Request for Proposal (RFP) for Haptic Primitives in a Universal Haptics API

Issued by:
Haptics Industry Forum (HIF)

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1. Introduction

The Haptics Industry Forum (HIF) invites proposals for the development and standardization of haptic primitives for a universal haptics API. This API will enable devices to receive and interpret haptic commands from host devices such as PCs, smartphones, tablets, and other connected platforms. The goal is to establish a standardized set of haptic primitives that can be universally recognized and implemented across different hardware and software environments.

2. Background

Haptic technology is increasingly being integrated into a wide range of devices, providing users with tactile feedback that enhances user experience in applications such as gaming, multimedia, communication, and wellness. However, the lack of standardized haptic primitives has led to fragmentation in how these effects are implemented and experienced across different devices.

HIF aims to standardize a core set of haptic primitives, such as "vibrate" and "impulse," which can be used to create complex haptic effects by playing these primitives sequentially or in combination. This standardization will help unify the haptics industry and provide a common language for device makers and content creators.

3. Objective

The primary objective of this RFP is to solicit proposals for haptic primitives that can be standardized as part of the universal haptics API. These primitives should be defined with clear parameters, ensuring they can be easily implemented across various devices and platforms.

4. Common Elements and Required Placeholders

Proposals should include the following common elements:

- **Primitive Name:** A unique identifier for the haptic primitive (e.g., "vibrate," "impulse").
- **Primitive Type:** The category of the primitive (e.g., continuous, transient).
- **Parameters:** A detailed list of parameters required to define the primitive, providing required and optional parameters.

  Example:

  Primitive: Vibration
  Frequency: The frequency at which the primitive operates (if applicable).
  Intensity: The strength of the haptic effect.
  Duration: The length of time the effect is played.

  Primitive: Temperature
  Temperature: The target temperature in degrees Celsius.
  Duration: The length of time the effect is played.

- **Use Cases:** Specific scenarios where the primitive would be most effectively utilized.
- **Implementation Guidelines:** Best practices for implementing the primitive in a universal haptics API.

  See Section 9, Submission Template

5. Submission Guidelines

- Proposals should be submitted electronically in PDF format to the Haptics Protocol WG Chair: tim@hapticsif.org.
- The deadline for submission is October 31, 2024.
- All proposals should include a cover page with the submitter's name, company/organization, contact information, and a brief summary of the proposal.

  Note: an example template for the proposal content is provided in Section 9.

6. Evaluation Criteria

Proposals will be evaluated based on the following criteria:

- **(60%) Usage and Industry Relevance:** The relevance of the primitive to current and emerging haptics applications.
- **(30%) Clarity:** The clarity and completeness of the proposal, including the definition of parameters and use cases.
- **(10%) Innovation:** The uniqueness and potential impact of the proposed primitive.

7. Use Cases and Personas (Appendix)

As part of this RFP, HIF has developed a set of use cases, personas, and target devices to help guide the development of haptic primitives. These use cases are provided in the appendix to help proposers understand the context and potential applications of their proposed primitives.

- **Personas:** Examples of end-users who would benefit from the haptic primitive.
- **Applications:** Specific applications (e.g., gaming, VR, wellness) where the primitive could be utilized.
- **Target Devices:** Categories of devices (e.g., smartphones, wearables, gaming controllers) that could implement the primitive.

8. Contact Information

For any questions or further information regarding this RFP, please contact:

- **Name:** Tim Szeto,
- **Email:** tim@hapticsif.org

9. Submission Template

To ensure consistency and completeness, please structure your proposal using the following template:

9.1 Primitive Details

Primitive Name (required):
Enter the unique identifier for the haptic primitive

Description (required):
Provide a detailed explanation of the primitive and its intended effects

Primitive Type (optional):
Specify the category (e.g., continuous, transient, thermal)

9.2 Parameters

Provide a comprehensive list of parameters that define your primitive. For each parameter, include the following:

- Parameter Name
- Description
- Required/Optional
- Value Range

Example:

Parameter Name	Description	Required/Optional	Value Range
Intensity	Controls the strength of the effect	Required	0% (min) – 100% (max)
Duration	Determines how long the effect lasts	Required	0.1 sec – 10 sec
Frequency	Sets the operating frequency (if applicable)	Optional	20 Hz – 200 Hz

Adjust and add parameters as relevant for your primitive.

