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Physical Context-Aware Prompt Interface for Generative AI Systems

System and method for haptic selection, context-dependent generation and HID transmission of prompts to existing conversational AI interfaces

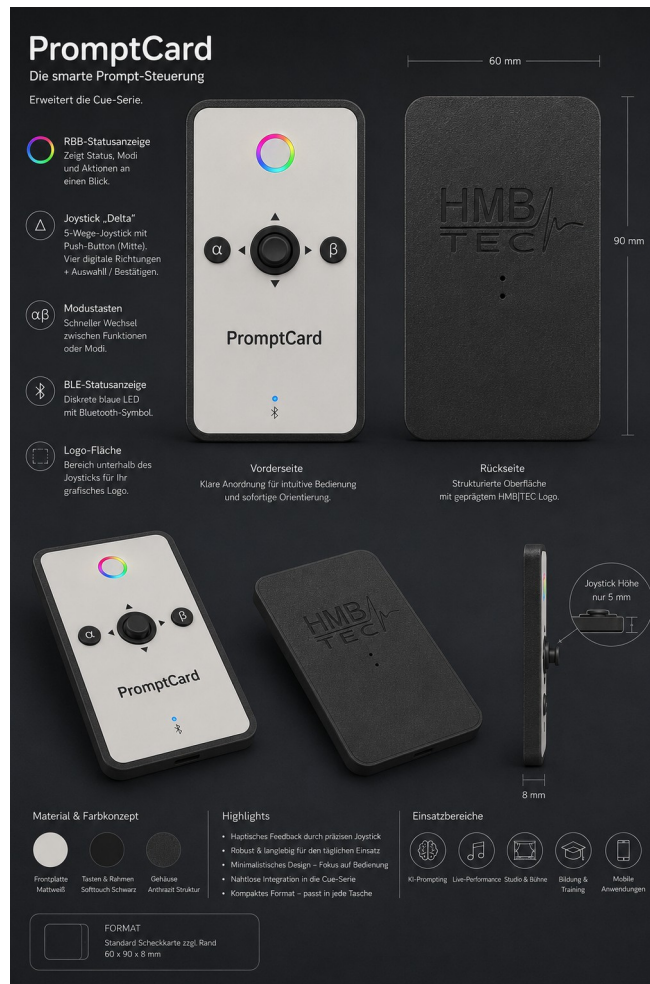


FIG. A - PromptCard concept embodiment · AI GENERATED - CONCEPT VISUAL

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Purpose: public technical disclosure intended to document the disclosed technical teaching and variants. This document is not a patent application and does not constitute legal advice.

Abstract

Disclosed is a physical interface system for controlling conversational or generative artificial-intelligence systems by means of context-dependent prompts. A portable input device receives haptic user actions through one or more physical controls. The actions are mapped to semantic prompt operations and converted into textual or otherwise machine-interpretable instructions. The instructions may be transmitted as Human Interface Device (HID) input, including Bluetooth Low Energy HID keyboard input, directly into an input field of an existing AI chat interface. The AI service may therefore remain independent of the physical device and need not expose a dedicated application programming interface to the device.

A configuration and context layer, for example a web application or PWA, may associate a device identifier with prompt mappings, profiles, initialization instructions, work context and domain-specific data. The existing chat interface may additionally serve as a dynamic display or menu for a displayless physical controller. Optional sensor modules may provide measured real-world data that is incorporated into the prompt or AI context. Voice input and audio output may be combined with the physical controller such that speech conveys content while physical actions convey meta-instructions concerning how the AI should process or continue the interaction.

1. Technical field

The disclosure relates to human-machine interfaces for generative AI, conversational AI and large-language-model systems; physical prompt generation; Bluetooth HID and other HID input; context-aware interaction; web-based device configuration; NFC-associated device identity; voice interaction; and optional sensor-assisted AI interaction.

2. Background and technical problem

Many AI systems are primarily controlled by free-form text or voice. Repeated meta-instructions such as requesting a deeper explanation, comparison, verification, alternative perspective, action, format or level of detail require attention to a screen and repeated formulation. This is undesirable in mobile, museum, educational, live-production, field-service and accessibility scenarios in which the user's primary attention should remain on the real-world environment.

A further problem is that conventional macro controllers typically emit fixed key sequences without understanding or exploiting the conversational context. Conversely, dedicated AI applications may require proprietary APIs, dedicated software and vendor-specific integrations. The disclosed system separates the physical interaction layer from the AI provider while retaining context-aware semantic behavior.

3. Core technical concept

A physical action is interpreted as a semantic prompt operation rather than merely as a conventional keyboard shortcut. The semantic operation is resolved with reference to one or more context sources and is converted into an instruction suitable for the current AI interaction.

