子20のノブの回転操作に応じて推移していく様子が、表示器14に表示されるようになる。そして、ノブ35がスライドされて指示線35aが予め定めた特定値(例えばゼロデシベル)の位置に達すると、CPU10の制御によりパイプライン20bが所定の時間だけ駆動されてユーザが操作している回転操作子20のノブを介して、振動がユーザに与えられて、ユーザはパラメータ値が特定値に設定されたことを感知することができる。なお、目盛り36に図3(a)(b)に示すような特定値マークを記すようにしてもよい。

10

【0016】

図3(d)に示す表示画像では、表示器14に表示された表示窓に数値とされたパラメータ値が表示される。図3(d)に示す例では、3つの表示窓40a、40b、40cが表示されており、例えば、表示窓40aには、レベルパラメータの値が「-18dB」として表示され、表示窓40bには、オーディオ信号の遅延時間を制御するディレイパラメータの値が「150ms」として表示され、表示窓40cには、フィルタや発振器等の周波数パラメータの値が「830Hz」として表示されている。図1(b)に示す回転操作子20のノブを回転操作すると、この回転操作子20に割り当てられたパラメータの値がその操作量に応じて増減され、表示窓40a~40cに表示されているパラメータ値が予め定めた特定値に達すると、CPU10の制御によりパイプライン20bが所定の時間だけ駆動されてユーザが操作している回転操作子20のノブを介して、振動がユーザに与えられる。これにより、ユーザはパラメータ値が特定値に設定されたことを感知することができる。ここで、振動を発生すべき特定値は、割り当てられたパラメータがレベルパラメータの場合、例えば、ゼロデシベルのレベル値とし、ディレイパラメータの場合、例えば、10ms毎の1の位が0になるディレイ値とし、周波数パラメータの場合、例えば、対数スケールで等間隔になる複数の周波数値とすればよい。すなわち、特定値は、単独の値や複数の値とすることができる。

20

30

図3(e)に示す例では、複数の特定値マーク32c1、32c2、32c3、32c4、32c5が目盛りに替えてノブ31の周囲のパネル上に記されていることを除いて、図3(a)に示す例と同様とされているので、その説明は省略するが、ノブ35の指示片31cが指す位置がパラメータ値となる。

【0017】

次に、オーディオ装置1において本発明のパラメータ設定装置にかかる処理として実行されるパラメータ変更処理の概要を示すフローチャートを図4(a)に示す。これは、ユーザが順に特定の操作を行った場合の、1の回転操作子20に着目した、「処理の概要」である。

40

まず、ユーザによる、複数のパラメータ設定画面のうちの1の選択操作に応じて、表示器14には、選択されたパラメータ設定画面であって、1ないし複数のパラメータの値を表示する画面が表示される(ステップS10)。そして、1の回転操作子20には、表示されている1ないし複数のパラメータの内の1つが割り当てられる(ステップS11)。また、この割り当てられたパラメータを特定するパラメータIDが、カレントメモリに静的変数pidとして記録される。そして、回転操作子20のノブ21が操作されると、その操作量に応じて、カレントメモリ中の回転操作子20に割り当てられたパラメータの値が変更される(ステップS13)。この場合、表示器14における各パラメータの表示態様は、図3(a)~(e)のうちの、表示する各パラメータに応じたパラメータ表示とされ

50

る。

【0018】

CPU10は、複数の操作子13のそれぞれの操作量を、所定時間毎に取り込んでおり、ユーザによる当該操作子13の操作があったか否かを、その操作量から判断している。そして、操作子13の操作があるとCPU10で判断された場合、CPU10は、その操作された操作子13に対する、「操作子操作ありイベント処理」を実行する。図4(b)に示す「ノブの操作ありイベント処理」は、この処理の一例であり、回転操作子20のノブ21が操作された時に実行される。

次に、その「ノブの操作ありイベント処理」を説明するが、この説明では図5(a)(b)(c)で示すグラフを参照しながら具体例を説明するものとする。図5(a)(b)(c)のグラフは、ユーザが回転操作子20のノブ21を操作した際の回転操作子20に割り当てられたパラメータのパラメータ値の変化、および、回転操作子20のパイプリータ20bの振動の発生タイミングを3つの態様で示す図である。これらの図において、DVはユーザに触感的フィードバックを与えるパラメータの値、すなわち特定値を表している。また、図5(a)(b)(c)のグラフで図示される丸印は、CPU10によるパラメータ値の設定タイミングと値とを示しており、また、破線では、仮にパラメータの設定が所定時間毎の離散的な処理ではなく連続した処理として行われた場合に、設定されるパラメータ値の変化を示している。

【0019】

ノブ21を回転させた時の操作量は、図1(b)に示す検出部20cで検出されて、CPU10が周期的に取り込んでいる。ここで、回転操作子20のノブ21が回転されると、CPU10は、取り込んだ操作量に基づいて、回転操作子20のノブ21の操作があったと判断し、「ノブの操作ありイベント処理」を開始する。「ノブの操作ありイベント処理」が開始されると、CPU10は、ユーザによるノブ21の回転操作量を取り込み、その操作量を一時変数Xに代入する(ステップS20)。この操作量Xは、ノブ21を右方向に回すと正の値、左方向に回すと負の値となる。次いで、静的変数pidに基づいて、カレントメモリから、回転操作子20に割り当てられたパラメータの値PV(pid)が読み出され、ノブ21の操作前のパラメータ値として、一時変数PVoに代入される(ステップS21)。そして、パラメータ値PVoと、関数f(PVo, X)の値の和が、ステップS22にて演算されて、その値によってカレントメモリのパラメータ値PV(pid)が更新される。パラメータは一般的に上限および/または下限を有しており、パラメータは上限値や下限値とされる境界値までが変化範囲となる。しかし、回転操作子20は何回転でも回転操作できるエンドレス操作子とされていることから、操作量Xによっては操作後のパラメータ値が境界値を超えてしまう恐れがある。ここでは、関数f(PVo, X)を用いて操作後のパラメータ値が境界値を超えないように調整している。すなわち、操作前のパラメータ値PVoが境界値の時に、パラメータの値を境界値外に出そうとする方向にノブ21が操作された場合は、操作量Xに対する関数f(PVo, X)の値がゼロになり、結果として、操作後のパラメータ値PV(pid)は、境界値を超えないようになる。また、操作前のパラメータ値PVoが境界値に達していないものの、操作量Xに対する関数f(PVo, X)との和が境界値を超える時は、パラメータ値PVoと関数f(PVo, X)の値との和が境界値になるように操作量Xに対する関数f(PVo, X)の値が調整され、結果として、操作後のパラメータ値PV(pid)は、境界値を超えないようになる。なお、境界値の近傍以外では、関数f(PVo, X)は、操作量Xにリニアに比例する関数としてもよいし、操作量Xに応じて傾きの変わる関数としてもよい。後者では、微調と大きな数値変化とを両立させるため、操作量Xの絶対値(=回転量)が大きくなるほど傾きが急になるようにする、いわゆる加速型の関数が代表的とされる。

【0020】

図5(a)のグラフを参照してステップS20ないしステップS22の処理を説明すると、時点ta2において検出部20cから操作量XがステップS20にて取り込まれた場合は、時点ta1のパラメータ値であるPVa1がステップS21にて操作前のパラメー

タ値 PV_o となり、 PV_{a1} と関数 $f(PV_o, X)$ の値との和がステップ $S22$ にて算出される。算出された $PV(pid)$ は、時点 t_{a2} における操作後のパラメータ値 PV_{a2} になる。時点 t_{a1} および時点 $t_{a3} \sim t_{a7}$ で実行される処理は、上記した時点 t_{a2} で実行される処理と同様とされ、時点 t_{a1} の直前の時点 t_{a0} とし、時点 t_{a0} のパラメータ値を PV_{a0} とすると、各時点 t_{a1} 、 $t_{a3} \sim t_{a7}$ で取り込まれたノブ 21 の各操作量 X に対する関数 $f(PV_o, X)$ の値と、操作前のパラメータ値 PV_o (PV_{a0} 、 $PV_{a2} \sim PV_{a6}$) との和が演算されて、操作後のパラメータ値 $PV(pid)$ である PV_{a1} 、 $PV_{a3} \sim PV_{a7}$ となる。このようにして、各時点 $t_{a1} \sim t_{a7}$ のパラメータ値は $PV_{a1} \sim PV_{a7}$ となる。この場合、図 $5(a)$ に示す例では、いずれの時点においても操作後のパラメータ値が境界値を超えることがないため、関数 $f(PV_o, X)$ の値は、操作量
 が大きくなるほど大きくなり、小さくなるほど小さくなる値となる。なお、時点 t_{a4} と
 時点 t_{a5} との間の時間が空いているのは、所定時間ごとにノブ 21 の操作量は取り込ま
 れているが、 t_{a4} の時点から t_{a5} の時点までは「操作なし」と判定され、「ノブの操
 作ありイベント処理」が実行されないためである。

10

図 $5(b)$ のグラフにおけるステップ $S20$ ないしステップ $S22$ の処理は、上記した
 図 $5(a)$ と同様であるのでその説明は省略するが、パラメータ値 $PV(pid)$ が各時点 $t_{b1} \sim t_{b6}$ のノブ 21 の操作量 X に応じて調整され、操作後の各時点 $t_{b1} \sim t_{b6}$ の
 パラメータ値は $PV_{b1} \sim PV_{b6}$ となる。また、図 $5(c)$ におけるステップ $S20$ ないし
 ステップ $S22$ の処理も、上記した図 $5(a)$ と同様であるのでその説明は省略する
 が、パラメータ値 $PV(pid)$ が各時点 $t_{c1} \sim t_{c6}$ のノブ 21 の操作量 X に応じて調整
 され、操作後の各時点 $t_{c1} \sim t_{c6}$ のパラメータ値は $PV_{c1} \sim PV_{c6}$ となる。

20

【0021】

ステップ $S22$ の処理が終了するとステップ $S23$ において、ステップ $S22$ で算出さ
 れた操作後のパラメータ値 $PV(pid)$ に応じて、表示器 14 の対応するパラメータ表示が
 その値に更新され、さらに、信号処理部 16 において操作後のパラメータ値 $PV(pid)$ に
 よる信号処理制御が行われる。次いで、ステップ $S24$ にて特定値である DV が範囲 [$PV(pid)$ 、 PV_o]
 に含まれるか否かが判断される。この場合、[,] の記号は、境界
 値を含む範囲を示している。そして、特定値である DV が、ステップ $S22$ で算出された
 操作後のパラメータ値 $PV(pid)$ と操作前のパラメータ値 PV_o との範囲に含まれている
 場合は、ステップ $S24$ にて「YES」と判定されてステップ $S26$ に分岐する。なお、
 ステップ $S24$ にて「YES」と判定されるのは、操作後のパラメータ値 $PV(pid)$ が DV
 に一致した場合、および、 DV をまたがって操作前のパラメータ値 PV_o から操作後の
 パラメータ値 $PV(pid)$ に設定された場合、さらに、操作前のパラメータ値 PV_o が DV
 に一致している場合である。ステップ $S26$ では、パイプレータ $20b$ を所定の時間だけ
 駆動する制御信号が $CPU10$ から回転操作子 20 に与えられて、ノブ 21 に所定の時間
 だけ振動が付与される。なお、 DV をまたがって操作前のパラメータ値 PV_o から操作後
 のパラメータ値 $PV(pid)$ に設定された場合には、振動をノブ 21 に付与することは必須
 ではなく、 DV が操作後のパラメータ値 $PV(pid)$ または操作前のパラメータ値 PV_o に
 一致する場合に振動を付与するようにしたり、操作後のパラメータ値 $PV(pid)$ と操作前
 のパラメータ値 PV_o の少なくとも一方が、 DV の近傍の場合に振動を付与するようす
 ればよい。

30

40

【0022】

図 $5(a)$ のグラフを参照してステップ $S24$ およびステップ $S26$ の処理を説明する
 と、時点 t_{a4} においては操作後のパラメータ値である PV_{a4} が DV となったことから
 、ステップ $S24$ では「YES」と判定される。これにより、ステップ $S26$ にて CPU
 10 はパイプレータ $20b$ を所定の時間 T だけ駆動する制御信号を送出し、ノブ 21 に持
 続時間 T の振動 S_{a1} が付与される。これにより、操作後のパラメータ値が特定値である
 DV に調整された時には、ノブ 21 に所定の時間 T の触感的フィードバックが与えられ、
 ノブ 21 を操作しているユーザは調整しているパラメータ値が特定値になったことを感得
 することができる。また、時点 t_{a5} においては操作前のパラメータ値 PV_o が DV にな

50

っていることから、ステップ S 2 4 では「YES」と判定されステップ S 2 6 にてノブ 2 1 に所定の時間 T の振動 S a 2 が付与される。これにより、操作後のパラメータ値が特定値である D V から他の値に調整された時には、ノブ 2 1 に所定の時間 T の触感的フィードバックを与えられ、ノブ 2 1 を操作しているユーザは調整しているパラメータ値が特定値から他の値になったことを感得することができる。なお、t a 4 および t a 5 を除く時点においては、いずれの時点においてもステップ S 2 4 では「NO」と判定され、ステップ S 2 6 の処理は行われない。なお、ノブ 2 1 に振動が与えられる所定の時間 T は、ノブ 2 1 を操作しているユーザが、ノブ 2 1 が振動していることを十分感知できる短い時間とされ、例えば数十ミリ秒ないし数百ミリ秒とされる。

【0023】

次に、図 5 (b) のグラフを参照してステップ S 2 4 およびステップ S 2 6 の処理を説明すると、時点 t b 4 においては操作前のパラメータ値 P V o が D V を超えている P V b 3 であり、操作後のパラメータ値 P V (pid) は D V に満たない P V b 4 であり、D V をまたがって操作前のパラメータ値 P V b 3 から操作後のパラメータ値 P V b 4 に設定されている。これにより、ステップ S 2 4 では「YES」と判定されステップ S 2 6 にてノブ 2 1 に所定の時間 T の振動 S b が付与される。このように、操作後のパラメータ値が特定値である D V をまたがって調整された時には、ノブ 2 1 に所定の時間 T の触感的フィードバックが与えられ、ノブ 2 1 を操作しているユーザは調整しているパラメータ値が特定値である D V をまたがって調整されたことを感得することができる。なお、パラメータ値が D V をまたがって調整されたことを感得させるのは、操作量 X は所定時間ごとに取り込まれ時間的に連続した処理ではないことから、時間当たりの操作量が多いと、図 5 (b) に示すように、パラメータ値 P V が D V を飛び越して変化する。この場合、従来技術ではノブ 2 1 に振動が付与されず、ユーザは特定値である D V をまたがって調整されたことを知覚できないが、本発明にかかるパラメータ設定装置では、特定値である D V をまたがって調整されたことを知覚することができる。また、t b 4 を除く時点においては、いずれの時点においてもステップ S 2 4 では「NO」と判定され、ステップ S 2 6 の処理は行われない。

図 5 (c) を参照するステップ S 2 4 およびステップ S 2 6 の処理の説明は、ステップ S 2 5 の処理の説明において後述する。

【0024】

ステップ S 2 4 において「NO」と判定されるとステップ S 2 5 に進む。ここで、ステップ S 2 2 で算出された操作後のパラメータ値 P V (pid) が、特定値 D V の近傍である $D V \pm \alpha$ の範囲に含まれている場合は、ステップ S 2 5 にて「YES」と判定されてステップ S 2 6 に分岐する。ステップ S 2 6 では上記したようにパイプライン 2 0 b を所定の時間だけ駆動する制御信号が C P U 1 0 から回転操作子 2 0 に与えられて、ノブ 2 1 に所定の時間だけ振動が付与される。ただし、ステップ S 2 5 の処理は必須ではなく、図 4 (b) の「ノブの操作ありイベント処理」は、ステップ S 2 5 を含まない処理としてもよい。例えば、検出される操作量の分解能が低い場合、ないし、丸め込んで操作量の分解能を下げた場合は、実質的にステップ S 2 4 の処理に含まれるのでステップ S 2 5 の処理を省略できる。あるいは、ステップ S 2 4 において、2 値 P V (pid)、P V o をそれぞれ丸め込んで分解能を下げた 2 値 P V x (pid)、P V x o を一時的に生成し、分解能の低い特定値 D V x とそれら 2 値 P V x (pid)、P V x o とに基づいてステップ S 2 4 の判断を行うようにすれば、同様にステップ S 2 5 の処理を省略できる。ユーザが、パラメータ値と特定値 D V の一致を、1 つの値と感じられる範囲の振動で感得できるようにさえなっていれば、何れを採用してもよい。この丸め込みは、下位ビットの切り捨て、四捨五入等、任意の方法で行えばよい。

【0025】

ステップ S 2 5 の処理を説明するために図 5 (c) が例として示されていることから、図 5 (c) のグラフを参照してステップ S 2 5 およびステップ S 2 6 の処理を説明する。時点 t c 3 においては操作後のパラメータ値である P V c 3 が $D V \pm \alpha$ の範囲に含まれることから、ステップ S 2 5 では「YES」と判定される。これにより、上記したようにス

10

20

30

40

50

ステップS26にてCPU10はバイブレータ20bを所定の時間Tだけ駆動する制御信号を送出し、ノブ21に所定の時間Tの振動Sc1が付与される。また、時点tc4、tc5、tc6においても操作後のパラメータ値がDV±αの範囲に含まれることから、ステップS24では「YES」と判定されステップS26にてノブ21に所定の時間Tの振動Sc2、Sc3、Sc4がそれぞれの時点において付与される。これにより、操作後のパラメータ値がDV±αの範囲に含まれるように調整された時には、ノブ21に所定の時間Tの触感的フィードバックを与えられ、ノブ21を操作しているユーザは調整しているパラメータ値がDV±αの範囲に含まれるようになったことを感得することができる。なお、tc1およびtc2の時点においてはステップS24およびステップS25でそれぞれ「NO」と判定され、ステップS26の処理は行われない。

10

ここでは、操作後のパラメータ値がDV±αの範囲に含まれるとき、ノブ21に振動が加えられるようになっていたが、それと共に、あるいは、それに代えて、操作前のパラメータ値がDV±αの範囲に含まれるとき、ノブ21に振動が加えられるようにしてもよい。

【0026】

なお、CPU10が、取り込んだノブ21の操作量に基づいて、「操作あり」を続けて判定し、かつ、その連続する操作ありの判定で連続して実行される「ノブの操作ありイベント処理」（図4（b））のステップS24またはステップS25で「YES」と判定された場合は、ステップS26の処理によるノブ21に付与される前後の振動はほぼ重なって1つになる。

20

「ノブの操作ありイベント処理」は、ステップS25の処理を行う場合はステップS25の処理で「NO」と判定されたときに、また、ステップS25の処理を行わない場合はステップS24の処理で「NO」と判定されたときに、あるいは、ステップS24またはステップS25で「YES」と判定された場合はステップS26の処理が終了したときに終了する。

この処理では、ノブ21に振動が与えられる特定値DVに、ある程度の幅（α）を持たせている。そして、この幅（α）は、ユーザが1値と認識する程度の、あまり広くない、適切な幅（ノブ21の回転角度で数度～二十度程度）に調整される。ノブ21の直径に応じて、直径が大きければ幅（α）を小さくするのがよく、直径が小さければ、幅（α）を大きくするのがよい。このように、特定値DVは、必ずしも単一の値である必要はなく、幅（α）を持つ範囲内の連続値であってもよい。

30

また、図5（a）～（c）に示す振動の所定の時間Tは、例えば数十ミリ秒ないし数百ミリ秒とされるが、振動は次の振動と時間が一部重なって発生されるようにしてもよい。

【0027】

以上説明したように、本発明の実施例のパラメータ装置を備えるオーディオ装置1は、ユーザにより操作され、その操作に応じてパラメータ値を設定する操作子と、ユーザにより操作子が操作されて、特定値だったパラメータ値が該特定値でなくなったことを検出した時に、所定の時間だけ、ユーザに触感的フィードバックを与えるフィードバック手段とを備えており、本発明にかかるパラメータ設定装置は、「操作子」が上記実施例におけるノブ21、ロータリーエンコーダ20a、検出部20c、CPU10、フラッシュメモリ11、RAM12が協働することにより実現され、「フィードバック手段」が上記実施例におけるCPU10、フラッシュメモリ11、RAM12、バイブレータ20b、ノブ21が協働することにより実現されている。

40

【産業上の利用可能性】

【0028】

以上説明した本発明にかかるパラメータ装置は、操作子と関連するハードウェアおよびソフトウェアが協働することにより実現するものとしたが、ソフトウェアにより実現した処理の一部またはすべてをLSI（Large Scale Integration）やロジック回路等に置き換えてもよい。

以上説明した本発明にかかるパラメータ設定装置においては、操作子は回転操作子に限

50

ることはなく、他のエンドレス操作子としてもよい。この場合、操作子は操作位置の相対値（変化量）が検出される相対値型操作子とされていたが、操作位置の絶対値が検出される絶対値型操作子としてもよい。例えば、フェーダ操作子、レバー操作子、ジョイスティック、回転型可変抵抗器、リボンコントローラやタッチパネル等を操作子に適用することができる。

なお、ロータリーエンコーダ20aは、2相インクリメンタルタイプだったが、3相パルスが発生する3相インクリメンタルタイプを用いてもよい。或いは、絶対位置を出力するアブソリュート型のエンコーダを使用してもよい。

以上説明した本発明の実施例のパラメータ設定装置を備えるオーディオ装置には、音響信号処理を制御する各種のレベルパラメータが存在するが、回転操作子20に割り当てるレベルパラメータは、そのうちの何れのレベルパラメータであってもよい。

10

本発明にかかるパラメータ設定装置は、オーディオ装置に適用されていたが、本発明にかかるパラメータ設定装置は、操作子でパラメータ値を設定する、様々な用途の電子機器および電気機器に適用可能である。例えば、パーソナルコンピュータ、タブレット端末、携帯電話等に適用しても良い。あるいは、本発明にかかるパラメータ設定装置を単独の装置やソフトウェアとしてもよい。

また、操作子で設定するパラメータは、オーディオ信号制御用のパラメータに限ることではなく、映像制御、文書処理、通信制御、モータ制御、照明制御等の、様々な用途のパラメータとすることができる。

さらに、パラメータ値が特定値になった時と、パラメータ値が特定値から他の値になった時とで、バイブレータの振動は同じとされていたが、両者の振動を異ならせることにより、触感的フィードバックを受けた時に両者のいずれであるかをユーザが区別できるようにしてもよい。この場合、両者の持続時間を異ならせたり、一方において持続時間内においてオン・オフを繰り返す振動としたり、両者のオン・オフの回数を異ならせたりすることにより、両者の振動を区別することができる。

20

さらにまた、触感的フィードバックを付与する特定値を1のパラメータについて2以上設定し、各々の特定値に対してフィードバック手段による触感的フィードバックを付与するようにしてもよい。

