

(12) PATENT APPLICATION PUBLICATION

(21) Application No.202511131505 A

(19) INDIA

(22) Date of filing of Application :24/12/2025

(43) Publication Date : 06/02/2026

(54) Title of the invention : APPARATUS FOR CONTEXT-AWARE MULTIMODAL WEARABLE HCI WITH PRIVACY-PRESERVED OUTPUT AND SAFETY FALLBACK PROTOCOLS

(51) International classification	:G06F 3/01, G06N 3/08, G06N 3/04, G06F 3/16, G06K 9/00	(71) Name of Applicant : 1)Swami Rama Himalayan University Address of Applicant :Swami Rama Himalayan University, Swami Ram Nagar, Jolly Grant, Dehradun-248016 Dehradun Uttarakhand India
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(61) Patent of Addition to Application Number	:NA	
Filing Date	:NA	
(62) Divisional to Application Number	:NA	
Filing Date	:NA	

(57) Abstract :

The present invention relates to wearable human-computer interaction systems that integrate multiple sensing modalities captured by a multimodal sensing layer comprising inertial, acoustic, biosignal, environmental, and optional neural sensors. A signal preprocessing module refines the raw data into a context vector, which is then analyzed by a context and user-state interpretation module to generate high-level descriptors. A modality decision engine selects an optimal input modality based on sensor integrity and historical data, while a privacy-governed output controller ensures that output channels, including directional audio and haptic signals, are chosen in accordance with environmental conditions. A fallback and safety module and personalization and adaptation module safeguard interaction efficacy and privacy, delivering adaptive, real-time responses via an output actuation layer.

No. of Pages : 22 No. of Claims : 10