1. Receive a physical input event from a button, joystick, rotary encoder, touch surface, gesture sensor, foot control or other haptic control.
2. Determine a semantic operation associated with the event and with a current device profile or interaction state.
3. Optionally combine the semantic operation with conversation state, work context, domain data, sensor data, user-selected mode or initialization rules.
4. Generate or select a context-dependent prompt or command.
5. Transmit the prompt to an existing AI interface, preferably by HID emulation, including BLE-HID keyboard transmission into the currently focused prompt field.
6. Optionally trigger submission of the prompt and receive the AI response as text, audio or another output modality.

4. System architecture

Physical interface	Configuration / context layer	AI layer
Haptic controls	Device ID / profile	Existing chat AI
Semantic input selection	Prompt mapping	Conversation context

HID transmission	WORK_CONTEXT / INIT	Reasoning / generation
Optional sensors	Domain data / references	Text / voice output

REAL-WORLD SITUATION -> PHYSICAL INPUT -> SEMANTIC OPERATION -> CONTEXTUAL PROMPT -> HID -> CHAT INPUT -> AI RESPONSE

5. Example physical embodiment

One embodiment is a portable card-like device having approximately 60 x 90 x 8 mm dimensions. The dimensions, geometry and number of controls are non-limiting.

- A status indicator, for example an addressable RGB light source or ring.
- A multi-directional digital joystick with four directional positions and a push function; in one embodiment the central control is denoted Delta.
- Two additional mode controls, in one embodiment denoted Alpha and Beta.
- A separate Bluetooth connection indicator.
- A customer- or application-specific printed front surface.
- An NFC element integrated into or associated with the device.
- Optional sensor apertures or sensor modules positioned near the status indicator or elsewhere on the housing.

Alternative embodiments may use more or fewer controls, rotary encoders, wheels, touch areas, capacitive controls, force sensors, gesture input, wearable controls, rings, remote buttons, foot switches or combinations thereof.

6. Semantic prompt mapping

The mapping between physical input and generated text need not be fixed. A single physical control can produce different prompts depending on the current profile, selected mode, conversation stage, domain, sensor state or prior AI output.

Example semantic operations include EXPLAIN, DEEPEN, VERIFY, COMPARE, SUMMARIZE, CHANGE PERSPECTIVE, NEXT, BACK, SELECT, EXECUTE, FORMAT, SIMPLIFY, TEACH, CRITIQUE and ACTION. The terms are illustrative and do not limit the disclosure.

7. Chat input field as an external dynamic display

In a displayless or minimally displayed embodiment, the AI chat interface itself is used as a dynamic visual menu and status surface for the physical controller. The controller may send an instruction causing the AI or surrounding web logic to present a context-dependent menu. Subsequent physical actions select, navigate or confirm items represented in that menu.

Thus, the physical controller does not require a conventional graphical display. The visible user interface can be generated dynamically in the existing chat window and may change according to context. This creates a distributed user interface in which physical input and graphical output reside on separate devices.

8. HID transmission and AI-provider independence

In a preferred embodiment, generated prompts are emitted as keyboard input using Bluetooth Low Energy HID. Other HID transports, USB HID, wired keyboard emulation, operating-system accessibility interfaces, clipboard mechanisms or equivalent input injection methods may be used.

Because the AI receives ordinary user-interface input, the physical controller can operate with multiple AI providers and applications without requiring the controller to call the AI provider's API. The AI provider may be changed while retaining the physical interaction model and prompt profile.

9. Configuration and context backend

A web application, progressive web application, local application, server or other configuration system may associate each physical device with configuration and context information. In one implementation this layer is referred to as PromptMapping.

- Device identifier and hardware variant.

- Profile name and application domain.
- Mapping of physical controls to semantic operations or prompt templates.
- WORK_CONTEXT describing the current work, location, exhibition, project or task.
- Initialization instructions defining interaction rules and response behavior.
- Domain-specific data, documents, facts, references or URLs intended to ground AI responses.
- Language, accessibility, audio, timing and interaction preferences.
- Sensor configuration, calibration metadata and interpretation rules.

10. NFC-associated identity and setup

An NFC tag or equivalent near-field identifier may be integrated into the physical device. A mobile device can read the NFC element to open a stable device-specific or profile-specific web address. The address may resolve to setup, configuration, documentation, profile activation, context selection or a customer-specific page.

The NFC target may contain or reference a device identifier. A stable redirect address can decouple the permanently encoded NFC content from later changes in the configuration service. A printed QR code may provide a fallback path to the same or a related resource.

11. Voice and audio embodiment

The physical prompt interface may be combined with a Bluetooth headset, microphone or other voice interface. The user supplies domain content naturally by speech, while the physical controller supplies meta-instructions concerning the treatment of that content. Examples include requesting greater depth, changing explanation level, checking claims, comparing alternatives or moving to a next topic.

The AI response may be rendered as audio through the headset. In this embodiment the user can maintain visual attention on the physical environment while controlling the conversational strategy haptically.

12. Sensor-assisted embodiments

One or more sensors may provide real-world measurement data to the prompt generation or context layer. The measured values can be encoded as text, structured data or derived features and combined with the semantic user instruction.