9.3 Use Cases (Required)

Describe scenarios where the primitive is best utilized. Include as many relevant use cases as desired.

9.4 Target Devices (Required)

Intended Devices:
List the types of devices that are intended to support the primitive. For example, Controllers, Smartphones, Touch interfaces, etc.

Hardware Requirements (Optional):
Specify any specific or special hardware requirements

9.5 Implementation Guidelines (Optional)

Best Practices:
Provide guidelines and recommendations for implementing the primitive

Potential Limitations:
Discuss any limitations or challenges in implementation

9.6 Additional Information (Optional)

Innovation Aspect:
Explain the uniqueness and potential impact of the primitive

References:
Cite any references or prior work related to the primitive

10. Legal and Confidentiality Considerations

All proposals submitted will be considered confidential and used solely for the purposes of evaluation by HIF and its designated reviewers. Intellectual property rights remain with the proposer until any agreements are made for standardization.

11. Timeline and Process

- **RFP Release Date**: September 25, 2024
- **Proposal Submission Deadline**: October 31, 2024*
- **Evaluation Period**: November 1 – December 15, 2024
- **Notification of Decisions**: By December 31, 2024
- **Standardization Process Begins**: January 15, 2025

**If you require additional time or special consideration, please feel free to email the Haptic Protocols WG chair: tim@hapticsif.org*

12. Encouraging Diverse Participation

HIF welcomes submissions from a diverse range of organizations, including startups, academic institutions, and international entities. Our aim is to foster collaboration across the global haptics community.

13. Feedback Mechanism

All proposers will receive feedback on their submissions, regardless of the outcome. This feedback is intended to encourage future participation and collaboration.

14. Accessibility and Formatting

Please ensure that your PDF submission is accessible, with searchable text and proper tags for screen readers. Use clear headings and formatting for readability.

Appendix A: Use Case Examples

This appendix provides a collection of detailed use cases to assist submitters in crafting proposals for the Haptic Primitives in a Universal Haptics API. The examples outlined here explore the practical application of haptic primitives across various contexts, offering a view of how haptic feedback can be integrated into both hardware and software systems to enrich user experiences.

Use Case 1: Gaming - Haptic Design in Software

Persona(s): Designer, Game Developer

Targeted Device(s)

- **Primary**: Smartphones, tablets, gaming peripherals, handheld consoles.
- **Secondary** (optional): VR headsets, gaming controllers, and other immersive devices.

Goal
Design haptic feedback for a mobile game that enhances visual and audio feedback, creating a more engaging and immersive user experience.

Flow

1. **Analyze Target Devices**: Identify the range of devices the game will support, considering device haptics capabilities (e.g., smartphones, tablets, gaming controllers).
2. **Align Haptics with Modalities**: Design haptic feedback that complements existing audio and visual effects. Ensure the haptics feel natural and enhance the gameplay without overwhelming the player.
3. **Evaluate Haptic Effect(s) on Devices**: Experience and assess the designed haptic effects on various devices. Consider how the primitive's parameters (e.g., intensity, duration, frequency) behave differently across target devices and hardware with varying haptic capabilities.
4. **Refine Haptic Design**: Adjust the design to ensure it works across devices with different haptic performance levels, refining intensity, duration, and patterns as needed.
5. **Hand Over to Developer for Implementation**: Provide detailed guidelines for the developer, including parameter values, timing, and integration points within the game.

Example

Target Device: Android Smartphone

Game Scenario: Multiplayer action game where the player hits an enemy with a sword upon pressing a button.

Haptic Design Objective: Create a haptic effect that represents the clash of the sword, aligned with an existing audio effect. Ensure that the haptic effect is dynamic enough to vary based on the force or intensity of the strike.