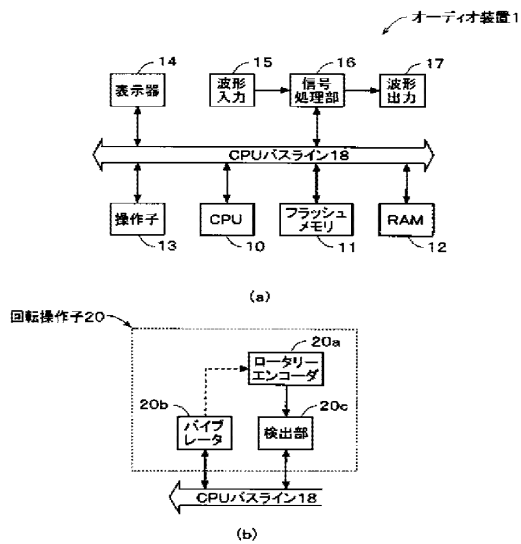
【符号の説明】

【0029】

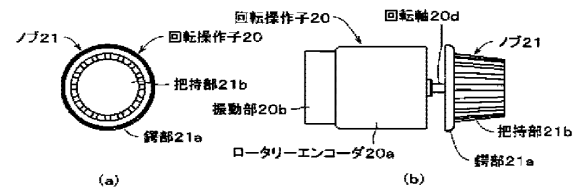
30

1 オーディオ装置、10 CPU、11 フラッシュメモリ、12 RAM、13 操作子、14 表示器、15 波形入力部、16 信号処理部、17 波形出力部、18 CPUバスライン、20 回転操作子、20a ロータリーエンコーダ、20b バイブレータ、20c 検出部、20d 回転軸、21 ノブ、21a 鐳部、21b 把持部、31 ノブ、31c 指示片、32 目盛り、32a 特定値マーク、32b 特定値マーク、32c 特定値マーク、35 ノブ、35a 指示線、36 目盛り、40a 表示窓、40b 表示窓、40c 表示窓

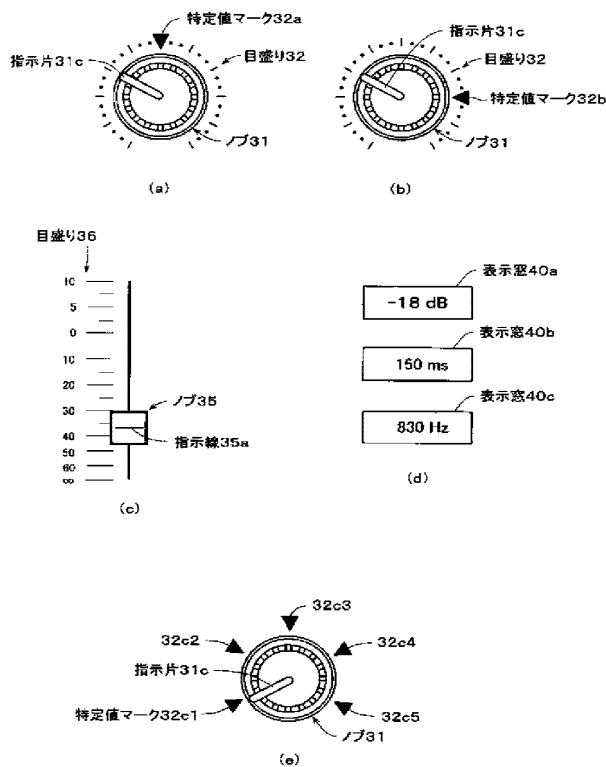
【図 1】



【図 2】

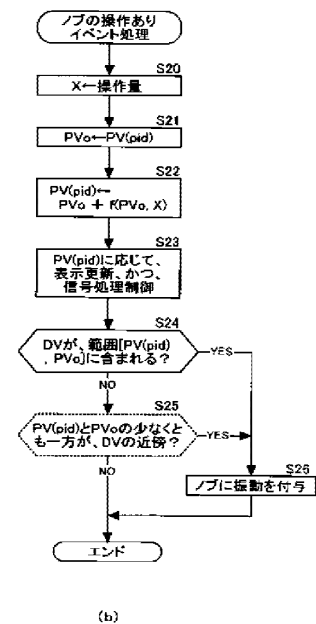
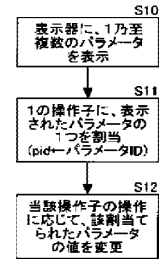


【図 3】

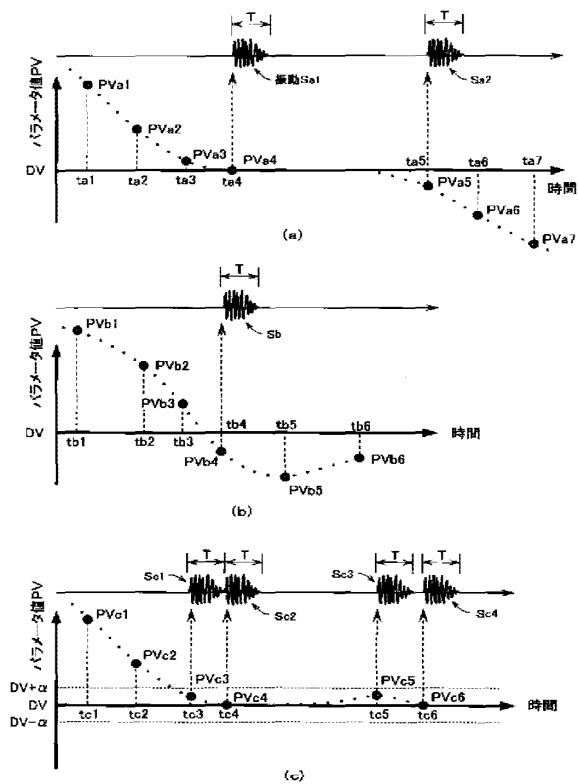


【図 4】

パラメータ変更処理の概要



【図 5】





Espacenet

Bibliographic data: JP2014216017 (A) — 2014-11-17

GAMING DEVICE HAVING HAPTIC-ENABLED TRIGGER

Inventor(s): DANNY A GRANT; AARON KAPELUS ± (ダニー エー . グラント, ;
アーロン カペラス)

Applicant(s): IMMERSION CORP ± (イマージョンコーポレーション IMMER S I O
N C O R P O R A T I O N, ; イマージョン コーポレーション IMME
R S I O N C O R P O R A T I O N)

Classification: - international: A63F13/90; A63F13/98; G06F3/01
- cooperative: A63F13/06; A63F13/212; A63F13/24; A63F13/285;
A63F13/50; G06F3/016; A63F2300/1037

Application number: JP20140087970 20140422 Global Dossier

Priority number (s): US201361814628P 20130422

Also published as: CN104107539 (A) EP2796965 (A2) EP2796965 (A3)
JP2019012550 (A) JP6469963 (B2) more

Abstract of JP2014216017 (A)

PROBLEM TO BE SOLVED: To provide devices with targeted actuators coupled to user input elements such that the haptic effect is transmitted to the elements. **SOLUTION:** A haptic peripheral comprises a housing, a user input element, a position sensor coupled to the element, and an actuator located within the housing and coupled to the element. The position sensor is configured to detect a position of the user input element and to send the position to a processor. The actuator is configured to receive a haptic effect drive signal from the processor and to output a force in response to the haptic effect drive signal from the processor. The force is transmitted to the user input element as a kinesthetic haptic

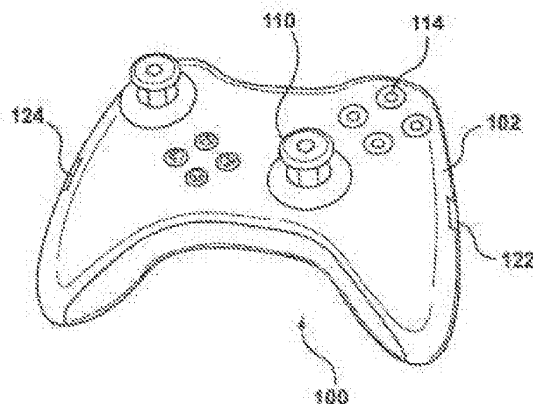


FIG. 1

effect. The haptic peripheral may include a mechanical amplification system coupled to the actuator and configured to increase the force output by the actuator. The increased force is transmitted from the mechanical amplification system to the user input element as a kinesthetic haptic effect.

(19) 日本国特許庁(JP)

(12) 公開特許公報(A)

(11) 特許出願公開番号

特開2014-216017**(P2014-216017A)**

(43) 公開日 平成26年11月17日 (2014. 11. 17)

(51) Int. Cl.	F I	テーマコード (参考)
G06F 3/01 (2006.01)	G06F 3/01 310A	2C001
A63F 13/98 (2014.01)	A63F 13/98	5E555
A63F 13/90 (2014.01)	A63F 13/90	

審査請求 未請求 請求項の数 20 O L 外国語出願 (全 45 頁)

(21) 出願番号	特願2014-87970 (P2014-87970)	(71) 出願人	500390995
(22) 出願日	平成26年4月22日 (2014. 4. 22)		イマージョン コーポレーション
(31) 優先権主張番号	61/814, 628		IMMERSSION CORPORATI ON
(32) 優先日	平成25年4月22日 (2013. 4. 22)		アメリカ合衆国 カリフォルニア州 95
(33) 優先権主張国	米国 (US)		134 サンノゼ リオ ロブレス 30
		(74) 代理人	100094112
			弁理士 岡部 譲
		(74) 代理人	100101498
			弁理士 越智 隆夫
		(74) 代理人	100107401
			弁理士 高橋 誠一郎
		(74) 代理人	100120064
			弁理士 松井 孝夫

最終頁に続く

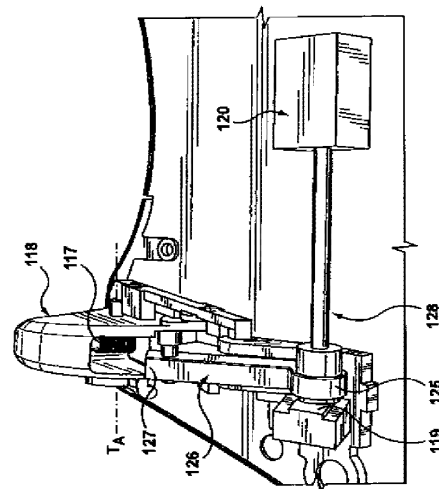
(54) 【発明の名称】 触覚対応トリガーを有するゲーミング装置

(57) 【要約】

【課題】 ユーザー入力エレメントに結合されるターゲットアクチュエーターを備え、触覚効果を該エレメントに伝える装置を提供する。

【解決手段】 触覚周辺装置は、ハウジング、ユーザー入力エレメント、該エレメントに結合される位置センサー、ハウジング内に位置するとともに該エレメントに結合されるアクチュエーターを備える。位置センサーは、ユーザー入力エレメントの位置を検出し、その位置をプロセッサに送信する。アクチュエーターは、プロセッサから触覚効果駆動信号を受信し、プロセッサからの触覚効果駆動信号に応答して力を出力する。この力は、ユーザー入力エレメントに運動触覚効果として伝達される。触覚周辺装置は、アクチュエーターに結合されるとともにアクチュエーターによって出力された力を増幅させる機械的増幅システムを備えてもよい。増幅された力は、機械的増幅システムからユーザー入力エレメントに運動触覚効果として伝達される。

【選択図】 図4



【特許請求の範囲】**【請求項 1】**

触覚周辺装置であって、
ハウジングと、
ユーザー入力エレメントと、

前記ユーザー入力エレメントに結合される位置センサーであって、該位置センサーは、
前記ユーザー入力エレメントの位置を検出するように構成されているとともに、前記位置
をプロセッサに送信するように構成されている、位置センサーと、

前記ハウジング内に位置するとともに前記ユーザー入力エレメントに結合されるアクチ
ュエーターであって、該アクチュエーターは、前記プロセッサから触覚効果駆動信号を受
信するように構成されているとともに、前記プロセッサからの前記触覚効果駆動信号に応
答して力を出力するように構成されている、アクチュエーターと、

前記アクチュエーターに結合されるとともに該アクチュエーターによって出力された前
記力を増幅させるように構成されている機械的増幅システムであって、前記増幅された力
は、該機械的増幅システムから前記ユーザー入力エレメントに運動触覚効果として伝達さ
れる、機械的増幅システムと、
を備える、触覚周辺装置。

【請求項 2】

前記ユーザー入力エレメントは、ボタン、トリガー、及びジョイスティックからなる群
から選択される、請求項 1 に記載の触覚周辺装置。

【請求項 3】

前記プロセッサは、該触覚周辺装置の前記ハウジング内に位置する、請求項 1 に記載の
触覚周辺装置。

【請求項 4】

前記プロセッサは、該触覚周辺装置の前記ハウジングから遠隔に位置する、請求項 1 に
記載の触覚周辺装置。

【請求項 5】

前記アクチュエーターは、回転可能シャフトを介して前記ユーザー入力エレメントに結
合され、前記アクチュエーターは、前記回転可能シャフトの回転を介して前記触覚効果駆
動信号を前記ユーザー入力エレメントに印加する、請求項 1 に記載の触覚周辺装置。

【請求項 6】

前記機械的増幅システムは、前記アクチュエーターに結合されるギアシステムである、
請求項 1 に記載の触覚周辺装置。

【請求項 7】

前記アクチュエーターは双方向モーターである、請求項 1 に記載の触覚周辺装置。

【請求項 8】

前記運動触覚効果は、デテント、振動、又はテキスチャからなる群から選択される、請
求項 1 に記載の触覚周辺装置。

【請求項 9】

前記位置センサーは、軸の回りに回転可能であるとともに、レバーアームを介して前記
ユーザー入力エレメントに結合される、請求項 1 に記載の触覚周辺装置。

【請求項 10】

前記触覚効果駆動信号は、前記ユーザー入力エレメントの前記位置にตอบสนองして前記プロ
セッサによって生成される、請求項 1 に記載の触覚周辺装置。

【請求項 11】

前記ハウジングに結合されるランブルアクチュエーターであって、該ランブルアクチュ
エーターは、前記プロセッサから第 2 の触覚効果制御振動を受信して、前記第 2 の触覚効
果制御信号にตอบสนองして前記ハウジングに第 2 の触覚効果を出力するように構成されてい
る、ランブルアクチュエーターを更に備える、請求項 1 に記載の触覚周辺装置。

【請求項 12】

前記ユーザー入力エレメントの第１の位置の結果として、前記アクチュエーターが第１の触覚効果駆動信号を生成して前記ユーザー入力エレメントに印加し、前記ユーザー入力エレメントの第２の位置の結果として、前記アクチュエーターが第２の触覚効果駆動信号を生成して前記ユーザー入力エレメントに印加し、前記第１の位置は前記第２の位置とは異なり、前記第１の触覚効果駆動信号は前記第２の触覚効果駆動信号とは異なる、請求項１に記載の触覚周辺装置。

【請求項１３】

触覚周辺装置であって、

ハウジングと、

軸の回りに回転可能であるトリガーと、

ヒンジ結合される第１の端部と、可動な第２の端部とを有するレバーアームであって、前記トリガーが該レバーアームの前記可動な第２の端部に取り付けられる、レバーアームと、

前記レバーアームの前記ヒンジ結合される第１の端部に取り付けられる位置センサーであって、該位置センサーは、前記トリガーの回転位置の変化を運動イベントとして検出するように構成されているとともに、該運動イベントをプロセッサに送信するように構成されている、位置センサーと、

前記ハウジング内に位置する双方向モーターであって、該モーターは、前記プロセッサから触覚効果駆動信号を受信するように構成されているとともに、前記プロセッサからの前記触覚効果駆動信号に応答して力を出力するように構成されている、双方向モーターと

、
前記モーターに取り付けられるとともに、該モーターから前記レバーアームの前記ヒンジ結合される第１の端部まで延びる回転可能シャフトであって、該回転可能シャフトは、該回転可能シャフトの回転が前記レバーアーム及び前記トリガーの運動を引き起こすように、前記レバーアームの前記ヒンジ結合される第１の端部に取り付けられる、回転可能シャフトと、
を備え、

前記モーターによって出力される前記力は、前記回転可能シャフトを介して前記トリガーに、運動触覚効果として伝達される、触覚周辺装置。

【請求項１４】

前記モーターと前記回転可能シャフトとの間に配置されるギアシステムであって、該ギアシステムは、前記モーターによって出力された前記力を増幅するように構成されており、該増幅された力は、該ギアシステムから前記トリガーに運動触覚効果として伝達される、ギアシステムを更に備える、請求項１３に記載の触覚周辺装置。

【請求項１５】

ゲーミングシステムであって、

ホストコンピューターと、

プロセッサと、

ハウジングと、ユーザー入力エレメントと、該ユーザー入力エレメントに結合される位置センサーと、機械的増幅システムを介して前記ユーザー入力エレメントに結合されるアクチュエーターとを有するコントローラーであって、前記位置センサーは、前記ユーザー入力エレメントの位置を検出して、該位置を前記プロセッサに送信するように構成されており、前記アクチュエーターは、前記プロセッサから触覚効果駆動信号を受信するとともに、前記プロセッサからの前記触覚効果駆動信号に応答して力を出力するように構成されており、前記機械的増幅システムは、前記アクチュエーターによって出力された前記力を増幅するように構成されており、該増幅された力は、前記機械的増幅システムから前記ユーザー入力エレメントに運動触覚効果として伝達される、コントローラーと、
を備える、ゲーミングシステム。

【請求項１６】

前記ホストコンピューターはタブレットコンピューターであり、前記コントローラーは

、ハンドルと、内部に前記タブレットコンピューターを収めるようになっているドッキングステーションとを備え、前記ユーザー入力エレメントは前記ハンドル上に配置される、請求項 15 に記載のゲーミングシステム。

【請求項 17】

前記プロセッサは前記コントローラー内に配置される、請求項 15 に記載のゲーミングシステム。

【請求項 18】

前記プロセッサは前記ホストコンピューター内に配置される、請求項 15 に記載のゲーミングシステム。

【請求項 19】

前記ユーザー入力エレメントは、ボタン、トリガー、及びジョイスティックからなる群から選択される、請求項 15 に記載のゲーミングシステム。

【請求項 20】

前記コントローラーは、前記ハウジングに結合されるランブルアクチュエーターも備え、該ランブルアクチュエーターは、前記プロセッサから第 2 の触覚効果制御信号を受信して、前記第 2 の触覚効果制御信号に応答して、前記ハウジングに第 2 の触覚効果を出力するように構成されている、請求項 15 に記載のゲーミングシステム。

【発明の詳細な説明】

【技術分野】

【0001】

本発明は、ユーザー入力エレメントに結合されるターゲットアクチュエーターを備え、触覚効果をユーザー入力エレメントに伝えるようになっている装置に関する。

【0002】

〔関連出願の相互参照〕

本願は、2013 年 4 月 22 日に提出された米国仮特許出願第 61/814628 号の利益を主張する。この米国仮特許出願は、引用することにより、全ての目的についてその全体が本明細書の一部をなす。

【背景技術】

【0003】

ビデオゲーム及びビデオゲームシステムは、カジュアルゲーマーに向けたマーケティング及びその結果のカジュアルゲーマーによる関与によって、更にいっそう一般的になっている。従来のビデオゲーム機器又はコントローラーは、視覚キュー及び聴覚キューを使用して、ユーザーにフィードバックを提供する。一部のインターフェース装置では、運動感覚フィードバック（アクティブな抵抗力覚フィードバック等）及び／又は触覚フィードバック（振動、テキスチャ、及び熱等）もユーザーに提供される。これらのフィードバックは、より一般的には「触覚フィードバック」又は「触覚効果」として総称的に知られている。触覚フィードバックは、ユーザーインターフェースを向上させ単純化するキューを提供することができる。具体的には、振動効果、すなわち振動触覚効果が、電子装置のユーザーに特定のイベントを知らせるようにそのユーザーにキューを提供するときには有用であるか、又はシミュレート環境若しくはバーチャル環境内でより高い知覚没入感をもたらすように現実的なフィードバックを提供する場合がある。

【0004】

また、ユーザーがユーザー入力エレメントとインターフェースして動作を引き起こす医療装置、自動車制御装置、遠隔制御装置、及び他の同様の装置等の他の機器が、触覚フィードバック又は触覚効果によって利益を受ける。例えば、限定するのではないが、医療装置のユーザー入力エレメントは、ユーザーによって医療装置の近位部において患者の体外で操作され、医療装置の遠位端部において患者の体内で動作を引き起こしてもよい。触覚フィードバック又は触覚効果を機器において用いて、ユーザーに特定のイベントを知らせるか、又は医療装置の遠位端部における医療装置と患者との相互作用に関する現実的なフィードバックをユーザーに提供してもよい。

【0005】

ゲーミング機器又は他の機器に用いられる従来の触覚フィードバックシステムは、一般的に、1つ又は複数のアクチュエーターを備える。1つ又は複数のアクチュエーターは、コントローラーのハウジングに取り付けられ、触覚フィードバックを生成する。しかし、これらの従来の触覚フィードバックシステムは、コントローラーの本体全体を伝って触感(haptic sensation)を生じさせる。このような装置は、特定の動作又はロケーションに関するターゲット触感又は指向性触感をユーザーに提供しない。

【0006】

本発明の実施形態は、運動触覚効果をユーザー入力エレメントに提供する触覚フィードバックシステムに関する。さらに、本発明の実施形態は、装置／コントローラーの本体全体を伝って生じる全体触覚効果(general haptic effects)に対して弁別可能又は区別可能である触覚効果をユーザー入力エレメントにもたらす触覚フィードバックシステムに関する。

【発明の概要】

【0007】

本発明の実施形態は、ハウジングと、ユーザー入力エレメントと、該ユーザー入力エレメントに結合される位置センサーと、前記ハウジング内に位置するとともに前記ユーザー入力エレメントに結合されるアクチュエーターとを備える触覚周辺装置に関する。該位置センサーは、前記ユーザー入力エレメントの位置を検出するように構成されているとともに、前記位置をプロセッサに送信するように構成されている。該アクチュエーターは、前記プロセッサから触覚効果駆動信号を受信するように構成されているとともに、前記プロセッサからの前記触覚効果駆動信号に応答して力を出力するように構成されている。前記力は、前記ユーザー入力エレメントに運動触覚効果として伝達される。該触覚周辺装置は、前記アクチュエーターに結合されるとともに該アクチュエーターによって出力された前記力を増幅させるように構成されている機械的増幅システムを備えてもよい。そのような実施形態では、前記増幅された力は、該機械的増幅システムから前記ユーザー入力エレメントに運動触覚効果として伝達される。

【0008】

触覚周辺装置は、ゲームコントローラー、タブレット、電話、個人情報端末(PDA)、コンピューター、ゲーミング周辺装置、マウス、入力装置を備える装着使用アイテム(wearable user items)、又はユーザー入力エレメントを備える他の装置としてもよい。触覚周辺装置のハウジングは、ユーザーによって保持されるようになっている。ユーザー入力エレメントは、ボタン、ジョイスティック、又はトリガーとしてもよく、ホストコンピューターと相互作用するようにユーザーによって操作される。プロセッサは、ホストコンピューター又はコントローラー内に配置してもよい。