Sensor class	Illustrative data	Illustrative use
Multichannel spectral sensor (e.g. AS734x family)	Spectral channels / intensity ratios	Light, color, material and liquid comparison
VOC / gas sensor array	Relative VOC / gas-response pattern	Room-air, odor-pattern or exploratory breath-related analysis
Thermal matrix	Spatial temperature values	Equipment, buildings, exhibits, education and field inspection
Other sensors	Motion, sound, proximity, environment, optical or chemical values	Context enrichment and AI-assisted interpretation

Sensor-assisted interpretation may require calibration, reference measurements and application-specific validation. Breath-related embodiments are not inherently medical diagnostic devices and should not be interpreted as such unless separately validated and regulated for that purpose.

13. Museum embodiment

A museum can associate a device profile with curated information about rooms, objects, artists, dates, provenance, interpretation rules and educational content. The visitor speaks or types about the currently observed object. A physical action then selects a semantic operation such as explain, deepen, compare or challenge. The resulting prompt is entered into the existing AI conversation. The AI combines the ongoing conversation with the museum context and the selected operation.

The same physical hardware can be reconfigured for another museum or exhibition by changing the profile, mapping, NFC target, printed graphics and context data without changing the underlying interaction principle.

14. Further embodiments and variants

- The prompt may be generated entirely on the device, entirely in the PWA/backend, or jointly.
- A short token, code or symbolic command may be transmitted instead of the complete natural-language prompt, with expansion occurring elsewhere.
- The physical input may select from a hierarchical prompt tree or a flat action set.
- The AI may generate the next available physical menu dynamically from the current conversation.
- Prompt submission may be automatic or may require a separate confirmation action.
- The device may disconnect HID after transmission to allow immediate manual keyboard input.
- Multiple physical devices may share a profile or one device may switch among multiple profiles.
- A profile may be selected by NFC, QR code, geofenced application state, device ID, user selection or external event.
- Sensor values may trigger prompts automatically or may only be included after explicit physical confirmation.
- The system may operate with smartphones, tablets, notebooks, desktop computers, head-mounted displays or embedded terminals.
- The physical controller may include no display, a simple status display, an OLED/LCD/e-paper display or another visual output.
- The same semantic mapping principle may be applied to accessibility controls, wearable devices, industrial controls, educational objects or interactive exhibits.

15. Example method sequence

7. Load or determine a device profile.
8. Establish a HID connection to a host running an AI chat interface.
9. Establish or initialize a work context and, where applicable, make domain data available to the AI.
10. Receive a haptic action.
11. Resolve the action to a semantic prompt operation using the current profile and state.
12. Combine the operation with available context and optional sensor data.
13. Generate or retrieve the corresponding prompt.
14. Transmit the prompt as HID input into the active AI chat input field.
15. Optionally submit the prompt.
16. Receive or present the AI response.
17. Optionally use the AI response to determine the next physical menu or action mapping.

16. Technical effects

- Reduction of repeated manual prompt entry.
- Operation with an existing AI user interface without requiring a dedicated AI API integration in the physical device.
- Context-dependent reuse of a small number of physical controls.
- Distributed user interface in which a chat window serves as a dynamic display for a physical controller.
- Reduced need for a local graphical display on the controller.
- Separation of hardware, application profile, domain knowledge and AI provider.
- Combination of real-world measurement data, conversation context and physical user intent in a single AI interaction.

17. Scope of disclosure

The embodiments described above are illustrative. Features described in separate embodiments may be combined. Individual features may be omitted where not required. The disclosure is intended to make available the general technical teaching of using a physical, semantically mapped controller to create or select context-aware AI prompts and to deliver those prompts to an existing AI interaction interface, including by HID emulation, together with the described configuration, dynamic-menu, NFC, voice and sensor variants.

18. Publication and prior-art notice

This document is intended for public dissemination. Under Article 54(2) EPC, the state of the art includes information made available to the public before the filing date of a European patent application. The EPO also explains that a written document is publicly available when members of the public could obtain knowledge of its content without a confidentiality restriction. For a disclosure to anticipate technical subject matter, the disclosed teaching should be sufficiently enabling for the skilled person. The DPMA likewise states that even an inventor's own pre-filing publication can form part of the state of the art.

Accordingly, public release of this document may adversely affect later patent applications by the publisher or others. Publication should therefore occur only after any desired patent-filing strategy has been considered.

19. References

- European Patent Convention, Article 54 - Novelty: <https://www.epo.org/en/legal/epc/2020/a54.html>
- EPO Guidelines for Examination, G-IV, 1 - General remarks and definition of state of the art: https://www.epo.org/en/legal/guidelines-epc/2026/g_iv_1.html
- EPO Guidelines for Examination, G-IV, 2 - Enabling disclosure: https://www.epo.org/en/legal/guidelines-epc/2026/g_iv_2.html
- DPMA - Schutzvoraussetzungen für Patente: <https://www.dpma.de/patente/patentschutz/schutzvoraussetzungen/>

20. Publication record

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