【図面の簡単な説明】

【0009】

【図1】コントローラーの一実施形態の概略図である。

【図2】図1のコントローラーの別の視点の概略図である。

【図3】ホストコンピューター及びディスプレイを伴った図1のコントローラーのブロック図である。

【図4】コントローラーの内部構成部品を示すようにコントローラーのハウジングが取り除かれている、図1のコントローラーの一部分の概略図である。

【図5】コントローラーの内部構成部品を示すようにコントローラーのハウジングが取り除かれている、本発明の別の実施形態によるコントローラーの一部分の概略図である。

【図6】ゲーミングタブレットの一実施形態の概略図である。

【図7】図6のゲーミングタブレットのブロック図である。

【図8】本発明の一実施形態による、触覚信号を判定してホスト装置から送信する方法を示すフローチャートである。

【図9】本発明の一実施形態による、触覚効果をコントローラーのユーザーに提供する方

法を示すフローチャートである。

【発明を実施するための形態】

【0010】

本発明の前述の特徴及び利点並びに他の特徴及び利点は、添付の図面に示されている本発明の実施形態の以下の説明から明らかになる。さらに、本明細書に援用されるとともに本明細書の一部をなす添付の図面は、本発明の原理を説明するとともに、当業者が本発明を実現及び使用することを可能にする役割を果たす。図面は縮尺どおりではない。

【0011】

ここで、図面を参照しながら本発明の特定の実施形態を記載する。図面において、同様の参照符号は、同一又は機能的に同様の要素を指す。

10

【0012】

以下の詳細な説明は、本質的に単なる例示であり、本発明又は本発明の適用及び使用を限定することを意図していない。さらに、前述の技術分野、背景技術、概要、又は以下の詳細な説明において提示されている明示的な又は黙示的な理論によって限定することは意図されていない。さらに、以下の説明はゲーミング機器及びゲーミング機器向けのコントローラーに関するが、その説明はユーザー入力エレメントを有する他の装置に等価に当てはまることが当業者には認識される。

【0013】

本発明の実施形態は、触覚フィードバックシステムの触覚周辺装置に関する。この触覚周辺装置は、ユーザー入力エレメントに結合されるターゲットアクチュエーター又はモーターを備える。このターゲットアクチュエーター又はモーターは、ターゲット運動触覚効果又は指向性運動触覚効果をユーザー入力エレメントに直接提供する。本明細書で用いられるとき、「運動」触覚効果は、ターゲットアクチュエーターがユーザー入力エレメントに力を印加して、ユーザーによって動かされる方向にユーザー入力エレメントを動かす（抵抗力フィードバックがアクティブである）、それによってユーザーが運動触覚効果を感じ取る効果を含む。運動触覚効果は慣性触覚効果に対して区別可能である。慣性触覚効果では、慣性アクチュエーターが力を出力又は生成し、ユーザーがその力を間接的に感じ取る場合がある。すなわち、ターゲットはアクチュエーターによって動かされず、ユーザーが出力された力を間接的に知覚する、すなわち感じ取る場合がある。慣性触覚効果をユーザー入力エレメントに提供する1つの触覚フィードバックシステムが、2013年11月12日に出願された本発明と同じ発明者らのうちの1人による米国特許出願第14/078478号に開示されている。この特許出願は、引用することにより、その全体が本明細書の一部をなす。このシステムは、デテント又は振動等の過渡的慣性効果をユーザー入力エレメントに提供するように、ユーザー入力エレメントに取り付けられる慣性アクチュエーターを呈している。慣性触覚効果をユーザー入力エレメントのターゲット領域に隔離するために、振動隔離／減衰装置が慣性アクチュエーターとともに利用される。しかし、本発明の実施形態によって生成される運動触覚効果は、アクチュエーターがユーザー入力エレメントを直接駆動する、すなわち押し／引きし、ユーザー入力エレメントの運動を引き起こすことにより、ユーザーによって感じ取られる。さらに、本発明の実施形態において開示されているユーザー入力エレメント上に生成される運動触覚効果は、全体触覚効果に対して弁別可能又は区別可能である。全体触覚効果は、ランブル効果とも呼ばれ、触覚周辺装置の本体又はハウジング全体を伝って生成される。触覚周辺装置は、例えば、図1及び図2に示されているようなゲーミングシステム向けのハンドヘルドゲーミングコントローラー100、図6に示されているようなゲーミングタブレットコントローラー600、又は、限定はしないが、電話、個人情報端末（PDA）、タブレット、コンピューター、ゲーミング周辺装置、及び当業者に既知であるゲーミングシステム向けの他のコントローラー等の、ユーザー入力（UI）エレメントを有する他のコントローラーとしてもよい。

20

30

40

【0014】

コントローラー100は、一般的に、コンピューター、携帯電話、テレビ、又は他の同様の装置に接続してもよいゲーミングシステムとともに用いられる場合がある。図1及び

50

図2は、コントローラー100の異なる斜視図を示しており、その一方で図3は、ホストコンピューター104及びディスプレイ106を更に備えるゲーミングシステム101において用いられるコントローラー100のブロック図を示している。図3のブロック図に示されているように、コントローラー100は、接続105を介してホストコンピューター104と通信するローカルプロセッサ108を備える。接続105は、有線接続、無線接続、又は当業者に既知である他のタイプの接続としてもよい。代替的には、コントローラー100は、ローカルプロセッサ108を備えずに構成してもよく、それにより、コントローラー100からの全ての入力／出力信号は、ホストコンピューター104によって直接ハンドリング及び処理される。ホストコンピューター104は、ディスプレイ106に結合される。一実施形態において、ホストコンピューター104はゲーミング装置コンソールであり、ディスプレイスクリーン106は、当該技術分野において既知のようなゲーミング装置コンソールに結合されるモニターである。当業者には既知であるように、別の実施形態において、ホストコンピューター104及びディスプレイ106は組み合わせて単一の装置にしてもよい。

10

【0015】

コントローラー100のハウジング102が、左利きユーザーによっても右利きユーザーによっても、装置を把持する両手に容易に適合する形状になっている。当業者には以下のことが認識される。コントローラー100は、単に、ビデオゲームコンソールシステムに現在利用可能な多数の「ゲームパッド」と同様の形状及びサイズのコントローラーの例示的な一実施形態である。ユーザー入力エレメントの他の構成、形状、及びサイズを有するコントローラーを用いてもよい。コントローラーとしては、限定はしないが、Wii（商標）リモートコントローラー又はWii（商標）Uコントローラー、ソニー（登録商標）Six Axis（商標）コントローラー又はソニー（登録商標）Wandコントローラー等のコントローラー、並びに実在の物体（例えばテニスラケット、ゴルフクラブ、野球のバット等）の形状及び他の形状になっているコントローラーを含む、ユーザー入力エレメントの他の構成、形状、及びサイズを有するものを用いてもよい。

20

【0016】

コントローラー100は、ジョイスティック110、ボタン114、及びトリガー118を含む、いくつかのユーザー入力エレメント又はマニピュランドムを備える。本明細書で用いられるとき、「ユーザー入力エレメント」は、ユーザーによって操作されてホストコンピューター104と相互作用する、例えばトリガー、ボタン、ジョイスティック等のインターフェース装置を指す。図1及び図2において見て取ることができるとともに当業者に既知であるように、各ユーザー入力エレメント及び追加のユーザー入力エレメントの2つ以上をコントローラー100上に備えてもよい。したがって、例えば、トリガー118の本説明は、コントローラー100を単一のトリガーに限定しない。さらに、図3のブロック図は、ジョイスティック110、ボタン114、及びトリガー118のそれぞれを1つのみ示している。しかし、上述したように、多数のジョイスティック、ボタン、及びトリガー並びに他のユーザー入力エレメントを用いてもよいことが当業者には理解される。

30

【0017】

図3のブロック図において見て取ることができるよう、コントローラー100は、自身のユーザー入力エレメントのそれぞれを直接駆動するターゲットアクチュエーター又はモーターと、ユーザーの手が概ね置かれる場所においてハウジング102に結合される1つ又は複数の全体アクチュエーターすなわちランブルアクチュエーター122、124とを備える。より具体的には、ジョイスティック110は、自身に結合されるターゲットアクチュエーター又はモーター112を備え、ボタン114は、自身に結合されるターゲットアクチュエーター又はモーター116を備え、トリガー118は、自身に結合されるターゲットアクチュエーター又はモーター120を備える。複数のターゲットアクチュエーターに加えて、コントローラー100は、自身のユーザー入力エレメントのそれぞれに結合される位置センサーを備える。より具体的には、ジョイスティック110は、自身に結

40

50

合される位置センサー１１１を備え、ボタン１１４は、自身に結合される位置センサー１１５を備え、トリガー１１８は、自身に結合される位置センサー１１９を備える。ローカルプロセッサ１０８が、ターゲットアクチュエーター１１２、１１６、１２０と、ジョイスティック１１０、ボタン１１４、及びトリガー１１８の位置センサー１１１、１１５、１１９とにそれぞれ結合される。本明細書においてより詳細に説明されるように、位置センサー１１１、１１５、１１９から受信される信号に応答して、ローカルプロセッサ１０８は、ターゲットアクチュエーター１１２、１１６、１２０に対して、指向性運動効果又はターゲット運動効果をジョイスティック１１０、ボタン１１４、及びトリガー１１８にそれぞれ直接提供するように命令する。このようなターゲット運動効果は、全体アクチュエーター１２２、１２４によってコントローラーの本体全体を伝って生成される全体触覚効果、すなわちランブル触覚効果に対して弁別可能又は区別可能である。複数の種類の感覚(multiple modalities)、例えば、映像、音声、及び触感(haptics)が同時に関与するとき、総合した触覚効果は、ゲームへのより高い没入感をユーザーにもたらす。

10

【００１８】

ここで、図４を参照する。図４は、コントローラー１００の内部構成部品を示すようにハウジング１０２が取り除かれているコントローラー１００の一部分の概略図である。トリガー１１８と、位置センサー１１９と、ターゲットアクチュエーター又はモーター１２０との構造的関係がより詳細に説明される。図示されていないが、トリガー１１８と、位置センサー１１９と、ターゲットアクチュエーター又はモーター１２０とが、ハウジング１０２内に配置又は収容されることが当業者には理解される。さらに、図４にはトリガー１１８のみが示されているが、ターゲット触覚効果又は指向性触覚効果を選択されたユーザー入力エレメントに生成するために、同様の構造関係を、ジョイスティック１１０、位置センサー１１１、及びターゲットアクチュエーター又はモーター１１２に関して、並びに、ボタン１１４、位置センサー１１５、及びターゲットアクチュエーター又はモーター１１６に関して用いてもよいことが当業者には理解される。

20

【００１９】

位置センサー１１９は、トリガー１１８の位置を検出するように構成されるとともに、この位置をローカルプロセッサ１０８（図４には示していない）に送信するように構成される。図４の実施形態では、トリガー１１８は、自身の内部に収容されるばね部材１１７を含み、ばね部材１１７は、ユーザーによる力がトリガーに加えられることなく、トリガーを基準位置に戻す。位置センサー１１９は、レバーアーム１２６を介してトリガー１１８に結合される。レバーアーム１２６は、ヒンジ結合される第１の端部１２５と、可動な第２の端部１２７とを有する。トリガー１１８は、レバーアーム１２６の可動な第２の端部１２７に取り付けられ、位置センサー１１９は、レバーアーム１２６のヒンジ結合される第１の端部１２５に取り付けられる。ユーザーがトリガー１１８を動かすと、すなわち押圧すると、ばね部材１１７が圧縮し、トリガー１１８がトリガー軸 T_A の周囲すなわち回りに回転する。レバーアーム１２６の第２の端部１２７もトリガー１１８とともに運動し、すなわち回転し、レバーアーム１２６が、ヒンジ結合される第１の端部１２５の周囲すなわち回りに回転する。位置センサー１１９は、レバーアーム１２６及びトリガー１１８の回転位置の変化を運動イベントとして検出し、この運動イベントをローカルプロセッサ１０８に送信する。本明細書においてより詳細に説明されるように、異なるトリガー位置及び運動イベントの結果として、異なる触覚効果がターゲットアクチュエーター又はモーター１２０によって印加されてもよい。一実施形態において、位置センサー１１９はポテンショメーターであるが、例えば、限定はしないが、光学センサー、光学エンコーダー、ホール効果センサー、静電容量式センサー等の、当該技術分野において既知の他のタイプの位置センサーとしてもよい。本発明の別の実施形態（図示していない）において、位置センサー１１９はトリガー１１８に直接結合してもよく、この場合、位置センサー１１９とトリガー１１８との間に延在するレバーアームは存在しない。

30

40

【００２０】

位置センサー１１９はレバーアーム１２６及びトリガー１１８の回転位置の変化を検出

50

するものであるが、ボタン１１４に結合される位置センサー１１５及びジョイスティック１１０に結合される位置センサー１１１は、トリガー１１８に関して示したような回転運動ではなく、特定のユーザー入力エレメントの運動イベントを検出するように構成しても良いことは当業者には理解されるであろう。例えば、ボタン１１４の位置センサー１１５は、ボタン１１４の直線運動又は並進運動（すなわちボタン１１４が押下される状況）を検出するように構成しても良い。ジョイスティック１１０の位置センサー１１１は、１つ又は複数の自由度内でのジョイスティック１１０の運動（すなわちジョイスティック１１０が前方、後方、左、又は右に物理的に動かされる状況）を検出するように構成しても良い。

【００２１】

ターゲットアクチュエーター又はモーター１２０は、回転シャフト１２８を介してトリガー１１８に結合される。より具体的には、回転シャフト１２８は、ターゲットアクチュエーター１２０に取り付けられるとともに、ターゲットアクチュエーター１２０からレバーアーム１２６の第１の端部１２５まで延びる。回転シャフト１２８は、シャフト１２８の回転がレバーアーム１２６の運動を引き起こすように、レバーアーム１２６の第１の端部１２５に取り付けられる。ターゲットアクチュエーター１２０はローカルプロセッサ１０８（図４には示していない）から触覚効果駆動信号を受信する。触覚効果駆動信号は、位置センサー１１９によって測定されるトリガー１１８の位置に応答して生成される。次に、ターゲットアクチュエーター１２０は、ローカルプロセッサ１０８からの触覚効果駆動信号に応答して、触覚効果をトリガー１１８に出力する。より具体的には、ターゲットアクチュエーター１２０は、回転シャフト１２８を直接駆動する、すなわち回転シャフト１２８の作動すなわち回転を引き起こす。また、回転シャフト１２８の回転により、レバーアーム１２６及びトリガー１１８の回転及び運動が引き起こされる。この場合、ユーザーはトリガー１１８の運動を感じ取る。このように、回転シャフト１２８の作動すなわち回転がトリガー１１８に伝達される。

【００２２】

本発明の一実施形態において、ターゲットアクチュエーター１２０は、トリガー１１８を押し引きする、すなわちトリガー１１８を双方向に動かす場合がある双方向モーターである。モーターに加えて、ターゲットアクチュエーター１２０は、形状記憶合金、信号に応答して変形する電気活性ポリマー、堅さを変化させるメカニズム、振動触覚アクチュエーター、慣性アクチュエーター、圧電アクチュエーター、又は、運動触覚効果をユーザー入力エレメントに直接生成するのに好適な他のタイプの作動装置としてもよい。一実施形態において、ターゲットアクチュエーター１２０は、１６mmのMaxonモーターであるが、当該技術分野において既知かつ利用可能な他のタイプのブラシ付電気DCモーター及びブラシレス電気DCモーターとしてもよい。ターゲットアクチュエーター１２０の停動トルクに応じて、トリガー１１８に印加することができる力の最大量が決まる。この場合、停動トルクは、静止状態からのターゲットアクチュエーター１２０の最大推力として測定される。ターゲットアクチュエーター１２０は０．５mNm～４０mNmの停動トルクを有してもよい。本発明の一実施形態において、ターゲットアクチュエーター１２０は、１２Vで駆動される場合には３４．５mNmの停動トルク、又は、５Vで駆動される場合には１４．４mNmの停動トルクを有する。当業者には理解されるように、強力なモーターすなわち高トルクモーターは、明確に感じ取られるとともに、全体触覚効果すなわちランブル触覚効果に対して区別される場合がある、比較的より強力な触覚効果を生成してもよい。さらに、高トルクモーター（１２Vで駆動される場合には３４．５mNmの停動トルク、又は、５Vで駆動される場合には１４．４mNmの停動トルクを有するモーター等）は、機械的増幅を行わなくても、トリガー１１８上で明確に感じ取られるとともに、互いに区別される場合がある、より多様な触覚効果を生成してもよい。しかし、力の弱いモーター、すなわち低トルクモーターは、通常、より安価でサイズがより小さい。図５に関して以下でより詳細に説明されるように、ギアシステム等の機械的増幅システムを低トルクモーターとともに使用して、より強力な触覚効果及びより多様な触覚効果を生成して

10

20

30

40

50

もよい。

【0023】

動作の際、ローカルプロセッサ108が、位置センサー119からトリガー位置及び／又は運動イベントを検出又は受信して、このトリガー位置及び／又は運動イベントをホストコンピュータ104に送信する。次に、ローカルプロセッサ108は、ホストコンピュータ104からの高水準監視コマンド又はストリーミングコマンドに基づき、触覚効果駆動信号をターゲットアクチュエーター120に提供する。例えば、動作しているとき、電圧の大きさ及び継続時間は、ホストコンピュータ104からコントローラー100にストリーミングされ、コントローラー100において、ローカルプロセッサ108を介してターゲットアクチュエーター120に情報が提供される。ホストコンピュータ104は、ターゲットアクチュエーター120によって出力される触覚効果のタイプ（例えば、振動、ジョルト、デテント、ポップ等）等の高水準コマンドをローカルプロセッサ108に提供してもよい。それにより、ローカルプロセッサ108は、出力される触覚効果の特定の特徴（例えば、大きさ、周波数、継続時間等）に関してターゲットアクチュエーター120に命令する。ローカルプロセッサ108は、自身に結合されるメモリ109（図3のブロック図に示されている）から触覚効果のタイプ、大きさ、周波数、継続時間、又は他の特徴を索出してもよい。

【0024】

多様な運動触覚効果又は触感をトリガー118に出力してもよい。より具体的には、ターゲットアクチュエーター120は、トリガー118を直接駆動し、すなわち押し／引きし、トリガー118の運動を引き起こす。ターゲットアクチュエーター120は、トリガー118上に抵抗力を出力して、それによりユーザーがトリガー118を押下し難くなるようにしてもよい。このような抵抗力は可変としてもよい、すなわち、トリガー位置又はビデオゲームにおけるユーザーアクションに応じて変化してもよい。本発明の一実施形態において、ターゲットアクチュエーター120は、トリガー118のロックアウトモードにおいてユーザーの運動全てを妨げる最大抵抗力を出力してもよい。別の例において、ターゲットアクチュエーター120は、トリガー118上に抵抗力を出力することにより、トリガー118上にデテントを出力してもよい。上記抵抗力は1つ又は複数の特定のトリガー位置又はロケーションにおいて取り除かれる。このように、ユーザーが感じ取るデテントはボタンを押す感覚（button click）に似ている。本発明の更に別の実施形態において、ターゲットアクチュエーター120は、トリガー118を高速で往復して押し引きすることによりトリガー118上に振動を出力してもよい。

【0025】

本発明の一実施形態において、上述した運動触覚効果は過渡的な短い触覚効果である。すなわち、その運動触覚効果は一時的でしかなく、継続時間が短い。例えば、このような効果は、10ミリ秒～100ミリ秒の継続時間をそれぞれ有してもよい。このように、ターゲットアクチュエーター120は、全運動感覚ジョイスティックにおいて用いられるアクチュエーターと比較して、小さい力及び制限された出力を有する。全運動感覚ジョイスティックは、触覚効果をジョイスティックに提供するために、電力を連続して消費する。しかし、上述したように、運動触覚効果をユーザー入力エレメントに直接提供するターゲットアクチュエーターを有するコントローラーは、触覚効果が印加又は変更される必要があるときにのみ電力を消費する。換言すると、本発明の実施形態による、過渡的運動触覚効果をユーザー入力エレメントに直接提供するターゲットアクチュエーターを有するコントローラーに関しては、ターゲットアクチュエーター120は、触覚効果が印加又は変更される必要があるときにのみエネルギーを必要とする。これは、全運動感覚ジョイスティックとは反対である。全運動感覚ジョイスティックでは、ジョイスティックに関する触覚効果を生成するのに、直接又は連続的に電力すなわちエネルギーが供給される。このように、本発明の実施形態による、過渡的運動触覚効果をユーザー入力エレメントに直接提供するターゲットアクチュエーターを有するコントローラーは、比較的低い電力要件を有し、それにより、コスト、体積、及び電力消費が低減される。さらに、本発明の実施形態に

において用いられるアクチュエーターは、供給される必要があるピーク電力がより小さいため、このアクチュエーターのサイズは、全運動感覚ジョイスティックにおいて用いられるアクチュエーターのサイズよりも比較的小さく安価である。

【0026】

ターゲット触覚フィードバックが有利である例示的な用途としては、ファーストパーソンシュータービデオゲーム又はレーシングビデオゲームが挙げられる。そのようなビデオゲームでは、ターゲットアクチュエーター120は、シュータービデオゲーム例ではユーザーがターゲットをヒットするとき、又は、レーシングビデオゲーム例ではユーザーがマイルストーン若しくは目印を通過するときに、振動、ジョルト、又はポップ等の触覚効果を出力してもよい。別の例において、ターゲットアクチュエーター120は、レーシングビデオゲーム例では種々のロケーションにおいてデテントを出力してもよいし、シュータービデオゲーム例では繰返しの発砲のフィードバックとしてデテントを出力してもよい。テキスチャフィードバックは、限定はしないが粒度合成 (granular synthesis) 等の位置依存触覚アルゴリズムを用いて生成してもよい。別の例において、ターゲットアクチュエーター120を用いて、ビデオゲームの、弾薬切れ、武器の不正確な照準決め、使用中の武器、及び／又は発砲レート等のステータスを示す触覚フィードバックを出力してもよい。複数の武器が使用される場合があるビデオゲームにおいて、このようなステータス表示は、ユーザーが各武器の最適な発砲レート及びトリガー位置／地点を知ることを支援する。他の例として以下のことが挙げられる。ターゲットアクチュエーター120は、様々なトリガー位置又はロケーションにおいてデテントを出力してもよく、各武器についてのブラグラム可能な「感触 (feel)」又は抵抗を出力してもよく、フィードバックにおいて発砲した感覚 (firing result) を出力してもよく、印加される抵抗を増大又は減少させることによってブレーキフィードバック又はスロットルフィードバックを出力してもよく、テキスチャフィードバックを出力してもよく、ばね117、ひいてはトリガー118の堅さを増大又は減少させてもよく、慣性をシミュレートしてもよい。

【0027】

前述したように、異なるトリガー位置及び運動イベントの結果として、ターゲットアクチュエーター120によって印加される運動触覚効果が異なってもよい。例えば、トリガー118の第1の位置の結果として、ターゲットアクチュエーター120が第1の触覚効果駆動信号を生成してトリガー118に印加し、トリガー118の第2の位置の結果として、ターゲットアクチュエーター120が第2の触覚効果駆動信号を生成してトリガー118に印加する。より具体的には、ローカルプロセッサ108は、ゲームアクション及び位置センサー119によって示されるトリガー118の位置に応じて、触覚効果駆動信号をターゲットアクチュエーター120に送信し、振動、デテント、テキスチャ、ジョルト、又はポップを含む多様な触覚効果又は触感のうちの1つを出力してもよい。さらに、触覚効果又は触感の強度又はレベルは、位置センサー119によって示されるトリガー118の位置に応じて変化してもよい。

【0028】

また、運動触覚効果は、ユーザー入力エレメントに応じて変化してもよい。例えば、いくつかのシューティングゲームは、別個の又は対応するターゲットアクチュエーターを有する2つのトリガーを有する。第1の触覚効果駆動信号が、第1のターゲットアクチュエーターによって第1のトリガーに印加されてもよく、第2の触覚効果駆動信号が、第2のターゲットアクチュエーターによって第2のトリガーに印加されてもよい。例えば、限定はしないが、Titanfall等のいくつかのビデオゲームにおいて、各トリガー（すなわち、左トリガー及び右トリガー）向けの触覚効果駆動信号は、コンピューター制御キャラクター又はオブジェクトの左手及び右手によって保持されている異なるタイプの武器に対応する。別の例において、各トリガー（すなわち、左トリガー及び右トリガー）向けの触覚効果駆動信号は、コンピューター制御キャラクター又はオブジェクトの左側及び右側に発生する指向性イベント（例えば、ビデオゲームにおいてキャラクターの左側に何か衝突するか又は当たる）に対応する。

【0029】

ターゲットアクチュエーター120は、全体アクチュエーター122、124によって生成される全体触覚フィードバックすなわちランブル触覚フィードバックとは独立しているとともに全体触覚フィードバックすなわちランブル触覚フィードバックと相補的である多様な運動触覚効果又は触感を、トリガー118に提供することが有利である。全体アクチュエーター122、124は、コントローラー100のハウジング102に結合され、全体触覚フィードバックすなわちランブル触覚フィードバックをコントローラー100のハウジング全体に提供する役割を果たす。全体アクチュエーター122、124は、ターゲットアクチュエーター又はモーター120と同様に、プロセッサ108に結合されるとともにプロセッサ108から制御信号を受信する。この場合、ローカルプロセッサ108は、ホストコンピューター104からの高水準監視コマンド又はストリーミングコマンドに基づき、触覚効果制御信号を全体アクチュエーター122、124に提供する。例えば、動作しているとき、電圧の大きさ及び継続時間が、ホストコンピューター104からコントローラー100にストリーミングされ、コントローラー100において、ローカルプロセッサ108を介して全体アクチュエーター122、124に情報が提供される。ホストコンピューター104は、全体アクチュエーター122、124によって出力される触覚効果のタイプ（例えば、振動、ジョルト、デテント、ポップ等）等の高水準コマンドをローカルプロセッサ108に提供してもよい。それにより、ローカルプロセッサ108は、出力される触覚効果の特定の特徴（例えば、大きさ、周波数、継続時間等）に関して全体アクチュエーター122、124に命令する。

10

20

【0030】

全体アクチュエーター122、124は、電磁モーター、モーターによって偏心質量体が動かされる偏心回転質量（「ERM」）アクチュエーター、ばねに取り付けられた質量体が往復して駆動されるリニア共振アクチュエーター（「LRA」）、形状記憶合金、信号に応答して変形する電気活性ポリマー、堅さを変えるメカニズム、振動触覚アクチュエーター、慣性アクチュエーター、圧電アクチュエーター、又は他の好適なタイプの作動装置を含んでもよい。1つの実施形態において、アクチュエーター122、124は、慣性アクチュエーターとして実施され、振動触覚フィードバックをユーザーに提供することができる。別の実施形態において、アクチュエーターは、例えば、ハウジング202の堅さ／振動減衰度を変えるソレノイド、ハウジング202内でサイズが変わる小型エアバッグ、又は形状変化材料を含む運動触覚フィードバックシステムを用いてもよい。

30

【0031】

上述したように、低停動トルクモーターがターゲットアクチュエーターとして用いられる本発明の実施形態では、ギアシステム等の機械的増幅システムを用いて、ユーザーが感じ取ることができる十分な触覚効果を生成してもよい。図5は、本発明の別の実施形態を示している。この実施形態では、コントローラー500が、ターゲットアクチュエーター又はモーター520の停動トルクと触覚強度とを増大させるギア機構530を備える。モーター520及びギア機構530に加えて、コントローラー500は、トリガー518と、位置センサー519と、位置センサー519からトリガー位置及び運動イベントを受信するとともに、触覚効果駆動信号をモーター520に出力するプロセッサ（図5には示していない）とを備える。図示していないが、トリガー518と、位置センサー519と、ターゲットアクチュエーター又はモーター520とは、ハウジング内に配置又は収容されることが当業者には理解される。図4と同様に、図5は、コントローラーの内部構成部品を示すようにコントローラーのハウジングが取り除かれている状態のコントローラー500の一部分の概略図である。

40

【0032】

ギア機構530は、少なくとも、歯すなわちコグ534を自身の外周に有する第1の回転可能ギア532と、歯すなわちコグ538を自身の外周に有する第2の回転可能ギア536とを備える。第1のギア532は、回転シャフト529を介してモーター520に結合され、回転シャフト529はモーター520に取り付けられるとともにモーター520

50

から延びる。第2のギア536は、レバーアーム526の第1の端部525に結合され、レバーアーム526は第2の回転可能シャフト528を介してトリガー518に取り付けられる。第1のギア532は第2のギア534よりも比較的小さく、第1のギア532の歯534は、第2のギア536の歯538と噛み合う。当業者には理解されるように、ギア532、536は、モーター520から生成されるトルクを変化又は増大させるためにギア比の機械的倍率 (mechanical advantage) を生成する。ギア機構530の高ギア比により、モーターの停動トルクの大幅な増大又は変化が生じ、これはモーター520からの伝達力の増大に対応する。しかし、高ギア比は、ギア機構530の出力において大きい慣性ももたらし、これはシステム応答時間及び触覚効果の知覚を低減させる可能性がある。したがって、ギア機構530に必要とされるモーター520及び対応するギア比を選択するとき、コスト、サイズ、所望の停動トルク、所望の応答時間、及び触覚効果の所望の強度を含む種々の要因を考慮しなければならない。本発明の一実施形態において、2:1〜28:1のギア比が用いられる。例えば、2.1 mNmの停動トルクを有するモーターには、9:1のギア比が必要とされる。図5は、ギア機構を低停動トルクモーターの機械的増幅手段として示しているが、限定はしないがプーリー機構等の他の機械的増幅手段を用いてもよい。

10

【0033】

いくつかの実施形態が、本明細書に具体的に図示及び／又は記載される。しかし、開示される実施形態の変更形態及び変形形態が、本発明の趣旨及び意図される範囲から逸脱することなく、上記教示により包含されること及び添付の特許請求項の範囲内にあることが理解される。例えば、図1〜図3は触覚周辺装置を示しており、この触覚周辺装置は、ビデオゲームコンソールシステムに現在利用可能な多くの「ゲームパッド」と同様の形状及びサイズのハンドヘルドゲーミングコントローラーである。しかし、このコントローラーは、触覚周辺装置の例示的な一実施形態にすぎず、他の構成、形状、及びサイズの触覚周辺装置を用いてもよいことが当業者には認識される。例えば、図6〜図7は本発明の別の実施形態を示しており、この実施形態では、触覚周辺装置は、タブレットコンピューター604とともに用いてもよいゲーミングタブレットコントローラー600である。タブレットコンピューター604は、Razer社から利用可能であるように、ゲーミングアクティビティに向けて特に設計してもよいし、Apple (登録商標)、Ipad (登録商標)、Kindle (登録商標) Fire (登録商標)、及びSamsung (登録商標) Galaxy Tab (登録商標) 等のよく知られているとともに市販されているタブレットコンピューターとしてもよい。

20

30

【0034】

ゲーミングタブレットコントローラー600は、タブレットコンピューター604を収めるように構成されているドッキング部605と、ハンドル640、642とを有し、ハンドル640、642上には、ユーザーがタブレットコンピューター604上のゲームの制御に用いるユーザー入力エレメントが配置される。ドッキング部605は、ゲーミングタブレットコントローラー600をタブレットコンピューター604に接続し、例えば、ボタンを押す、ジョイスティックを動かす、トリガーを押す等のハンドル640、642上でのユーザーによる動作が、タブレットコンピューター604上でプレイされているゲーム上でのアクションを生じるようになっている。

40

【0035】

ハンドル640、642は、コントローラー上にある通常のユーザー入力エレメントを備える。ユーザー入力エレメントはハンドル642に関して記載される。しかし、同じ又は同様のユーザー入力エレメントをハンドル640上に用いてもよいことが当業者には理解される。特に、ハンドル642は、ジョイスティック610、ボタン614、及びトリガー618を備える。図6に見て取ることができるとともに当業者に既知であるように、これらのユーザー入力エレメントのそれぞれを2つ以上、各ハンドル640、642上に備えてもよい。さらに、ハンドル642は、全体アクチュエーターすなわちランブルアクチュエーター624を備える。全体アクチュエーターすなわちランブルアクチュエーター624

50

は、ハンドル 6 4 2 の、ユーザーの手が概ね配置される場所に取り付けられ、全体アクチュエーターすなわちランブルアクチュエーター 1 2 2、1 2 4 に関して上述したように、全体触覚効果すなわちランブル触覚効果をゲーミングタブレットコントローラー 6 0 0 に提供する。

【0036】

図 7 は、一実施形態による図 6 のゲーミングタブレットコントローラーのブロック図を示している。図 7 に示されているように、ゲーミングタブレットコントローラー 6 0 0 は、ドッキング部 6 0 5 を介してタブレットコンピューター 6 0 4 と通信するローカルプロセッサ 6 0 8 を備える。ドッキング部 6 0 5 の代わりに、有線接続又は無線接続等の他の接続を用いてもよい。この実施形態のタブレットコンピューター 6 0 4 はディスプレイスクリーンを備える。代替的には、ゲーミングタブレットコントローラー 6 0 0 は、ローカルプロセッサ 6 0 8 を備えないように構成してもよく、それにより、ゲーミングタブレットコントローラー 6 0 0 からの全ての入力／出力信号はタブレットコンピューター 6 0 4 によって直接ハンドリング及び処理される。

【0037】

ローカルプロセッサ 6 0 8 は、ジョイスティック 6 1 0、ボタン 6 1 4、及びトリガー 6 1 8 と、位置センサー 6 1 1、6 1 5、及び 6 1 9 とに結合される。位置センサー 6 1 1、6 1 5、及び 6 1 9 は、ジョイスティック 6 1 0、ボタン 6 1 4、及びトリガー 6 1 8 にそれぞれ結合してもよい。図 7 のブロック図は、ジョイスティック 6 1 0、ボタン 6 1 4、及びトリガー 6 1 8 のそれぞれ 1 つのみを示している。しかし、上述したように、複数のジョイスティック、ボタン、及びトリガー、並びに他の入力エレメントを用いてもよいことが当業者には理解される。ターゲットアクチュエーター又はモーター 6 1 2、6 1 6、及び 6 2 0 は、ジョイスティック 6 1 0、ボタン 6 1 4、及びトリガー 6 1 8 にそれぞれ結合される。また、ターゲットアクチュエーター 6 1 2、6 1 6、6 2 0、及び全体アクチュエーター 6 2 2、6 2 4 は、ローカルプロセッサ 6 0 8 に結合される。ローカルプロセッサ 6 0 8 は、タブレットコンピューター 6 0 4 からの高水準監視コマンド又はストリーミングコマンドに基づき、触覚効果駆動信号をアクチュエーター 6 1 2、6 1 6、6 2 0、6 2 2、6 2 4 に提供する。ストリーミングを用いる実施形態において、電圧の大きさ及び継続時間がゲーミングタブレットコントローラー 6 0 0 にストリーミングされ、この場合、タブレットコンピューター 6 0 4 によってアクチュエーターに情報が提供される。動作の際、タブレットコンピューター 6 0 4 は、1 つ又は複数の選択されたアクチュエーターによって出力される触覚効果のタイプ（例えば、振動、ジョルト、デテント、ポップ等）等の高水準コマンドをローカルプロセッサ 6 0 8 に提供してもよい。それにより、ローカルプロセッサ 6 0 8 は、出力される触覚効果の特定の特徴（例えば、大きさ、周波数、継続時間等）に関してアクチュエーターに命令する。ローカルプロセッサ 6 0 8 は、ローカルプロセッサ 6 0 8 に結合されるメモリ 6 0 9 から、触覚効果のタイプ、大きさ、周波数、継続時間、又は他の特徴を索出してもよい。複数の種類の感覚、例えば、映像、音声、及び触感が同時に関与するとき、触覚効果は、ゲームへのより高い没入感をユーザーにもたらす。

【0038】

図 8 は、本発明の 1 つの実施形態による、ホストコンピューターシステム、すなわちホストコンピューター 1 0 4 又はタブレットコンピューター 6 0 4 から触覚効果駆動信号を生成することのフロー図である。例示のために、フロー図はホストコンピューター 1 0 4 及びコントローラー 1 0 0 に関して記載する。一実施形態において、図 8 のフロー図の機能は、ホストコンピューター 1 0 4 のメモリ内に記憶されるときにホストコンピューター 1 0 4 のプロセッサによって実行されるソフトウェア、及び／又はコントローラー 1 0 0 のメモリ 1 0 9 内に記憶されるときにコントローラー 1 0 0 のローカルプロセッサ 1 0 0 によって実行されるソフトウェアによって実施される。他の実施形態において、上記機能は、特定用途向け集積回路（「ASIC」）、プログラマブルゲートアレイ（「PGA」）、フィールドプログラマブルゲートアレイ（「FPGA」）、又はハードウェアと

10

20

30

40

50

ソフトウェアとの任意の組合せの使用を通してハードウェアによって実施してもよい。

【0039】

ステップ844において、ホストコンピューター104がトリガー118の運動イベントを判定又は検出する。より具体的には、ホストコンピューター104は、トリガー118に取り付けられている位置センサー119によって検知された位置信号に基づき、運動イベントが発生したか否かを判定する。一例として、シューティングゲーム例では武器を発砲するために、又は、レーシングビデオゲーム例では車を加速させるために、ユーザーがトリガー118を押下する、すなわち押し下げる場合がある。トリガー118の運動イベントは、上述した例に限定されないことが当業者には理解される。

【0040】

次に、ステップ846において、ホストコンピューター104がその運動イベントに関連付けられている触覚効果が存在するか否かを判定する。例えば、シューティングビデオゲームのシナリオにおいて、武器の発砲が、振動、ジョルト、又はポップ等の関連付けられた触覚効果を有してもよく、繰返しの発砲が、デテント等の関連付けられた触覚効果を有してもよい。別の例として、レーシングビデオゲームのシナリオにおいて、車の加速又は制動が、テキスチャの変化等の関連付けられた触覚効果を有してもよく、マイルストーン又は目印の通過が、振動、ジョルト、ポップ、又はデテント等の関連付けられた触覚効果を有してもよい。

【0041】

運動イベントに関連付けられている触覚効果が存在するか否かを判定するために、ホストコンピューター104は、その運動イベントを、ターゲットアクチュエーター120向けの触覚効果信号にマッピングする。より具体的には、ホストコンピューターは、運動イベントと触覚効果との事前定義マッピングにアクセスする。運動イベントが関連付けられた触覚効果を有すると判定される場合、触覚信号が送信される。運動イベントが関連付けられた触覚効果を有しない場合、触覚信号は送信されない。

【0042】

ステップ848において、ホストコンピューター104が、触覚効果信号に基づき触覚効果駆動信号を生成及び送信することにより、触覚制御情報をコントローラー100に送信する。触覚効果駆動信号の送信は、前述したように、有線通信によっても無線通信によっても行うことができる。

【0043】

図8は、運動イベントの検出に基づき、ホストコンピューターシステムから触覚効果駆動信号を生成する1つの方法を示している。しかし、本発明の一実施形態において、運動イベントの検出は、ホストコンピューターシステムから触覚効果駆動信号を生成するのに必須ではない。換言すると、ホストコンピューターシステムは、運動イベントの検出を行わずに、触覚効果駆動信号を生成してコントローラー100に送信してもよい。例えば、ホストコンピューターシステムは、コンピューター制御キャラクター又はオブジェクトに関するイベントに基づき、触覚効果駆動信号を生成してコントローラー100に送信してもよい（すなわち、ビデオゲームにおいて、キャラクターの手に何かが衝突するか又は当たり、このイベントを示すように触覚効果がユーザー入力エレメントに出力される）。

【0044】

図9は、本発明の1つの実施形態による、ホストコンピューターシステムから触覚情報を受信して、触覚効果をコントローラーに印加することのフロー図である。一実施形態において、図9のフロー図の機能は、ホストコンピューター104のメモリに記憶されるときともにホストコンピューター104のプロセッサによって実行されるソフトウェア、及び／又はコントローラー100のメモリ109に記憶されるときともにコントローラー100のローカルプロセッサ108によって実行されるソフトウェアによって実施される。他の実施形態において、上記機能は、特定用途向け集積回路（「ASIC」）、プログラマブルゲートアレイ（「PGA」）、フィールドプログラマブルゲートアレイ（「FPGA」）、又はハードウェアとソフトウェアとの任意の組合せの使用を通してハードウェアによ

って実施してもよい。

【0045】

ステップ950において、触覚周辺装置がホストコンピュータ104から信号を受信する。信号が受信されると、ステップ952において、ローカルプロセッサ108が、その信号が触覚信号であるか又は何らかの他の非触覚関連信号であるかを判定する。信号が触覚信号でないと判定される場合、ローカルプロセッサ108はいかなる触覚効果もユーザーに与えることなく機能し続け、ホストコンピュータから別の信号を受信するのを待つ。信号が触覚信号であると判定される場合、ローカルプロセッサ108は、どの構成要素、すなわちハウジング102又はユーザー入力エレメントに信号を送信しなければならないかを判定しなければならない。

10

【0046】

ステップ954において、ローカルプロセッサ108は、触覚関連信号が全体アクチュエーター触覚信号であるのかターゲットアクチュエーター触覚信号であるのかを判定しなければならない。信号が、全体アクチュエーター122、124のうちの一方が全体触覚効果すなわちランブル触覚効果をユーザーに提供することを要求する場合、ローカルプロセッサ108は、ステップ960において、その信号を適切な全体アクチュエーター122、124に送信する。次に、ステップ962において、全体アクチュエーターが命令された触覚効果を出力する。全体アクチュエーターによって出力される触覚効果としては、限定はしないが、様々な程度の振動又は他のタイプの触覚効果を挙げることができる。例示的な一例として、ユーザーがキャラクター又は何らかの他のグラフィカルオブジェクトを制御しており、そのときそのバーチャル環境において衝突に遭遇する場合、関連付けられる触覚効果は振動としてもよい。この場合では、ローカルプロセッサ108は、コントローラー100のハウジング102が振動するべきであることを示す信号を受信する。結果として、ローカルプロセッサ108が、適切な触覚効果を提供するように適切なアクチュエーター122、124に信号を送信する。この例では、適切な触覚効果は振動である。

20

【0047】

一方、その信号が、ターゲットアクチュエーター112、116、120のうちの1つがターゲット触覚効果をボタン110、ジョイスティック114、トリガー118それぞれに出力することを要求する場合、ローカルプロセッサ108は、ステップ956において、その信号をターゲットアクチュエーターに送信する。次に、ステップ958において、ターゲットアクチュエーターが命令された触覚効果を出力する。ターゲットアクチュエーターによって出力される触覚効果としては、限定はしないが、様々な程度の振動、様々な程度のデテント、又は他のタイプの触覚効果を挙げることができる。

30

【0048】

実行及びユーザーに提供される触覚効果のタイプを判定する際、高水準触覚パラメーター又はストリーミング値がソフトウェアコードに生成され、触覚エンジン（図示していない）に送信される。触覚エンジンにおいて高水準触覚パラメーター又はストリーミング値が処理され、適切な電圧レベルがアクチュエーターに対して生成される。これにより、コントローラーが、適切な触覚フィードバックをユーザーに提供することと、アクチュエーターに対して生成される異なる電圧レベルによる触覚フィードバックの大きさ又はタイプを変化させることが可能になる。さらに、ゲーミングソフトウェア及び触覚ソフトウェアは、同じプロセッサ上又は複数のプロセッサ上に存在することができる。

40

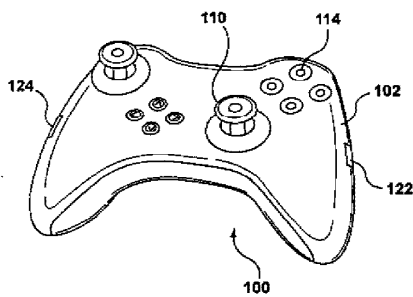
【0049】

本発明による種々の実施形態が上述されているが、それらの実施形態は、限定ではなく説明及び例のために提示されているにすぎないことが理解されるべきである。本発明の趣旨及び範囲から逸脱することなく、形態及び細部の種々の変更をそれらの実施形態において行うことができることが当業者には明らかである。例えば、全体アクチュエーター、すなわちランブルアクチュエーターを有するコントローラーとの併用に関して記載されているが、本明細書に記載されているようなターゲット触覚効果又は指向性触覚効果をユーザー

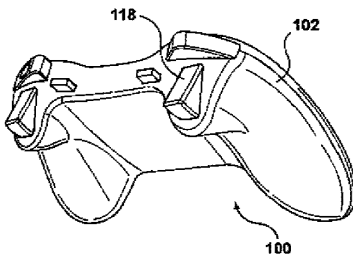
50

ー入力エレメントに出力するターゲットアクチュエーター又はモーターは、触覚効果をコントローラーのハウジングに出力する全体アクチュエーター又はランブルアクチュエーターを備えないコントローラーにおいて用いてもよいことが当業者には理解される。このように、本発明の広さ及び範囲は、上述の例示的な実施形態のいずれによっても限定されるべきではなく、添付の特許請求の範囲及びそれらの均等物によってのみ規定されるべきである。また、本明細書において論じられている各実施形態の各特徴と、本明細書に引用されている各参照文献の各実施形態の各特徴とは、任意の他の実施形態の特徴と組み合わせることができる。本明細書において論じられている全ての特許及び刊行物は、本明細書に引用することにより、その全体が本明細書の一部をなす。

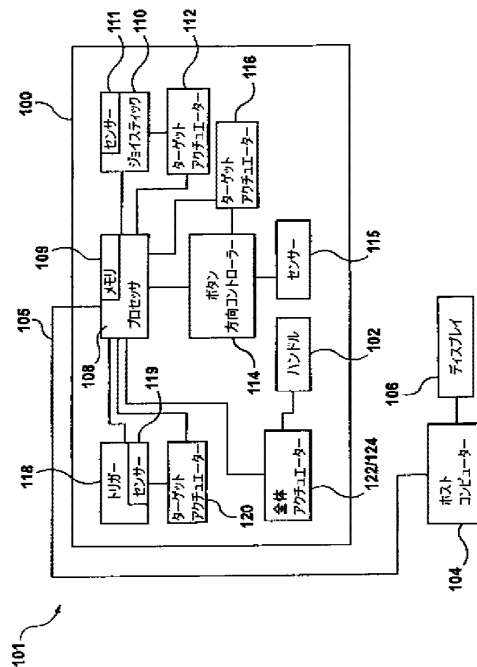
【図 1】



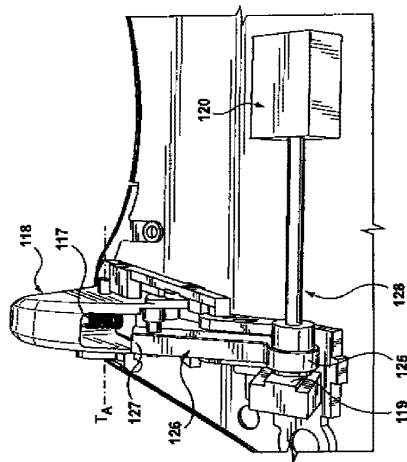
【図 2】



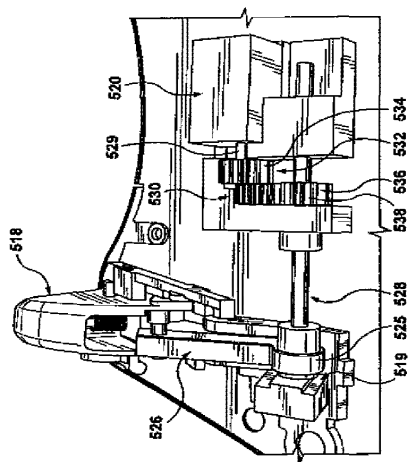
【図 3】



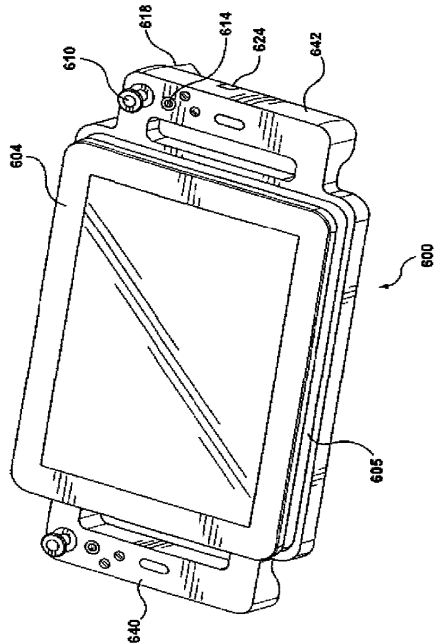
【図 4】



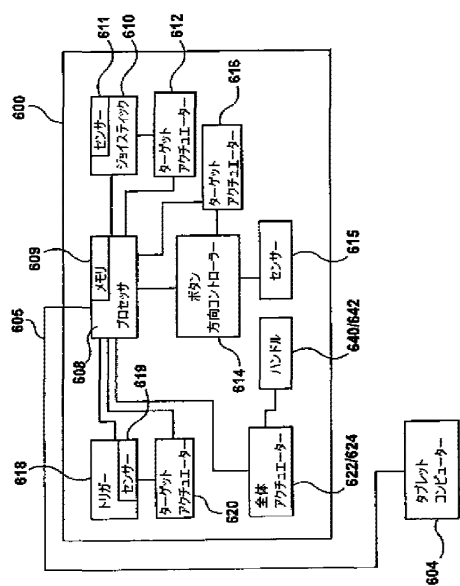
【図 5】



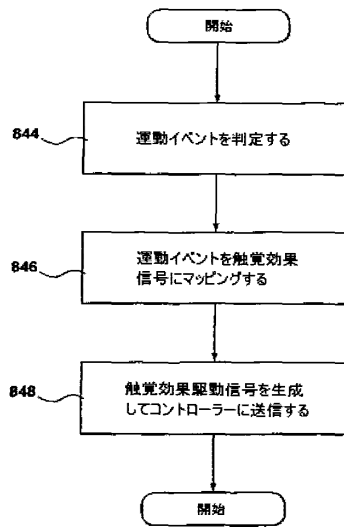
【図 6】



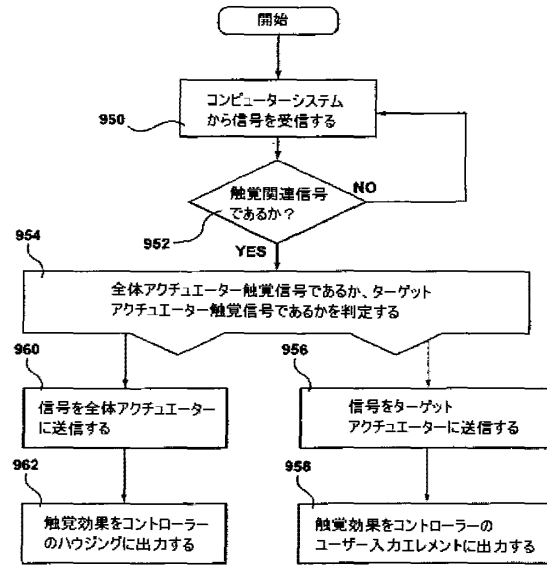
【図 7】



【図 8】



【図 9】



フロントページの続き

(74)代理人 100154162

弁理士 内田 浩輔

(74)代理人 100182257

弁理士 川内 英主

(72)発明者 ダニー エー, グラント

カナダ エイチ7エム 2エー1, ケベック シティ, ラヴァル, ドゥ ルネブルグ 1 7 8 4

(72)発明者 アーロン カペラス

カナダ エイチ2ヴィ 1ゼット7, ケベック, モントリオール, コート セント キャサリン
1 9 ナンバー1 6

Fターム(参考) 2C001 CA01

5E555 AA08 AA76 BA02 BA04 BA05 BA06 BA20 BB02 BB04 BB05

BB06 BB20 BC01 CA02 CA06 CA17 CA45 DA24 FA30

【外国語明細書】

[Title of The Invention]

GAMING DEVICE HAVING A HAPTIC-ENABLED TRIGGER

[Technical Field]

[0001] The invention relates to devices with targeted actuators coupled to user input elements such that the haptic effect is directed to the user input elements.

CROSS-REFERENCE TO RELATED APPLICATIONS

[0002] This application claims the benefit of U.S. Provisional Patent Application Serial No. 61/814,628, filed April 22, 2013, which is hereby incorporated by reference in its entirety for all purposes.

[Background Art]

[0003] Video games and video game systems have become even more popular due to the marketing toward, and resulting participation from, casual gamers. Conventional video game devices or controllers use visual and auditory cues to provide feedback to a user. In some interface devices, kinesthetic feedback (such as active and resistive force feedback) and/or tactile feedback (such as vibration, texture, and heat) is also provided to the user, more generally known collectively as “haptic feedback” or “haptic effects”. Haptic feedback can provide cues that enhance and simplify the user interface. Specifically, vibration effects, or vibrotactile haptic effects, may be useful in providing cues to users of electronic devices to alert the user to specific events, or provide realistic feedback to create greater sensory immersion within a simulated or virtual environment.

[0004] Other devices, such as medical devices, automotive controls, remote controls, and other similar devices wherein a user interacts with a user input elements to cause an action also benefit from haptic feedback or haptic effects. For example, and not by way of limitation, user input elements on medical devices may be operated by a user outside the body of a patient at a proximal portion of a medical device to cause an action within the patient’s body at a distal end of the medical device. Haptic feedback or haptic effects may be employed devices to alert the

user to specific events, or provide realistic feedback to user regarding interaction of the medical device with the patient at the distal end of the medical device.

[0005] Conventional haptic feedback systems for gaming and other devices generally include one or more actuators attached to the housing of the controller for generating the haptic feedback. However, these conventional haptic feedback systems create a haptic sensation along the entire body of the controller. Such a device does not provide a targeted or directed haptic sensation to the user for specific actions or locations.

[0006] Embodiments hereof relate to a haptic feedback system that provides a kinesthetic haptic effect to the user input element. Further, embodiments hereof relate to a haptic feedback system which produces haptic effects to the user input element that are discernible or distinguishable from general haptic effects produced along the entire body of the device/controller.

[Summary of The Invention]

[0007] Embodiments hereof are directed to a haptic peripheral including a housing, a user input element, a position sensor coupled to the user input element, and an actuator located within the housing and coupled to the user input element. The position sensor is configured to detect a position of the user input element and is configured to send the position to a processor. The actuator is configured to receive a haptic effect drive signal from the processor and is configured to output a force in response to the haptic effect drive signal from the processor. The force is transmitted to the user input element as a kinesthetic haptic effect. The haptic peripheral may include a mechanical amplification system coupled to the actuator and configured to increase the force output by the actuator. In such an embodiment, the increased force is transmitted from the mechanical amplification system to the user input element as a kinesthetic haptic effect.

[0008] The haptic peripheral may be a game controller, tablet, phone, personal digital assistant (PDA), computer, gaming peripheral, mouse, wearable user items including an input device, or other devices which include user input elements. The housing of the haptic peripheral is adapted to be held by a user. The user input element may be a button, joystick, or trigger and is manipulated by a user to interact with a host computer. The processor may be disposed in the host computer or in the controller.

[Brief Description of the Drawings]

[0009] FIG. 1 is a schematic illustration of an embodiment of a controller.

[0010] FIG. 2 is a schematic illustration of another view of the controller of FIG. 1.

[0011] FIG. 3 is a block diagram of the controller of FIG. 1 in conjunction with a host computer and display.

[0012] FIG. 4 is a schematic illustration of a portion of the controller of FIG. 1, wherein a housing of the controller is removed to illustrate the internal components thereof.

[0013] FIG. 5 is a schematic illustration of a portion of a controller according to another embodiment hereof, wherein a housing of the controller is removed to illustrate the internal components thereof.

[0014] FIG. 6 is a schematic illustration of an embodiment of a gaming tablet.

[0015] FIG. 7 is a block diagram of the gaming table of FIG. 6.

[0016] FIG. 8 is a flow chart illustrating a method for determining and transmitting a haptic signal from a host device according to an embodiment hereof.

[0017] FIG. 9 is a flow chart illustrating a method for providing haptic effects to a user of a controller according to an embodiment hereof.

[Configuration to Work The Invention]

DETAILED DESCRIPTION OF THE INVENTION

The foregoing and other features and advantages of the invention will be apparent from the following description of embodiments hereof as illustrated in the accompanying drawings. The accompanying drawings, which are incorporated herein and form a part of the specification, further serve to explain the principles of the invention and to enable a person skilled in the pertinent art to make and use the invention. The drawings are not to scale.

[0018] Specific embodiments of the present invention are now described with reference to the figures, wherein like reference numbers indicate identical or functionally similar elements.

[0019] The following detailed description is merely exemplary in nature and is not intended to limit the invention or the application and uses of the invention. Furthermore, there is no intention to be bound by any expressed or implied theory presented in the preceding technical field, background, brief summary or the following detailed description. Furthermore, although the following description is directed to gaming devices and controllers for gaming devices, those skilled in the art would recognize that the description applies equally to other devices having user input elements.

[0020] Embodiments hereof relate to a haptic peripheral of a haptic feedback system, the haptic peripheral including a targeted actuator or motor coupled to a user input element for providing targeted or directed kinesthetic haptic effects directly to the user input element. As used herein, “kinesthetic” haptic effects includes effects in which the targeted actuator applies force to the user input element to move the user input element in directions it would be moved by the user (active or resistive force feedback), thereby resulting in kinesthetic haptic effects that are felt by the user. Kinesthetic haptic effects are distinguishable from inertial haptic effects, in which an inertial actuator outputs or creates a force that may be indirectly felt by the user, *i.e.*, the target is not moved by the actuator but the output force may be indirectly perceived or felt by the user. One haptic feedback system that provides inertial haptic effects to a user input device is disclosed in U.S. Patent Application No. 14/078,478, filed November 12, 2013 (Attorney Docket No. IMM465) by one of the same inventors as the present invention, herein incorporated by reference in its entirety. This system describes an inertial actuator attached to the user input element for providing inertial transient effects such as detents or vibrations to the user input element. In order to isolate the inertial haptic effects to a targeted region of the user input element, a vibration isolation/dampening device is utilized with the inertial actuator. Kinesthetic haptic effects as produced by embodiments hereof, however, are felt by the user because the actuator directly drives or pushes/pulls on the user input element to cause movement thereof. In addition, kinesthetic haptic effects produced on user input elements as disclosed in embodiments

hereof are discernible or distinguishable from general haptic effects, also referred to as rumble effects, produced along the entire body or housing of the haptic peripheral. The haptic peripheral may be, for example, a handheld gaming controller 100 for a gaming system as shown in FIGS. 1-2, a gaming tablet controller 600 as shown in FIG. 6, or other controllers that having user input (UI) elements such as, but not limited to, phones, personal digital assistants (PDA), tablets, computers, gaming peripherals, and other controllers for gaming systems known to those skilled in the art.

[0021] Controller 100 may be generally used with a gaming system that may be connected to a computer, mobile phone, television, or other similar device. FIGS. 1-2 illustrate different perspective views of controller 100, while FIG. 3 illustrates a block diagram of controller 100 used in a gaming system 101 that further includes a host computer 104 and a display 106. As shown in the block diagram of FIG. 3, controller 100 includes a local processor 108 which communicates with host computer 104 via a connection 105. Connection 105 may be a wired connection, a wireless connection, or other types of connections known to those skilled in the art. Controller 100 may be alternatively configured to not include local processor 108, whereby all input/output signals from controller 100 are handled and processed directly by host computer 104. Host computer 104 is coupled to display screen 106. In an embodiment, host computer 104 is a gaming device console and display screen 106 is a monitor which is coupled to the gaming device console, as known in the art. In another embodiment, as known to those skilled in the art, host computer 104 and display screen 106 may be combined into a single device.

[0022] A housing 102 of controller 100 is shaped to easily accommodate two hands gripping the device, either by a left-handed user or a right-handed user. Those skilled in the art would recognize that controller 100 is merely an exemplary embodiment of a controller of similar shape and size to many “gamepads” currently available for video game console systems, and that controllers with other configurations of user input elements, shapes, and sizes may be used, including but not limited to controllers such as a Wii™ remote or Wii™ U Controller, Sony® SixAxis™ controller or Sony® Wand controller, as well as controllers shaped as real life objects (such as tennis rackets, golf clubs, baseball bats, and the like) and other shapes.

[0023] Controller 100 includes several user input elements or manipulandums, including a joystick 110, a button 114, and a trigger 118. As used herein, user input element refers to an interface device such as a trigger, button, joystick, or the like, which is manipulated by the user to interact with host computer 104. As can be seen in FIGS. 1-2 and known to those skilled in the art, more than one of each user input element and additional user input elements may be included on controller 100. Accordingly, the present description of a trigger 118, for example, does not limit controller 100 to a single trigger. Further, the block diagram of FIG. 3 shows only one (1) of each of joystick 110, button 114, and trigger 118. However, those skilled in the art would understand that multiple joysticks, buttons, and triggers, as well as other user input elements, may be used, as described above.

[0024] As can be seen in the block diagram of FIG. 3, controller 100 includes a targeted actuator or motor to directly drive each of the user input elements thereof as well as one or more general or rumble actuators 122, 124 coupled to housing 102 in a location where a hand of the user is generally located. More particularly, joystick 110 includes a targeted actuator or motor 112 coupled thereto, button 114 includes a targeted actuator or motor 116 coupled thereto, and trigger 118 includes a targeted actuator or motor 120 coupled thereto. In addition to a plurality of targeted actuators, controller 100 includes a position sensor coupled to each of the user input elements thereof. More particularly, joystick 110 includes a position sensor 111 coupled thereto, button 114 includes a position sensor 115 coupled thereto, and trigger 118 includes a position sensor 119 coupled thereto. Local processor 108 is coupled to targeted actuators 112, 116, 120 as well as position sensors 111, 115, 119 of joystick 110, button 114, and trigger 118, respectively. As will be described in more detail herein, in response to signals received from position sensors 111, 115, 119, local processor 108 instructs targeted actuators 112, 116, 120 to provide directed or targeted kinesthetic effects directly to joystick 110, button 114, and trigger 118, respectively. Such targeted kinesthetic effects are discernible or distinguishable from general or rumble haptic effects produced by general actuators 122, 124 along the entire body of the controller. The collective haptic effects provide the user with a greater sense of immersion to the game as multiple modalities are being simultaneously engaged, *e.g.*, video, audio, and haptics.

[0025] Turning now to FIG. 4, which is a schematic illustration of a portion of controller 100 with housing 102 removed to illustrate the internal components thereof, the structural relationship between trigger 118, position sensor 119, and targeted actuator or motor 120 will be described in more detail. Although not shown, it will be understood by those of ordinary skill in the art that trigger 118, position sensor 119, and targeted actuator or motor 120 are positioned or housed within housing 102. Further, although only trigger 118 is shown in FIG. 4, those skilled in the art would understand that a similar structural relationship may be used with respect to joystick 110, position sensor 111, and targeted actuator or motor 112 as well as to button 114, position sensor 115, and targeted actuator or motor 116 in order to produce targeted or directed haptic effects to the selected user input element.

[0026] Position sensor 119 is configured to detect a position of trigger 118 and is configured to send the position to local processor 108 (not shown in FIG. 4). In the embodiment of FIG. 4, trigger 118 includes a spring element 117 housed therein that returns the trigger to a nominal position without user force applied thereto. Position sensor 119 is coupled to trigger 118 via a lever arm 126 having a hinged first end 125 and a moveable second end 127. Trigger 118 is attached to moveable second end 127 of lever arm 126, and position sensor 119 is attached to hinged first end 125 of lever arm 126. When a user moves or presses on trigger 118, spring element 117 compresses and trigger 118 rotates around or about a trigger axis T_A . Second end 127 of lever arm 126 also moves or rotates with trigger 118 and lever arm 126 rotates around or about hinged first end 125. Position sensor 119 detects a change in the rotational position of lever arm 126 and trigger 118 as a movement event, and sends the movement event to local processor 108. As will be explained in more detail herein, different trigger positions and movement events may result in different haptic effects being applied by targeted actuator or motor 120. In an embodiment, position sensor 119 is a potentiometer but may be other types of position sensors known in the art such as but not limited to optical sensors, optical encoders, hall-effect sensors, capacitive sensors, and the like. In another embodiment hereof (not shown), position sensor 119 may be coupled directly to trigger 118 without a lever arm extending therebetween.

[0027] Although position sensor 119 detects a change in the rotational position of lever arm 126 and trigger 118, it will be understood by one of ordinary skill in the art that position sensors 115,

111 coupled to button 114, joystick 110, respectively, would be configured to detect movement events of the particular user input element rather than rotational movement as shown with respect to trigger 118. For example, position sensor 115 of button 114 would be configured to detect linear motion or translation of button 114, *i.e.*, when button 114 is pressed down. Position sensor 111 of joystick 110 would be configured to detect motion of joystick 110 within one or more degrees of freedom, *i.e.*, when joystick 110 is physically moved forward, backwards, left or right.

[0028] Targeted actuator or motor 120 is coupled to trigger 118 via a rotatable shaft 128. More particularly, rotatable shaft 128 is attached to targeted actuator 120 and extends therefrom to first end 125 of lever arm 126. Rotatable shaft 128 is attached to first end 125 of lever arm 126 such that rotation of shaft 128 causes movement of lever arm 126. Targeted actuator 120 receives a haptic effect drive signal from local processor 108 (not shown in FIG. 4), the haptic effect drive signal having been generated in response to the position of trigger 118 as measured by position sensor 119. Targeted actuator 120 then outputs a haptic effect to trigger 118 in response to the haptic effect drive signal from local processor 108. More particularly, targeted actuator 120 directly drives or causes actuation or rotation of rotatable shaft 128. Rotation of rotatable shaft 128 also causes rotation and movement of lever arm 126 and trigger 118, with the movement of trigger 118 being felt by the user. Thus, actuation or rotation of rotatable shaft 128 is transferred to trigger 118.

[0029] In an embodiment hereof, targeted actuator 120 is a bidirectional motor that may push and pull trigger 118, *i.e.*, move trigger 118 in opposing directions. In addition to a motor, targeted actuator 120 may be shape memory alloys, electro-active polymers that deform in response to signals, mechanisms for changing stiffness, vibrotactile actuators, inertial actuators, piezoelectric actuators, or other types of actuating devices suitable for producing kinesthetic haptic effects directly to the user input element. In an embodiment, targeted actuator 120 is a 16 mm Maxon motor but may be other types of brushed and brushless electric DC motors known and available in the art. The stall torque of targeted actuator 120 determines the maximum amount of force that can be applied to trigger 118, with stall torque being measured as the maximum force of targeted actuator 120 from rest. Targeted actuator 120 may have a stall torque between 0.5 mNm and 40 mNm. In an embodiment hereof, targeted actuator 120 has a

stall torque of 34.5 mNm when driven at 12V or a stall torque of 14.4 mNm when driven at 5V. As will be understood by those of ordinary skill in the art, strong or high torque motors may produce relatively stronger haptic effects that may be clearly felt and differentiated from general or rumble haptic effects. In addition, high torque motors (such as a motor having a stall torque of 34.5 mNm when driven at 12V or a stall torque of 14.4 mNm when driven at 5V) may produce a wider range of haptic effects that may be clearly felt and differentiated from each other on trigger 118 without mechanical amplification. However, weak or low torque motors are generally less expensive and smaller in size. As will be explained in more detail below with respect to FIG. 5, mechanical amplification such as a gear system may be utilized with a low torque motor to produce stronger haptic effects as well as a wider range of haptic effects.

[0030] In operation, local processor 108 detects or receives trigger positions and/or movement events from position sensor 119 and sends the trigger positions and/or movement events to host computer 104. Local processor 108 then provides haptic effect drive signals to targeted actuator 120 based on high level supervisory or streaming commands from host computer 104. For example, when in operation, voltage magnitudes and durations are streamed from host computer 104 to controller 100 where information is provided to targeted actuator 120 via local processor 108. Host computer 104 may provide high level commands to local processor 108 such as the type of haptic effect to be output (e.g. vibration, jolt, detent, pop, etc.) by targeted actuator 120, whereby the local processor 108 instructs targeted actuator 120 as to particular characteristics of the haptic effect which is to be output (e.g. magnitude, frequency, duration, etc.). Local processor 108 may retrieve the type, magnitude, frequency, duration, or other characteristics of the haptic effect from a memory 109 coupled thereto (shown in the block diagram of FIG. 3).

[0031] A wide variety of kinesthetic haptic effects or sensations may be output to trigger 118. More particularly, targeted actuator 120 directly drives or pushes/pulls on trigger 118 to cause movement thereof. Targeted actuator 120 may output resistive force on trigger 118, thereby making it more difficult for a user to press down on trigger 118. Such resistive force may be variable, *i.e.*, vary according to trigger position or user actions in a video game. In an embodiment hereof, targeted actuator 120 may output a maximum resistive force which impedes all user motion in a lock-out mode of trigger 118. In another example, targeted actuator 120 may

output a detent on trigger 118 by outputting a resistive force on trigger 118 which is removed at one or more particular trigger positions or locations. As such, the detent felt by the user resembles a button click. In yet another embodiment hereof, targeted actuator 120 may output a vibration on trigger 118 by rapidly pushing and pulling trigger 118 back and forth.

[0032] In an embodiment hereof, the kinesthetic haptic effects described above are transient, short haptic effects meaning that they are only temporary and of short duration. For example, such effects may each have a duration between 10 milliseconds and 100 milliseconds. As such, targeted actuator 120 has lower power and limited output compared to actuators utilized in full kinesthetic joysticks. Full kinesthetic joysticks continuously consume power in order to provide haptic effects to the joystick. However, a controller having a targeted actuator for providing kinesthetic haptic effects directly to the user input element as described above only consumes power when the haptic effects needs to be applied or changed. Stated another way, with respect to a controller having a targeted actuator for providing transient kinesthetic haptic effects directly to the user input element according to embodiments hereof energy is only required from targeted actuator 120 when the haptic effects needs to be applied or changed as opposed to a full kinesthetic joystick in which power or energy is directly or continuously supplied to render the haptic effects relating to the joystick. As such, a controller having a targeted actuator for providing transient kinesthetic haptic effects directly to the user input element according to embodiments hereof has relatively lower power requirements, thereby reducing cost, volume, and power consumption. In addition, the size of the actuators utilized in embodiments hereof are relative smaller and less expensive than those utilized in full kinesthetic joysticks as they require less peak power to be delivered.

[0033] Exemplary applications in which targeted haptic feedback is advantageous include a first person shooter video game or a racing video game. In such video games, targeted actuator 120 may output a haptic effect such as a vibration, jolt or pop when the user hits the target in the shooter video game example or passes a milestone or marker in the racing video game example. In another example, targeted actuator 120 may output a detent at variable locations in the racing video game example or a detent as feedback for repeat firing in the shooter video game example. Texture feedback may be created with position dependent haptic algorithms such as but not limited to granular synthesis. In another example, targeted actuator 120 may be used output

haptic feedback to indicate a status of the video game such as out of ammunition, incorrect range of a weapon, which weapon is being used, and/or firing rates. In a video game in which multiple weapons may be utilized, such status indications assist a user in learning the optimal firing rate and trigger position/point for each weapon. Other examples include that targeted actuator 120 may output detents at variable trigger positions or locations, may output a programmable “feel” or resistance for each weapon, may output firing results in feedback, may output brake or throttle feedback by increasing or decreasing the applied resistance, may output texture feedback, may increase or decrease stiffness of spring 117 and therefore trigger 118, and may simulate inertia.

[0034] As previously stated, different trigger positions and movement events may result in different kinesthetic haptic effects being applied by targeted actuator 120. For example, a first position of trigger 118 results in targeted actuator 120 generating and applying a first haptic effect drive signal to trigger 118, while a second position of trigger 118 results in targeted actuator 120 generating and applying a second haptic effect drive signal to trigger 118. More particularly, depending on game actions and the position of trigger 118 as indicated by position sensor 119, local processor 108 may send a haptic effect drive signal to targeted actuator 120 to output one of a wide variety of haptic effects or sensations, including vibrations, detents, textures, jolts or pops. Further, the strength or level of the haptic effect or sensation may vary depending on the position of trigger 118 as indicated by position sensor 119.

[0035] Kinesthetic haptic effects may also vary according to user input element. For example, some shooting games include two triggers having separate or corresponding targeted actuators. A first haptic effect drive signal may be applied to a first trigger by a first targeted actuator and a second haptic effect drive signal may be applied to a second trigger by a second targeted actuator. For example, in some video games such as but not limited to Titanfall, the haptic effect drive signals for each trigger (i.e., the left trigger and the right trigger) correspond to different types of weapons that are being held by the left and right hand of the computer controlled character or object. In another example, the haptic effect drive signals for each trigger (i.e., the left trigger and the right controller) correspond to directional events happening to the left and right sides of the computer controlled character or object (i.e., a left side of the character is bumped or hit by something in the video game).

[0036] Advantageously, targeted actuator 120 provides a variety of kinesthetic haptic effects or sensations to trigger 118 that are independent of and complementary to general or rumble haptic feedback produced by general actuators 122, 124. General actuators 122, 124 are coupled to housing 102 of controller 100, and serve to provide the entire housing of controller 100 with general or rumble haptic feedback. General actuators 122, 124 are coupled to and receive control signals from processor 108 in a manner similar to targeted actuator or motor 120 in which local processor 108 provides haptic effect control signals to general actuators 122, 124 based on high level supervisory or streaming commands from host computer 104. For example, when in operation, voltage magnitudes and durations are streamed from host computer 104 to controller 100 where information is provided to general actuators 122, 124 via local processor 108. Host computer 104 may provide high level commands to local processor 108 such as the type of haptic effect to be output (e.g. vibration, jolt, detent, pop, etc.) by general actuators 122, 124, whereby the local processor 108 instructs general actuators 122, 124 as to particular characteristics of the haptic effect which is to be output (e.g. magnitude, frequency, duration, etc.).

[0037] General actuators 122, 124 may include electromagnetic motors, eccentric rotating mass (“ERM”) actuators in which an eccentric mass is moved by a motor, linear resonant actuators (“LRAs”) in which a mass attached to a spring is driven back and forth, shape memory alloys, electro-active polymers that deform in response to signals, mechanisms for changing stiffness, vibrotactile actuators, inertial actuators, piezoelectric actuators, or other suitable types of actuating devices. In one embodiment, actuators 122, 124 can be implemented as an inertial actuator to provide vibrotactile feedback to the user. In another embodiment, the actuators may use kinesthetic haptic feedback including, for example, solenoids to change the stiffness/damping of housing 202, small air bags that change size in housing 202, or shape changing materials.

[0038] As stated above, in embodiments hereof in which a low stall torque motor is utilized as a targeted actuator, mechanical amplification such as a gear system may be utilized to produce sufficient haptic effects that can be felt by the user. FIG. 5 illustrates another embodiment hereof in which a controller 500 includes a gear mechanism 530 to increase stall torque and haptic strength of a targeted actuator or motor 520. In addition to motor 520 and gear

mechanism 530, controller 500 includes trigger 518, position sensor 519, and a processor (not shown in FIG. 5) for receiving the trigger position and movement events from position sensor 519 and outputting haptic effect drive signals to motor 520. Although not shown, it will be understood by those of ordinary skill in the art that a trigger 518, position sensor 519, and targeted actuator or motor 520 are positioned or housed within a housing. Similar to FIG. 4, FIG. 5 is a schematic illustration of a portion of a controller 500 within a housing thereof removed to illustrate the internal components of the controller.

[0039] Gear mechanism 530 includes at least a first rotatable gear 532 having teeth or cogs 534 around an outer circumference thereof and a second rotatable gear 536 having teeth or cogs 538 around an outer circumference thereof. First gear 532 is coupled to motor 520 via a first rotatable shaft 529, which is attached to and extends from motor 520. Second gear 536 is coupled to a first end 525 of a lever arm 526, which is attached to trigger 518, via a second rotatable shaft 528. First gear 532 is relatively smaller than second gear 534, and teeth 534 of first gear 532 mesh with teeth 538 of second gear 536. As will be understood by those of ordinary skill in the art, gears 532, 536 produce a mechanical advantage through a gear ratio in order to change or increase the torque produced from motor 520. A high gear ratio of gear mechanism 530 result in high increases or changes in the motor stall torque, which corresponds to an increase in transmission forces from motor 520. However, high gear ratios also result in high inertia in the output of gear mechanism 530, which may reduce system response time and perception of haptic effects. Thus, various factors including cost, size, desired stall torque, desired response time, and desired strength of the haptic effects must be considered when selecting motor 520 and the corresponding gear ratio required for gear mechanism 530. In an embodiment hereof, a gear ratio between 2:1 to 28:1 is used. For example, a gear ration of 9:1 is required for a motor having 2.1 mNm stall torque. Although FIG. 5 illustrates a gear mechanism as means for mechanical amplification of a low stall torque motor, other means of mechanical amplification may be utilized such as but not limited to pulley mechanisms.

[0040] Several embodiments are specifically illustrated and/or described herein. However, it will be appreciated that modifications and variations of the disclosed embodiments are covered by the above teachings and within the purview of the appended claims without departing from

the spirit and intended scope of the invention. For example, FIGS. 1-3 illustrate a haptic peripheral which is a handheld gaming controller of similar shape and size to many “gamepads” currently available for video game console systems. However, those skilled in the art would recognize that the controller is merely an exemplary embodiment of a haptic peripheral and that haptic peripherals with other configurations, shapes, and sizes may be used. For example, FIGS. 6-7 illustrate another embodiment hereof in which the haptic peripheral is a gaming tablet controller 600 that may be used with a tablet computer 604. Tablet computer 604 may be designed specifically for gaming activities, such as is available from Razer Inc., or may be a tablet computer well known and available in the market, such as an Apple® Ipad®, Kindle® Fire®, and Samsung® Galaxy Tab®.

[0041] Gaming tablet controller 600 includes a docking portion 605 configured to receive tablet computer 604 and handles 640, 642 with user input elements disposed thereon for a user to control a game on tablet computer 604. Docking portion 605 connects gaming tablet controller 600 to tablet computer 604 such that actions by the user on handles 640, 642 such as pressing buttons, moving joysticks, pressing triggers, etc., result in actions on the game being played on tablet computer 604.

[0042] Handles 640, 642 include typical user input elements found on controllers. The user input elements will be described with respect to handle 642. However, those skilled in the art would recognize that the same or similar user input elements may be used on handle 640. In particular, handle 642 includes a joystick 610, a button 614, and a trigger 618. As can be seen in FIG. 6 and known to those skilled in the art, more than one of each of these user input elements may be included on each handle 640, 642. Further, handle 642 includes a general or rumble actuator 624 attached thereto in a location where a hand of the user is generally located for providing general or rumble haptic effects to gaming tablet controller 600 as described above with respect to general or rumble actuators 122, 124.

[0043] FIG. 7 illustrates a block diagram of the gaming tablet controller of FIG. 6 in accordance with an embodiment. As shown in FIG. 7, gaming tablet controller 600 includes a local processor 608 which communicates with tablet computer 604 via docking portion 605. Other connections, such as wired or wireless connections, may be used instead of docking

portion 605. Tablet computer 604 in this embodiment includes a display screen. Gaming tablet controller 600 may be alternatively configured to not include local processor 608, whereby all input/output signals from gaming tablet controller 600 are handled and processed directly by tablet computer 604.

[0044] Local processor 608 is coupled to joystick 610, button 614, and trigger 618, and to position sensors 611, 615, and 619 that may be coupled to joystick 610, buttons 614, and trigger 618, respectively. The block diagram of FIG. 7 shows only one (1) of each of joystick 610, button 614, and trigger 618. However, those skilled in the art would understand that multiple joysticks, buttons, and triggers, as well as other user input elements, may be used, as described above. Targeted actuators or motors 612, 616, and 620 are coupled to joystick 610, button 614, and trigger 618, respectively. Targeted actuators 612, 616, 620 and general actuators 622, 624 are also coupled to local processor 608, which provides haptic effect drive signals to the actuators 612, 616, 620, 622, 624 based on high level supervisory or streaming commands from tablet computer 604. In the streaming embodiment, the voltage magnitudes and durations are streamed to gaming tablet controller 600 where information is provided by the tablet computer 604 to the actuators. In operation, tablet computer 604 may provide high level commands to the local processor 608 such as the type of haptic effect to be output (e.g. vibration, jolt, detent, pop, etc.) by one or more selected actuators, whereby local processor 608 instructs the actuator as to particular characteristics of the haptic effect which is to be output (e.g. magnitude, frequency, duration, etc.). Local processor 608 may retrieve the type, magnitude, frequency, duration, or other characteristics of the haptic effect from a memory 609 coupled to local processor 608. The haptic effects provide the user with a greater sense of immersion to the game as multiple modalities are being simultaneously engaged, e.g., video, audio, and haptics.

[0045] FIG. 8 is a flow diagram for producing a haptic effect drive signal from the host computer system, *i.e.*, host computer 104 or tablet computer 604, according to one embodiment of the present invention. For sake of illustration, the flow diagram will be described with reference to host computer 104 and controller 100. In an embodiment, the functionality of the flow diagram of FIG. 8 is implemented by software stored in the memory of host computer 104 and executed by processor of host computer 104, and/or memory 109 of controller 100 and

executed by local processor 108 of controller 100. In other embodiments, the functionality may be performed by hardware through the use of an application specific integrated circuit (“ASIC”), a programmable gate array (“PGA”), a field programmable gate array (“FPGA”), or any combination of hardware and software.

[0046] At step 844, host computer 104 determines or detects a movement event of trigger 118. More particularly, host computer 104 determines whether a movement event has occurred based on a position signal sensed by position sensor 119 attached to trigger 118. As an example, a user may depress or press down on trigger 118 in order to fire a weapon in a shooting game example or to accelerate a car in a racing video game example. One of ordinary skill in the art would understand that movement events of trigger 118 are not limited to the examples stated above.

[0047] At step 846, host computer 104 then determines whether there is an associated haptic effect with the movement event. For example, in a shooting video game scenario, firing a weapon may have an associated haptic effect such as a vibration, jolt or pop and repeat firing may have associated haptic effects such as detents. For another example, in a racing video game scenario, accelerating or braking a car may have an associated haptic effect such as a texture change and passing a milestone or marker may have an associated haptic effect such as a vibration, jolt, pop, or detent.

[0048] In order to determine whether there is an associated haptic effect with the movement event, host computer 104 maps the movement event onto a haptic effect signal for targeted actuator 120. More particularly, host computer accesses a pre-defined mapping of movement events and haptic effects. If it is determined that the movement event has an associated haptic effect, then a haptic signal will be sent. If it is determined that the movement event does not have an associated haptic effect, then no haptic signal will be sent.

[0049] At step 848, host computer 104 sends haptic control information to controller 100 by generating and transmitting a haptic effect drive signal based on the haptic effect signal. The transmission of the haptic effect drive signal can be done either through wired or wireless communication, as previously described.

[0050] FIG. 8 illustrates one method for producing a haptic effect drive signal from the host computer system based on detection of a movement event. However, in an embodiment hereof, detection of a movement event is not required for producing a haptic effect drive signal from the host computer system. Stated another way, the host computer system may generate and transmit a haptic effect drive signal to controller 100 without detection of a movement event. For example, the host computer system may generate and transmit a haptic effect drive signal to controller 100 based on events relating to the computer controlled character or object (*i.e.*, the character's hand is bumped or hit by something in the video game and a haptic effect is output to the user input element to signify this event).

[0051] FIG. 9 is a flow diagram for receiving haptic information from a host computer system and applying a haptic effect to a controller, according to one embodiment of the present invention. In an embodiment, the functionality of the flow diagram of FIG. 9 is implemented by software stored in the memory of host component 104 and executed by the processor of host computer 104, and/or memory 109 of controller 100 and executed by local processor 108 of controller 100. In other embodiments, the functionality may be performed by hardware through the use of an application specific integrated circuit ("ASIC"), a programmable gate array ("PGA"), a field programmable gate array ("FPGA"), or any combination of hardware and software.

[0052] At step 950, the haptic peripheral receives a signal from host computer 104. Upon receiving the signal, local processor 108 then determines whether the signal is a haptic signal at step 952 or some other non-haptic related signal. If it is determined that the signal is not a haptic signal, local processor 108 continues to function without applying any haptic effect to the user and waits to receive another signal from the host computer. If it is determined that the signal is a haptic signal, local processor 108 then must determine to which component, *i.e.*, housing 102 or a user input element, the signal must be sent.

[0053] At step 954, local processor 108 must determine if the haptic related signal is a general actuator haptic signal or a targeted actuator haptic signal. If the signal calls for one of general actuators 122, 124 to provide a general or rumble haptic effect to the user, then local processor 108 will send the signal to the appropriate general actuators 122, 124 at step 960 and then the

general actuator will output the instructed haptic effect at step 962. The haptic effects that are output by the general actuator can include but are not limited to varying degrees of vibrations or other types of haptic effects. As an illustrative example, if a user is controlling a character or some other graphical object and then encounters a collision in the virtual environment, the associated haptic effect might be a vibration. In this case, local processor 108 receives a signal indicating that housing 102 of controller 100 should vibrate. As a result, local processor 108 sends the signal to the appropriate actuator 122, 124 to provide the appropriate haptic effect, which in this example is a vibration.

[0054] However, if the signal calls for one of the targeted actuators 112, 116, 120 to output a targeted haptic effect to button 110, joystick 114, trigger 118, respectively, then local processor 108 will send the signal to the targeted actuator at step 956 and then the targeted actuator will output the instructed haptic effect at step 958. The haptic effects that are output by the targeted actuator can include but are not limited to varying degrees of vibrations, varying degrees of detents, or other types of haptic effects.

[0055] In determining the type of haptic effects to be executed and provided to the user, high level haptic parameters or streaming values are generated in the software code and sent to a haptic engine (not shown) where they are processed and the appropriate voltage levels are generated for the actuators. This allows the controller to provide the appropriate haptic feedback to the user and vary the amount or type of haptic feedback through the different voltage levels that are generated for the actuators. In addition, the gaming software and the haptic software can reside on the same processor or on multiple processors.

[0056] While various embodiments according to the present invention have been described above, it should be understood that they have been presented by way of illustration and example only, and not limitation. It will be apparent to persons skilled in the relevant art that various changes in form and detail can be made therein without departing from the spirit and scope of the invention. For example, although described for use in conjunction with controllers having general or rumble actuators, it will be understood by those of ordinary skill in the art that targeted actuators or motors as described herein for outputting targeted or directed haptic effects to user input elements may be used in controllers that do not include general or rumble actuators

for outputting haptic effects to the housing of the controller. Thus, the breadth and scope of the present invention should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the appended claims and their equivalents. It will also be understood that each feature of each embodiment discussed herein, and of each reference cited herein, can be used in combination with the features of any other embodiment. All patents and publications discussed herein are incorporated by reference herein in their entirety.

1. A haptic peripheral comprising:
 - a housing;
 - a user input element;
 - a position sensor coupled to the user input element, wherein the position sensor is configured to detect a position of the user input element and is configured to send the position to a processor;
 - an actuator located within the housing and coupled to the user input element, wherein the actuator is configured to receive a haptic effect drive signal from the processor and is configured to output a force in response to the haptic effect drive signal from the processor; and
 - a mechanical amplification system coupled to the actuator and configured to increase the force output by the actuator, wherein the increased force is transmitted from the mechanical amplification system to the user input element as a kinesthetic haptic effect.
2. The haptic peripheral of claim 1, wherein user input element is selected from the group consisting of a button, a trigger, and a joystick.
3. The haptic peripheral of claim 1, wherein the processor is located within the housing of the haptic peripheral.
4. The haptic peripheral of claim 1, wherein the processor is remotely located from the housing of the haptic peripheral.
5. The haptic peripheral of claim 1, wherein the actuator is coupled to the user input element via a rotatable shaft and wherein the actuator applies the haptic effect drive signal to the user input element via rotation of the rotatable shaft.

6. The haptic peripheral of claim 1, wherein the mechanical amplification system is a gear system coupled to the actuator.
7. The haptic peripheral of claim 1, wherein the actuator is a bidirectional motor.
8. The haptic peripheral of claim 1, wherein the kinesthetic haptic effect is selected from the group consisting of a detent, a vibration, or a texture.
9. The haptic peripheral of claim 1, wherein the position sensor is rotatable about an axis and coupled to the user input element via a lever arm.
10. The haptic peripheral of claim 1, wherein the haptic effect drive signal was generated by the processor in response to the position of the user input element.
11. The haptic peripheral of claim 1, further comprising:
 - a rumble actuator coupled to the housing, wherein the rumble actuator is configured to receive a second haptic effect control signal from the processor and output a second haptic effect to the housing in response to a second haptic effect control signal received from the processor.
12. The haptic peripheral of claim 1, wherein a first position of the user input element results in the actuator generating and applying a first haptic effect drive signal to the user input element and a second position of the user input element results in the actuator generating and applying a second haptic effect drive signal to the user input element, the first position being different than the second position and the first haptic effect drive signal being different than the second haptic effect drive signal.
13. A haptic peripheral comprising:
 - a housing;
 - a trigger which is rotatable about an axis;
 - a lever arm having a hinged first end and a moveable second end, wherein the trigger is attached to the moveable second end of the lever arm;

a position sensor attached to the hinged first end of the lever arm, wherein the position sensor is configured to detect a change in the rotational position of the trigger as a movement event and is configured to send the movement event to a processor;

a bidirectional motor located within the housing, wherein the motor is configured to receive a haptic effect drive signal from the processor and is configured to output a force in response to the haptic effect drive signal from the processor; and

a rotatable shaft attached to the motor and extending therefrom to the hinged first end of the lever arm, wherein the rotatable shaft is attached to the hinged first end of the lever arm such that rotation of the rotatable shaft causes movement of the lever arm and the trigger,

wherein the force output by the motor is transmitted to the trigger via the rotatable shaft as a kinesthetic haptic effect.

14. The haptic peripheral of claim 13, further comprising a gear system disposed between the motor and the rotatable shaft, the gear system being configured to increase the force output by the motor, wherein the increased force is transmitted from the gear system to the trigger as a kinesthetic haptic effect.

15. A gaming system comprising:

a host computer;

a processor;

a controller having a housing, a user input element, a position sensor coupled to the user input element, and an actuator coupled to the user input element via a mechanical amplification system, wherein the position sensor is configured to detect a position of the user input element and send the position to the processor, the actuator is configured to receive a haptic effect drive signal from the processor and is configured to output a force in response to the haptic effect drive signal from the processor, and the mechanical amplification system is configured to increase the force output by the actuator, the increased force being transmitted from the

mechanical amplification system to the user input element as a kinesthetic haptic effect.

16. The gaming system of claim 15, wherein the host computer is a tablet computer and the controller includes a handle and a docking station adapted to receive the tablet computer therein, wherein the user input element is disposed on the handle.
17. The gaming system of claim 15, wherein the processor is disposed in the controller.
18. The gaming system of claim 15, wherein the processor is disposed in the host computer.
19. The gaming system of claim 15, wherein user input element is selected from the group consisting of a button, a trigger, and a joystick.
20. The gaming system of claim 15, wherein the controller also includes a rumble actuator coupled to the housing, wherein the rumble actuator is configured to receive a second haptic effect control signal from the processor and output a second haptic effect to the housing in response to a second haptic effect control signal received from the processor.

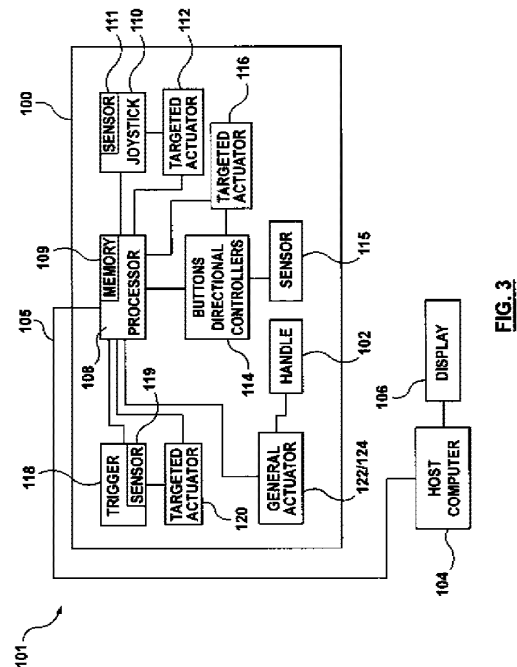
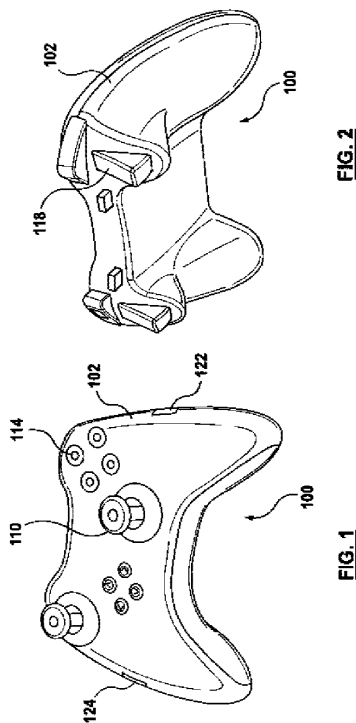
[Abstract]

An object of the invention is to provide devices with targeted actuators coupled to user input elements such that the haptic effect is directed to the user input elements.

A haptic peripheral comprises a housing, a user input element, a position sensor coupled to the user input element, and an actuator located within the housing and coupled to the user input element. The position sensor is configured to detect a position of the user input element and is configured to send the position to a processor. The actuator is configured to receive a haptic effect drive signal from the processor and is configured to output a force in response to the haptic effect drive signal from the processor. The force is transmitted to the user input element as a kinesthetic haptic effect. The haptic peripheral may include a mechanical amplification system coupled to the actuator and configured to increase the force output by the actuator. The increased force is transmitted from the mechanical amplification system to the user input element as a kinesthetic haptic effect.

[Representative Drawing]

Fig. 4



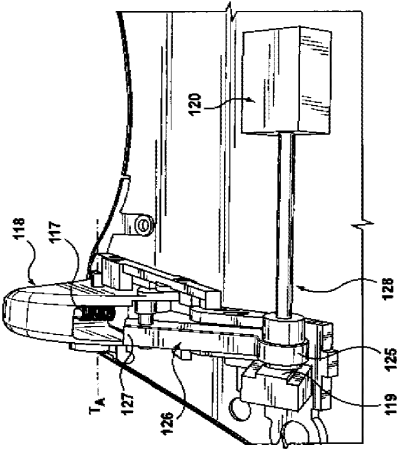


FIG. 4

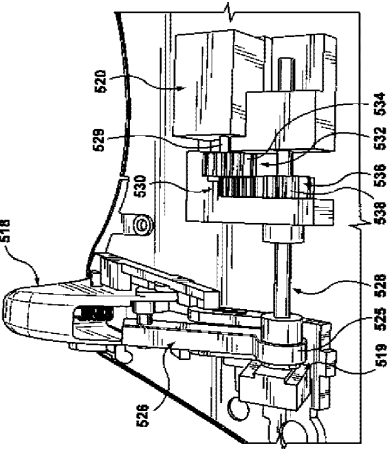


FIG. 5

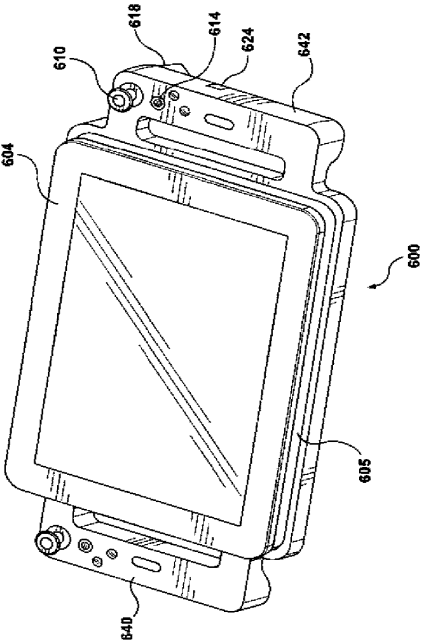


FIG. 6

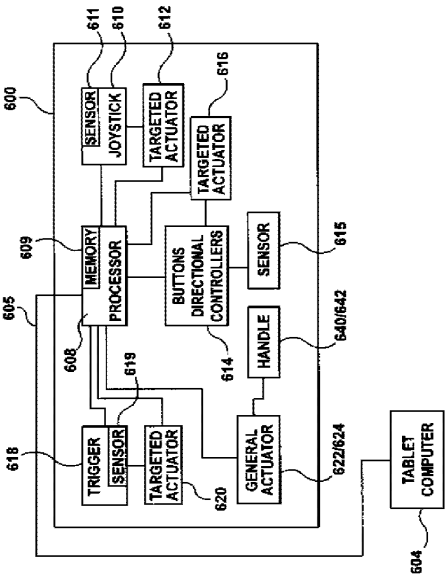


FIG. 7

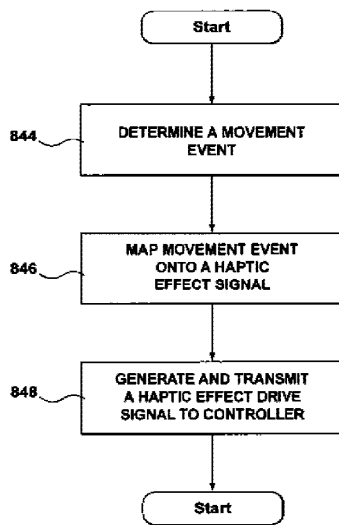


FIG. 8

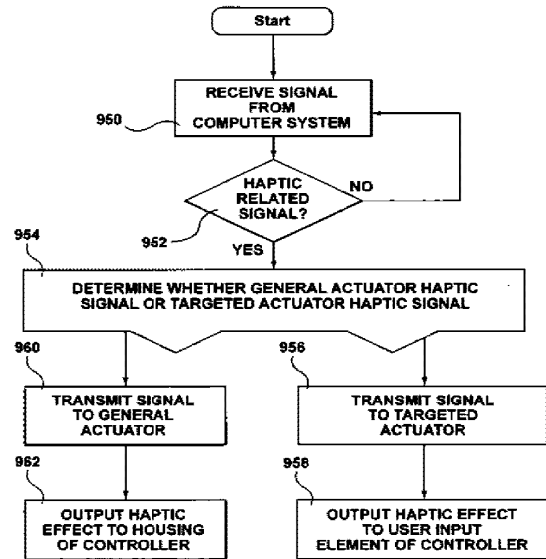


FIG. 9

Electronic Patent Application Fee Transmittal				
Application Number:		16058399		
Filing Date:		08-Aug-2018		
Title of Invention:		POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE		
First Named Inventor/Applicant Name:		Srivatsav VENKATESAN		
Filer:		Andrew Wadie Wahba/Hilary Shannon		
Attorney Docket Number:		T9047-22090US02; IMM631C1		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
Total in USD (\$)				240

Electronic Acknowledgement Receipt	
EFS ID:	37060263
Application Number:	16058399
International Application Number:	
Confirmation Number:	2869
Title of Invention:	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
First Named Inventor/Applicant Name:	Srivatsav VENKATESAN
Customer Number:	95000
Filer:	Andrew Wadie Wahba/Hilary Shannon
Filer Authorized By:	Andrew Wadie Wahba
Attorney Docket Number:	T9047-22090US02; IMM631C1
Receipt Date:	04-SEP-2019
Filing Date:	08-AUG-2018
Time Stamp:	14:49:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$240
RAM confirmation Number	E201994E50000659
Deposit Account	501165
Authorized User	Hilary Shannon
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)
 37 CFR 1.20 (Post Issuance fees)
 37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	T9047-22090US02-IDS.pdf	1034850	no	4
			d0d072b656a09fae8b19c48531934684c526461b		
Warnings:					
Information:					
2	Foreign Reference	JP2008015679A.pdf	1059575	no	24
			62626368cec761cd9a18e8e0381eeea4aeb1468a		
Warnings:					
Information:					
3	Foreign Reference	JP2014215850A.pdf	706807	no	14
			6ce6eaa971c756b4645256e4c276ee0d1689e680		
Warnings:					
Information:					
4	Foreign Reference	JP2014216017A.pdf	1991561	no	47
			79c00b553f5cb04c8e39c776c8c85a0b1ccc4107		
Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	30759	no	2
			04f0dd443f125c385a3ba70bc603f9b99737cab3		
Warnings:					
Information:					
Total Files Size (in bytes):			4823552		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/058,399	08/08/2018	Srivatsav VENKATESAN	T9047-22090US02; IMM631C1	2869
95000	7590	09/12/2019	EXAMINER	
MILES & STOCKBRIDGE P.C. Immersion Corporation 1751 Pinnacle Drive Suite 1500 Tysons Corner, VA 22102-3833			D'AGOSTINO, PAUL ANTHONY	
			ART UNIT	PAPER NUMBER
			3715	
			NOTIFICATION DATE	DELIVERY MODE
			09/12/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

lpdocketing@MilesStockbridge.com
awahba@milesstockbridge.com
eofficeaction@appcoll.com

Office Action Summary

Application No. 16/058,399	Applicant(s) VENKATESAN et al.	
Examiner PAUL A D'AGOSTINO	Art Unit 3715	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on 8/30/2019.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.

2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.

3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☒ Claim(s) 1-20 is/are pending in the application.
5a) Of the above claim(s) ____ is/are withdrawn from consideration.

6) ☐ Claim(s) ____ is/are allowed.

7) ☒ Claim(s) 1,8 and 15 is/are rejected.

8) ☒ Claim(s) 2-7,9-14 and 16-20 is/are objected to.

9) ☐ Claim(s) ____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10) ☐ The specification is objected to by the Examiner.

11) ☒ The drawing(s) filed on 8/30/19 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some** c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. ____.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date ____.

3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date ____.

4) ☐ Other: ____.

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA. This supersedes the Non-Final Rejection mailed on 7/25/2019.

Double Patenting

2. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

3. A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP §§ 706.02(l)(1) - 706.02(l)(3) for applications not subject to examination under the

first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

4. The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

5. Claims 1, 8, and 15 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1 and 7 of U.S. Patent No.10,073,523. Although the claims at issue are not identical, they are not patentably distinct from each other because the instant claims are anticipated by the granted species claims as demonstrated in the table below for Claim 1, as representative of Claims 8 and 15.

U.S. Pat. No. 10,073,523	U.S. Pat. Pub. No. 16/058,399
1. A method for rendering a haptic effect at a trigger user input element, the trigger user input element configured to move in a rotational direction and associated with a haptic output device, the method comprising: defining a primary range and a secondary range of positions for the trigger user input element; defining a boundary range of positions for the trigger user input element, the boundary range partially overlapping each of the primary range and the secondary range; monitoring a rotary position of the trigger user input element; scaling the primary range, secondary range, and boundary range of positions; and	1. A method for controlling a user input element associated with a haptic output device, the method comprising: defining position and range information for the user input element associated with the haptic output device, including a primary range of positions, a secondary range of positions, and a boundary range of positions, wherein the boundary range of positions partially overlaps each of the primary range of positions and the secondary range of positions; and

rendering the haptic effect in response to an entry of the trigger user input element to positions within the boundary range.	rendering a haptic effect in response to an entry of the user input element to one or more positions within the boundary range of positions.
---	--

Allowable Subject Matter

6. Claims 2-7, 9-14, and 16-20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
7. The following is a statement of reasons for the indication of allowable subject matter:

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure is in the Notice of References Cited.
9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Paul A. D'Agostino whose telephone number is (571) 270-1992.
10. Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.
11. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dmitry Suhol can be reached on (571) 272-4430. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.
12. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private

PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/PAUL A D'AGOSTINO/
Primary Examiner, Art Unit 3715

<i>Notice of References Cited</i>	Application/Control No. 16/058,399		Applicant(s)/Patent Under Reexamination VENKATESAN et al.	
	Examiner PAUL A D'AGOSTINO		Art Unit 3715	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-6020876-A	02-2000	Rosenberg; Louis B.	G06F3/011	345/157
*	B	US-20110260990-A1	10-2011	Ali; Yassir	G06F3/016	345/173
*	C	US-20060290662-A1	12-2006	Houston; John	A63F13/06	345/156
*	D	US-6184868-B1	02-2001	Shahoian; Erik J.	A63F13/06	345/161
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<i>Search Notes</i> 	Application/Control No. 16/058,399	Applicant(s)/Patent Under Reexamination VENKATESAN et al.
	Examiner PAUL A D'AGOSTINO	Art Unit 3715

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
see east search history	07/21/2019	pd
see search history	09/08/2019	pd

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

--	--

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	171418	(G07F17/\$\$ or A63F13/\$\$).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/06 08:35
S2	652273	(G06F17/\$\$ or A63F13/\$\$).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/06 08:35
S3	171418	(G07F17/\$\$ or A63F13/\$\$).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/06 08:44
S4	321	"6020876"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:23
S5	4	"6020876".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:23
S6	2	controller and haptic with actuator with (ID identifier) and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:34
S7	0	(A63F13/\$\$ or G07F17/\$\$).cpc. and controller and haptic with actuator with (ID identifier) and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:39
S8	16	(A63F13/\$\$ or G07F17/\$\$).cpc. and controller and haptic with actuator and (ID identifier) and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:39
S9	10	(A63F13/\$\$ or G07F17/\$\$).cpc. and controller and haptic same (ID identifier) and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:41
S10	1	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic.ti. and signal same (ID identifier) and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:43

S11	130	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic.ti. and actuator and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:44
S12	5	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic.ti. and actuator same identif\$4 and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:45
S13	0	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic.ti. same packet and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 21:28
S14	9	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic same packet and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 21:28
S15	17	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic same clock and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 22:01
S16	10983	haptic and range and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 23:07
S17	5994	controller and haptic and range and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 23:08
S18	123	controller and haptic and boundary with range and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 23:08
S19	19	controller and haptic same boundary with range and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 23:09
S20	121	"463".clas. and haptic with (joystick)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2018/01/08 13:06
S21	73	"463".clas. and haptic with (joystick) and @py<"2012"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2018/01/08 13:06
S24	18	("20050156892" "20060142657" "20060290662" "20110118032" "20110260990" "20140043228" "20140315642" "20150130706" "6020876" "6184868"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	OFF	2019/07/21 18:17

EAST Search History

		"7490530").PN.				
--	--	----------------	--	--	--	--

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S22	8	(haptic effect trigger first second range positions).clm.	US-PGPUB; USPAT	AND	ON	2018/04/15 10:19
S23	2	(haptic effect trigger first scal\$4 second range positions).clm.	US-PGPUB; USPAT	AND	ON	2018/04/15 10:20

9/ 8/ 2019 4:17:54 PM

C:\Users\pdagostino\Documents\EAST\Workspaces\16058399.wsp

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)

Approved for use through 11/30/2020. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16058399
	Filing Date	2018-08-08
	First Named Inventor	Srivatsav VENKATESAN et al.
	Art Unit	3715
	Examiner Name	Paul Anthony D'AGOSTINO
	Attorney Docket Number	T9047-22090US02; IMM631C1

U.S. PATENTS							Remove	
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
	1	8622833	B2	2014-01-07	Kake	corresponds to JP2008015679		
	2	9778743	B2	2017-10-03	Grant et al.	corresponds to JP2014216017		
If you wish to add additional U.S. Patent citation information please click the Add button.							Add	
U.S. PATENT APPLICATION PUBLICATIONS							Remove	
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
	1	20140320406	A1	2014-10-30	NISHIZAWA	corresponds to JP2014215850		
If you wish to add additional U.S. Published Application citation information please click the Add button.							Add	
FOREIGN PATENT DOCUMENTS							Remove	
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²ⁱ	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	2008015679	JP	A	2008-01-24	Sony Computer Entertainment Inc	corresponds to U.S. Patent No. 8,622,833	
	2	2014215850	JP	A	2014-11-17	Yamaha Corp	corresponds to U.S. Patent Publication No. 2014/0320406	

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16058399
Filing Date	2018-08-08
First Named Inventor	Srivatsav VENKATESAN et al.
Art Unit	3715
Examiner Name	Paul Anthony D'AGOSTINO
Attorney Docket Number	T9047-22090US02; IMM631C1

3	2014216017	JP	A	2014-11-17	Immersion Corp	corresponds to U.S. Patent No. 9,778,743
---	------------	----	---	------------	----------------	---

If you wish to add additional Foreign Patent Document citation information please click the Add button

Add

NON-PATENT LITERATURE DOCUMENTS

Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1		

If you wish to add additional non-patent literature document citation information please click the Add button

Add

EXAMINER SIGNATURE

Examiner Signature	/PAUL A D'AGOSTINO/	Date Considered	09/08/2019
--------------------	---------------------	-----------------	------------

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16058399
Filing Date	2018-08-08
First Named Inventor	Srivatsav VENKATESAN et al.
Art Unit	3715
Examiner Name	Paul Anthony D'AGOSTINO
Attorney Docket Number	T9047-22090US02; IMM631C1

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Andrew W. Wahba/	Date (YYYY-MM-DD)	2019-09-04
Name/Print	Andrew W. Wahba	Registration Number	73,661

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /P.A.D/

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Immersion Corporation
Application No./Patent No.: 16/058,399 Filed/Issue Date: August 8, 2018
Titled: POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
Immersion Corporation, a corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☒ The assignee of the entire right, title, and interest.
2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):
- ☐ The extent (by percentage) of its ownership interest is ____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.
- ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (e.g., bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

- A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 046587, Frame 0109, or for which a copy thereof is attached.

- B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

[Page 1 of 2]

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☒ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Teresa U. Medler/

November 7, 2019

Signature

Date

Teresa U. Medler

44,933

Printed or Typed Name

Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:



Practitioners associated with Customer Number:

99292

OR



Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number

Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:



The address associated with Customer Number:

99292

OR

☐	Firm or Individual Name			
	Address			
	City	State	Zip	
	Country			
	Telephone	Email		

Assignee Name and Address: Immersion Corporation
50 Rio Robles
San Jose, CA 95134

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	12/17/15
Name	Catherine C. Maresh	Telephone	408.350.8755
Title	Senior IP Counsel		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt	
EFS ID:	37686080
Application Number:	16058399
International Application Number:	
Confirmation Number:	2869
Title of Invention:	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
First Named Inventor/Applicant Name:	Srivatsav VENKATESAN
Customer Number:	95000
Filer:	Teresa U. Medler/Melissa Satorre
Filer Authorized By:	Teresa U. Medler
Attorney Docket Number:	T9047-22090US02; IMM631C1
Receipt Date:	07-NOV-2019
Filing Date:	08-AUG-2018
Time Stamp:	16:25:34
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment		no			
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	IMM631C1_STMT.pdf	118437	no	3
			b131a85a9cd94f5ab8464a4fadf7a45858980e9		
Warnings:					

Information:					
2	Power of Attorney	IMMPoA.pdf	190687	no	1
			fbcc6819ed140a06cdec91b979f9b36214750928e		
Warnings:					
Information:					
Total Files Size (in bytes):			309124		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/058,399	08/08/2018	Srivatsav VENKATESAN	T9047-22090US02; IMM631C1

CONFIRMATION NO. 2869

POWER OF ATTORNEY NOTICE



95000
MILES & STOCKBRIDGE P.C.
Immersion Corporation
1751 Pinnacle Drive
Suite 1500
Tysons Corner, VA 22102-3833

Date Mailed: 11/13/2019

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 11/07/2019.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/hsarwari/



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/058,399	08/08/2018	Srivatsav VENKATESAN	T9047-22090US02; IMM631C1

CONFIRMATION NO. 2869

POA ACCEPTANCE LETTER

99292

Medler Ferro Woodhouse & Mills/Immersion
8201 Greensboro Drive, Suite 1060
McLean, VA 22102



Date Mailed: 11/13/2019

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 11/07/2019.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/hsarwari/

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/058,399		Filing Date 08/08/2018		☐ To be Mailed		
ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO										
APPLICATION AS FILED - PART I										
		(Column 1)	(Column 2)							
FOR		NUMBER FILED	NUMBER EXTRA	RATE (\$)		FEE (\$)				
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A	N/A	N/A						
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))		N/A	N/A	N/A						
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A	N/A	N/A						
TOTAL CLAIMS (37 CFR 1.16(j))		minus 20 =	*	x \$100 =						
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 =	*	x \$460 =						
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).								
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL						
APPLICATION AS AMENDED - PART II										
		(Column 1)	(Column 2)	(Column 3)						
AMENDMENT	12/12/2019	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	x \$100 =		0		
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0	x \$460 =		0		
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
					TOTAL ADD'L FEE		0			
AMENDMENT		(Column 1)	(Column 2)	(Column 3)						
		CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(i))	*	Minus	**	=	x \$0 =				
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x \$0 =				
	☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
					TOTAL ADD'L FEE					
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.					LIE					
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".					/Ruby Johnson/					
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".										
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.										

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed		PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce	
Electronic Petition Request	TERMINAL DISCLAIMER TO OBTAIN A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT		
Application Number	16058399		
Filing Date	08-Aug-2018		
First Named Inventor	Srivatsav VENKATESAN		
Attorney Docket Number	T9047-22090US02; IMM631C1		
Title of Invention	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE		
☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action ☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.			
Owner		Percent Interest	
IMMERSION CORPORATION		100%	
The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s) 10073523 as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns. In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later: - expires for failure to pay a maintenance fee; - is held unenforceable; - is found invalid by a court of competent jurisdiction; - is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321; - has all claims canceled by a reexamination certificate; - is reissued; or - is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer. ☒ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.			

☐ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.	
Applicant claims the following fee status: ☐ Small Entity ☐ Micro Entity ☒ Regular Undiscounted	
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.	
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES I certify, in accordance with 37 CFR 1.4(d)(4) that I am: ☒ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application Registration Number <u>58508</u> ☐ A sole inventor ☐ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application ☐ A joint inventor; all of whom are signing this request	
Signature	/Jun S. Ha/
Name	Jun S. HA

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
 Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal				
Application Number:		16058399		
Filing Date:		08-Aug-2018		
Title of Invention:		POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE		
First Named Inventor/Applicant Name:		Srivatsav VENKATESAN		
Filer:		Jun Sang Ha/Derya SEVINC		
Attorney Docket Number:		T9047-22090US02; IMM631C1		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	160	160
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				160

Doc Code: DISQ.E.FILE

Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 16058399

Filing Date: 08-Aug-2018

Applicant/Patent under Reexamination: VENKATESAN

Electronic Terminal Disclaimer filed on December 12, 2019

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt	
EFS ID:	37998016
Application Number:	16058399
International Application Number:	
Confirmation Number:	2869
Title of Invention:	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
First Named Inventor/Applicant Name:	Srivatsav VENKATESAN
Customer Number:	99292
Filer:	Jun Sang Ha/Derya SEVINC
Filer Authorized By:	Jun Sang Ha
Attorney Docket Number:	T9047-22090US02; IMM631C1
Receipt Date:	12-DEC-2019
Filing Date:	08-AUG-2018
Time Stamp:	12:37:46
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$160
RAM confirmation Number	E2019BBC37433279
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Terminal Disclaimer-Filed (Electronic)	eTerminal-Disclaimer.pdf	33600	no	2
			f6030618dd1e1b4693929cb64ed1351c6f290a76		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30391	no	2
			f5fb38376db024112203969b04dd92560edf3592		
Warnings:					
Information:					
Total Files Size (in bytes):			63991		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No. : 16/058,399
Confirmation No. : 2869
Applicant : IMMERSION CORPORATION
Inventors : Srivatsav VENKATESAN, *et al.*
Filing Date : August 8, 2018
TC/A.U. : 3715
Examiner : Paul Anthony D'AGOSTINO

Docket No. : IMM631C1
Customer No. : 99292
Title : **POSITION CONTROL OF A USER INPUT ELEMENT
ASSOCIATED WITH A HAPTIC OUTPUT DEVICE**

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REPLY UNDER 37 C.F.R § 1.111

Commissioner:

In response to the Non-Final Office Action mailed September 12, 2019, Applicant submits the following amendments and remarks.

Amendments to the Claims are reflected in the listing of claims which begins on page two (2) of this paper.

Remarks/Arguments begin on page six (6) of this paper.

This Reply is being filed before the three-month date of December 12, 2019. The Reply is therefore timely.

It is not believed that extensions of time are required beyond those that may otherwise be provided for in documents accompanying this paper. However, if additional extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 C.F.R. § 1.136(a), and any fees required therefor (including fees for net addition of claims) are hereby authorized to be charged to our Deposit Account No. 60-1939.

Electronic Acknowledgement Receipt	
EFS ID:	37998162
Application Number:	16058399
International Application Number:	
Confirmation Number:	2869
Title of Invention:	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
First Named Inventor/Applicant Name:	Srivatsav VENKATESAN
Customer Number:	99292
Filer:	Jun Sang Ha/Derya SEVINC
Filer Authorized By:	Jun Sang Ha
Attorney Docket Number:	T9047-22090US02; IMM631C1
Receipt Date:	12-DEC-2019
Filing Date:	08-AUG-2018
Time Stamp:	12:39:01
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment		no			
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		IMM631C1_RespondetoNFOAd ated12Sept2019asfiled.pdf	129004	yes	7
			092c663758f89940024777d82ba23f95602 ba7c7		

Multipart Description/PDF files in .zip description			
	Document Description	Start	End
	Applicant Arguments/Remarks Made in an Amendment	6	7
	Claims	2	5
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Warnings:			
Information:			
Total Files Size (in bytes):		129004	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.			

REMARKS

Reconsideration of this Application is respectfully requested. Upon entry of the foregoing amendment, claims 1-20 are pending in the application, with claims 1, 8, and 15 being the independent claims. Claims 8 and 15 are amended to correct drafting errors identified therein. No new matter has been added.

Double Patenting

Claims 1, 8, and 15 are rejected on the ground of nonstatutory double patenting as allegedly being unpatentable over claims 1 and 7 of U.S. Patent No. 10,073,523. NFOA, pp. 3-4.

While not conceding the appropriateness of the Examiner's rejection, but merely to advance prosecution of the present application, the Applicant is herewith submitting a Terminal Disclaimer disclaiming the terminal portion of any patent granted on the present application which would extend beyond the expiration of U.S. Patent No. 10,073,523.

Accordingly, withdrawal of the rejection and allowance of claims 1, 8, and 15 are respectfully requested.

Allowable Subject Matter

Claims 2-7, 9-14, and 16-20 are objected to as allegedly being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. NFOA, p. 4.

The Applicant thanks the Examiner for indicating the allowable subject matter. The Applicant believes that independent claims 1, 8, and 15 are allowable at least for the reasons stated above, where each of claims 2-7, 9-14, and 16-20 depend from a respective one of independent claims 1, 8, 15. Accordingly, withdrawal of the objection and allowance of claims 2-7, 9-14, and 16-20 are respectfully requested.

Conclusion

The Commissioner is hereby authorized to charge any additional fees which may be required under 37 C.F.R. § 1.17, or credit any overpayment, to Deposit Account No. 60-1939. If

U.S. Appl. No. 16/058,399
Response Filed: December 12, 2019
Response to Non-Final Office Action dated 12 Sept. 2019

the Examiner feels that a telephone conference would in any way expedite the prosecution of the application, please do not hesitate to call the undersigned at 703-712-8526.

Respectfully submitted,

/Jun S. HA/

Jun S. HA

Registration No. 58,508

Attorney for Applicant

Date: December 12, 2019

MEDLER FERRO WOODHOUSE & MILLS

8201 Greensboro Drive, Suite 1060

McLean, VA 22102

4844-8533-0350, v. 2

Amendment to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (previously presented) A method for controlling a user input element associated with a haptic output device, the method comprising:
defining position and range information for the user input element associated with the haptic output device, including a primary range of positions, a secondary range of positions, and a boundary range of positions, wherein the boundary range of positions partially overlaps each of the primary range of positions and the secondary range of positions; and
rendering a haptic effect in response to an entry of the user input element to one or more positions within the boundary range of positions.
2. (previously presented) The method of claim 1, wherein one of the primary range of positions, the secondary range of positions, and the boundary range of positions is calculated based on a movement of the user input element from a maximum out position to a grounding position.
3. (previously presented) The method of claim 1, wherein a profile for the user input element is calculated by mapping each position of the user input element to an analog to digital conversion value.
4. (previously presented) The method of claim 3, wherein the profile for the user input element is an increasing profile or a decreasing profile.
5. (previously presented) The method of claim 1, wherein a normalized profile for the user input element is calculated by removing at least one of the secondary range of positions or the boundary range of positions from mapped analog to digital conversion values.
6. (previously presented) The method of claim 1, further comprising monitoring a position

of the user input element.

7. (previously presented) The method of claim 1, further comprising adjusting a profile and a normalized profile of the user input element to adjust for a change to a resting position of the user input element.

8. (currently amended) A non-transitory computer readable storage medium storing a program configured to be executed by a processor, the program comprising instructions for:

defining position and range information for a user input element associated with the haptic output device, including a primary range of positions, a secondary range of positions, and a boundary range of positions, wherein the boundary range of positions partially overlaps each of the primary range of positions and the secondary range of positions; and

rendering a haptic effect in response to an entry of the user input element to one or more positions within the boundary range of positions.

9. (previously presented) The non-transitory computer readable storage medium of claim 8, wherein one of the primary range of positions, the secondary range of positions, and the boundary range of positions is calculated based on a movement of the user input element from a maximum out position to a grounding position.

10. (previously presented) The non-transitory computer readable storage medium of claim 8, wherein a profile for the user input element is calculated by mapping each position of the user input element to an analog to digital conversion value.

11. (previously presented) The non-transitory computer readable storage medium of claim 10, wherein the profile for the user input element is an increasing profile or a decreasing profile.

12. (previously presented) The non-transitory computer readable storage medium of claim 8, wherein a normalized profile for the user input element is calculated by removing at least

one of the secondary range of positions or the boundary range of positions from mapped analog to digital conversion values.

13. (previously presented) The non-transitory computer readable storage medium of claim 8, further comprising instructions for monitoring a position of the user input element.

14. (previously presented) The non-transitory computer readable storage medium of claim 13, further comprising instructions for adjusting a profile and a normalized profile of the user input element to adjust for a change to a resting position of the user input element.

15. (currently amended) A device comprising:

a processor; and

a memory storing a program for execution by the processor, the program including instructions for:

defining position and range information for a user input element associated with the haptic output device, including a primary range of positions, a secondary range of positions, and a boundary range of positions, wherein the boundary range of positions partially overlaps each of the primary range of positions and the secondary range of positions; and

rendering a haptic effect in response to an entry of the user input element to one or more positions within the boundary range of positions.

16. (previously presented) The device of claim 15, wherein one of the primary range of positions, the secondary range of positions, and the boundary range of positions is calculated based on a movement of the user input element from a maximum out position to a grounding position.

17. (previously presented) The device of claim 15, wherein a profile for the user input element is calculated by mapping each position of the user input element to an analog to digital conversion value.

18. (previously presented) The device of claim 15, wherein a normalized profile for

the user input element is calculated by removing at least one of the secondary range of positions or the boundary range of positions from mapped analog to digital conversion values.

19. (previously presented) The device of claim 15, further comprising instructions for monitoring a position of the user input element.

20. (previously presented) The device of claim 19, further comprising instructions for adjusting a profile and a normalized profile of the user input element to adjust for a change to a resting position of the user input element.

Organization United States Patent and Trademark Office
Bldg/Room P.O. Box 1450
Alexandria, VA 22313-1450
If Undeliverable Return in Ten Days

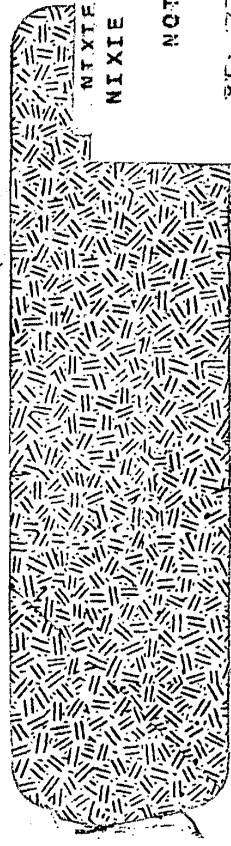
OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, \$300

AN EQUAL OPPORTUNITY EMPLOYER

TX 757
PM 51

RETURN
FOR
POSTAGE

RECEIVED
DEC 30 2019
USPTO MAIL CENTER

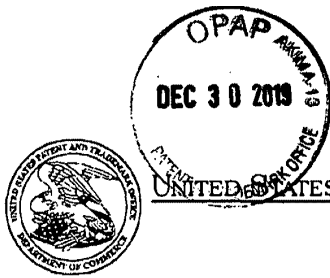


207 5E 1 8612/05/19
207 7E 1 8612/22/19

RETURN TO SENDER
NOT DELIVERABLE AS ADDRESSED
UNABLE TO FORWARD

BC: 22313145050 21892-01321-12-41

22313145050



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/058,399	08/08/2018	Srivatsav VENKATESAN	T9047-22090US02; IMM631C1

CONFIRMATION NO. 2869

POWER OF ATTORNEY NOTICE



95000
MILES & STOCKBRIDGE P.C.
Immersion Corporation
1751 Pinnacle Drive
Suite 1500
Tysons Corner, VA 22102-3833

Date Mailed: 11/13/2019

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 11/07/2019.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/hsarwari/



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

99292 7590 01/15/2020
Medler Ferro Woodhouse & Mills/Immersion
8201 Greensboro Drive, Suite 1060
McLean, VA 22102

EXAMINER

D'AGOSTINO, PAUL ANTHONY

ART UNIT

PAPER NUMBER

3715

DATE MAILED: 01/15/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/058,399	08/08/2018	Srivatsav VENKATESAN	T9047-22090US02; IMM631C1	2869

TITLE OF INVENTION: POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	04/15/2020

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

99292 7590 01/15/2020
Medler Ferro Woodhouse & Mills/Immersion
8201 Greensboro Drive, Suite 1060
McLean, VA 22102

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/058,399	08/08/2018	Srivatsav VENKATESAN	T9047-22090US02; IMM631C1	2869

TITLE OF INVENTION: POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	04/15/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
D'AGOSTINO, PAUL ANTHONY	3715	463-037000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/058,399	08/08/2018	Srivatsav VENKATESAN	T9047-22090US02; IMM4631C1	2869
99292	7590	01/15/2020	EXAMINER	
Medler Ferro Woodhouse & Mills/Immersion 8201 Greensboro Drive, Suite 1060 McLean, VA 22102			D'AGOSTINO, PAUL ANTHONY	
			ART UNIT	PAPER NUMBER
			3715	
DATE MAILED: 01/15/2020				

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.** Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/058,399	Applicant(s) VENKATESAN et al.	
	Examiner PAUL A D'AGOSTINO	Art Unit 3715	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 12/12/2019.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 1-20 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
Certified copies:
a) ☐ All b) ☐ Some *c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

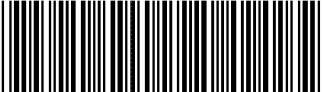
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)	5. ☐ Examiner's Amendment/Comment
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.	6. ☐ Examiner's Statement of Reasons for Allowance
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.	7. ☐ Other _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____.	

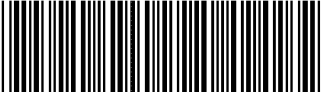
/PAUL A D'AGOSTINO/ Primary Examiner, Art Unit 3715	
--	--

Issue Classification 	Application/Control No. 16/058,399	Applicant(s)/Patent Under Reexamination VENKATESAN et al.
	Examiner PAUL A D'AGOSTINO	Art Unit 3715

CPC						
Symbol					Type	Version
G06F	/	3	/	016	F	2013-01-01
A63F	/	13	/	285	I	2014-09-02
A63F	/	13	/	23	I	2014-09-02
A63F	/	13	/	42	I	2014-09-02
A63F	/	13	/	218	I	2014-09-02

CPC Combination Sets					
Symbol				Type	Version
/		/			

NONE (Assistant Examiner)		Total Claims Allowed: 20	
/PAUL A D'AGOSTINO/ Primary Examiner, Art Unit 3715 (Primary Examiner)		30 December 2019 (Date)	O.G. Print Claim(s) 1
			O.G. Print Figure 1

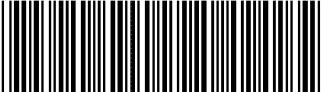
Issue Classification 	Application/Control No. 16/058,399	Applicant(s)/Patent Under Reexamination VENKATESAN et al.
	Examiner PAUL A D'AGOSTINO	Art Unit 3715

INTERNATIONAL CLASSIFICATION			
CLAIMED			
A63F		13	00
NON-CLAIMED			

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE (Assistant Examiner)		Total Claims Allowed: 20	
/PAUL A D'AGOSTINO/ Primary Examiner, Art Unit 3715 (Primary Examiner)		30 December 2019 (Date)	O.G. Print Claim(s) 1
			O.G. Print Figure 1

Issue Classification 	Application/Control No. 16/058,399	Applicant(s)/Patent Under Reexamination VENKATESAN et al.
	Examiner PAUL A D'AGOSTINO	Art Unit 3715

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
CLAIMS															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 20	
/PAUL A D'AGOSTINO/ Primary Examiner, Art Unit 3715 (Primary Examiner) _____ (Date) 30 December 2019		O.G. Print Claim(s) 1	O.G. Print Figure 1

<i>Search Notes</i> 	Application/Control No. 16/058,399	Applicant(s)/Patent Under Reexamination VENKATESAN et al.
	Examiner PAUL A D'AGOSTINO	Art Unit 3715

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
see east search history	07/21/2019	pd
see search history	09/08/2019	pd

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	see east search history	12/30/2019	pd

--	--

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	171418	(G07F17/\$\$ or A63F13/\$\$).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/06 08:35
S2	652273	(G06F17/\$\$ or A63F13/\$\$).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/06 08:35
S3	171418	(G07F17/\$\$ or A63F13/\$\$).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/06 08:44
S4	321	"6020876"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:23
S5	4	"6020876".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:23
S6	2	controller and haptic with actuator with (ID identifier) and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:34
S7	0	(A63F13/\$\$ or G07F17/\$\$).cpc. and controller and haptic with actuator with (ID identifier) and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:39
S8	16	(A63F13/\$\$ or G07F17/\$\$).cpc. and controller and haptic with actuator and (ID identifier) and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:39
S9	10	(A63F13/\$\$ or G07F17/\$\$).cpc. and controller and haptic same (ID identifier) and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:41
S10	1	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic.ti. and signal same (ID identifier) and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:43

S11	130	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic.ti. and actuator and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:44
S12	5	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic.ti. and actuator same identif\$4 and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 20:45
S13	0	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic.ti. same packet and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 21:28
S14	9	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic same packet and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 21:28
S15	17	(A63F13/\$\$ or G07F17/\$\$).cpc. and haptic same clock and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 22:01
S16	10983	haptic and range and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 23:07
S17	5994	controller and haptic and range and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 23:08
S18	123	controller and haptic and boundary with range and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 23:08
S19	19	controller and haptic same boundary with range and @py<"2013"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2017/09/08 23:09
S20	121	"463".clas. and haptic with (joystick)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2018/01/08 13:06
S21	73	"463".clas. and haptic with (joystick) and @py<"2012"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2018/01/08 13:06
S24	18	("20050156892" "20060142657" "20060290662" "20110118032" "20110260990" "20140043228" "20140315642" "20150130706" "6020876" "6184868"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	OFF	2019/07/21 18:17

EAST Search History

		"7490530").PN.				
S25	3	"14979321"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	OFF	2019/09/08 16:22

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	3	(control\$5 user input haptic output range positions boundary range).clm.	US-PGPUB; USPAT	AND	ON	2019/12/30 16:48
S22	8	(haptic effect trigger first second range positions).clm.	US-PGPUB; USPAT	AND	ON	2018/04/15 10:19
S23	2	(haptic effect trigger first scal\$4 second range positions).clm.	US-PGPUB; USPAT	AND	ON	2018/04/15 10:20

12/ 30/ 2019 4:49:27 PM

C:\ Users\ pdagostino\ Documents\ EAST\ Workspaces\ 16058399.wsp

Bibliographic Data

Application No: 16/058,399

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☐ No ☐ Met After Allowance

Verified and Acknowledged: /PAUL A D'AGOSTINO/

Examiner's Signature

Initials

Title:

POSITION CONTROL OF A USER INPUT ELEMENT
ASSOCIATED WITH A HAPTIC OUTPUT DEVICE

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
08/08/2018	463	3715	T9047-22090US02; IMM631C1
RULE			

APPLICANTS

Immersion Corporation, San Jose, CA, UNITED STATES

INVENTORS

Srivatsav VENKATESAN Sunnyvale, CA, UNITED STATES

Kaniyalal SHAH Fremont, CA, UNITED STATES

Douglas George BILLINGTON Campbell, CA, UNITED STATES

Aaron KAPELUS Jamaica Plain, MA, UNITED STATES

Stephen RANK San Jose, CA, UNITED STATES

Daniel PARKER San Jose, CA, UNITED STATES

CONTINUING DATA

This application is a CON of 14979321 12/22/2015 PAT 10073523

14979321 has PRO of 62096251 12/23/2014

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

08/28/2018

STATE OR COUNTRY

UNITED STATES

ADDRESS

Medler Ferro Woodhouse & Mills/Immersion

8201 Greensboro Drive, Suite 1060

McLean, VA 22102

UNITED STATES

FILING FEE RECEIVED

\$1,880

Document Description: Issue Fee Payment (PTO-85B)

Issue Fee Transmittal Form

Application Number	Filing Date	First Named Inventor	Atty. Docket No.	Confirmation No.
16058399	08-Aug-2018	Srivatsav VENKATESAN	IMM631C1	2869

TITLE OF INVENTION :

POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE

Entity Status	Application Type	Art Unit	Class - Subclass	EXAMINER
Regular Undiscounted	Utility under 35 USC 111(a)	3715	037000	PAUL D'AGOSTINO
Issue Fee Due	Publication Due	Total Fee(s) Due	Date Due	Prev. Paid Fee
\$1000	\$0	\$1000	15-Apr-2020	\$0

1.Change of Correspondence Address and/or Indication Of Fee Address (37 CFR 1.33 & 1.363)

Current Correspondence Address:	Current Indicated Fee Address :
99292 Medler Ferro Woodhouse & Mills/Immersion 8201 Greensboro Drive, Suite 1060 McLean VA 22102 UNITED STATES 703-712-8518 ~~docketing@medlerferro.com~~	
☐ Change of correspondence address requested, system generated AIA/122-EFS form attached	☐ Fee Address indication requested, system generated SB/47-EFS form attached

2.Entity Status**Change in Entity Status**

Applicant certifying micro entity status; system generated Micro Entity certification form attached. See 37 CFR 1.29.

Note: Absent a valid certification of micro entity status, issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment. If this box is checked, you will be prompted to choose a micro entity status on the gross income basis (37 CFR 1.29(a)) or the institution of higher education basis (37 CFR 1.29(d)), and make the applicable certification online.



Applicant asserting small entity status. See 37 CFR 1.27.

Note: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.



Applicant changing to regular undiscounted fee status.

Note: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.



Document Description: Issue Fee Payment (PTO-85B)

3.The Following Fee(s) Are Submitted:☒ Issue Fee☐ I authorize USPTO to apply my previously paid issue fee to the current fees due☐ Publication Fee☐ The Director is hereby authorized to apply my previously paid issue fee to the current fee due and to charge deficient fees to Deposit Account Number _____☐ Advance Order - # of copies _____

If **in addition to** the payment of the issue fee amount submitted with this form, there are any discrepancies in any amount(s) due, the Director is authorized to charge any deficiency, or credit any overpayment, to Deposit Account Number 60-1939.

☒ The **issue fee must be submitted** with this form. **If payment of the issue fee does not accompany this form, checking this box and providing a deposit account number will NOT be effective to satisfy full payment of the fee(s) due.**

4.Firm and/or Attorney Names To Be Printed**NOTE: If no name is listed, no name will be printed**

For printing on the patent front page, list to be displayed as entered

1. MEDLER FERRO WOODHOUSE & MILLS PLLC

2.

3.

5.Assignee Name(s) and Residence Data To Be Printed

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

Name	City	State	Country	Category
Immersion Corporation	San Jose	CALIFORNIA	united states	corporation

6.Signature

I certify, in accordance with 37 CFR 1.4(d)(4) that I am an attorney or agent registered to practice before the Patent and Trademark Office who has filed and has been granted power of attorney in this application. I also certify that this Fee(s) Transmittal form is being transmitted to the USPTO via EFS-WEB on the date indicated below.

Signature	/Jun S. Ha/	Date	03-16-2020
Name	Jun Sang Ha	Registration Number	58508

Electronic Patent Application Fee Transmittal				
Application Number:		16058399		
Filing Date:		08-Aug-2018		
Title of Invention:		POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE		
First Named Inventor/Applicant Name:		Srivatsav VENKATESAN		
Filer:		Jun Sang Ha/Derya SEVINC		
Attorney Docket Number:		IMM631C1		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPL ISSUE FEE	1501	1	1000	1000
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1000

Electronic Acknowledgement Receipt	
EFS ID:	38870673
Application Number:	16058399
International Application Number:	
Confirmation Number:	2869
Title of Invention:	POSITION CONTROL OF A USER INPUT ELEMENT ASSOCIATED WITH A HAPTIC OUTPUT DEVICE
First Named Inventor/Applicant Name:	Srivatsav VENKATESAN
Customer Number:	99292
Filer:	Jun Sang Ha/Derya SEVINC
Filer Authorized By:	Jun Sang Ha
Attorney Docket Number:	IMM631C1
Receipt Date:	16-MAR-2020
Filing Date:	08-AUG-2018
Time Stamp:	11:42:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$1000
RAM confirmation Number	E20203FB42395282
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	Web85b.pdf	46286	no	2
			973c3e91ba77b701dfae90f7514421c5bc61588a		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	31837	no	2
			ab95ffb7724105d6704eb95e7f8460450523196e		
Warnings:					
Information:					
Total Files Size (in bytes):			78123		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/058,399	04/21/2020	10627907	IMM631C1	2869

99292 7590 04/01/2020
Medler Ferro Woodhouse & Mills/Immersion
8201 Greensboro Drive, Suite 1060
McLean, VA 22102

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Srivatsav VENKATESAN, Sunnyvale, CA;
Immersion Corporation, San Jose, CA;
Kaniyalal SHAH, Fremont, CA;
Douglas George BILLINGTON, Campbell, CA;
Aaron KAPELUS, Jamaica Plain, MA;
Stephen RANK, San Jose, CA;
Daniel PARKER, San Jose, CA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.