Primitives used in Haptic Effects:

- **Primitives:** Pulses, Vibrations and Rumbles
- **Haptic Effects:**
  Clash: To simulate the sword clash (*Pulses and Vibrations*)
  Hit: To represent the force of the hit (*Rumble*)

Design Considerations:

- Ensure the effect is compatible across Android devices with different levels of haptics support.
- Adjust intensity and duration based on the device's haptics performance.
- Implement fallback haptic patterns for devices with limited haptic capabilities.

Success Criteria:

- The haptic effect enhances the gameplay experience, reinforcing the visual and audio cues.
- The effect is noticeable but not intrusive, and it scales appropriately with different types of devices (e.g., flagship smartphones vs. budget models).

Use Case 2: Accessibility - Enhancing Interaction Through Haptics

Persona(s): (Accessibility) Designer, device engineer

Targeted Device(s)

- **Primary:** HID peripherals such as keyboards, mice, and touchpads used with PCs and laptops.
- **Secondary (optional):** Braille readers, tablets, and accessibility-focused handheld devices.

Goal: Create haptic feedback designs for hardware peripherals to help users with visual impairments or motor disabilities engage with a computer more effectively and accessibly.

Flow

1. **Analyze Target Devices**: Analyze how users with visual or motor impairments interact with hardware peripherals and determine the haptic features supported by each device.

2. **Map Haptics to Actions:** Assign haptic responses to specific actions and provide haptic feedback. Ensure that the haptic cues are intuitive, consistent, and clear.
3. **Design Haptic Patterns for Accessibility:** Create distinct haptic patterns for different actions and tailor them to the user's accessibility needs. Incorporate customizable feedback settings to accommodate varying levels of impairment.
4. **Evaluate Haptic Effect(s) on Devices**: Test the haptic feedback on different HID devices to ensure compatibility and effectiveness across a wide range of hardware and optimize it based on the hardware's haptic performance.
5. **Provide Guidelines for Integration:** Document the haptic designs and their intended behavior across devices, providing engineers with precise parameter values and integration points and include fallback patterns for devices with limited haptic functionality.

Example

Target Device: Digital braille reader with built-in haptic feedback

Interaction Scenario: A user with visual impairment reads and types a document

Hardware Design Objective:

- Provide localized haptic feedback to enhance user input and to output information, avoiding neighboring interaction points to interfere with each other
- Satisfy space constraints to enable users to use the interface without requiring significant hand movement

Haptic Design Objective:

- Provide subtle and clear feedback when using the device for input
- Use different haptic patterns to indicate special interactions
- Ensure clear haptic display of output

Primitives used in Haptic Effects:

Primitives: Clicks, Pulses, Vibrations and Rumbles

Haptic Effects:
Confirmation: Immediate feedback upon key presses (*Pulses and Vibrations*)
Activation: To signal long presses or activation of special interactions (*Pulses*)
In-progress: For sustained haptic feedback during tasks like holding down a key to select multiple items (*Rumbles and Vibration*)

Design Considerations:

- Ensure haptic feedback is distinct yet unobtrusive, allowing the user to focus on their tasks without being overwhelmed by too much sensation.

- Account for users with varying tactile sensitivity by offering adjustable haptic strength.
- Consider fallback patterns for keyboards without advanced haptic motors.

Success Criteria:

- The user can effectively navigate, type, and execute commands with the help of haptic feedback.
- Haptics enhance the experience by providing clear, accessible cues, without overwhelming or distracting the user.
- The haptic design works consistently across different devices, from high-end to budget peripherals.

Appendix B: Example Personas, Applications and Devices for Use Cases

The following tables provide an example overview of key personas, applications, and devices that are relevant to the development and implementation of haptic primitives in the Universal Haptics API. These tables are intended to assist submitters in contextualizing their proposals by identifying common user roles, use cases, and hardware platforms that would benefit from standardized haptic feedback.

Personas

Persona	**Goal**	**Includes**
Haptic Designer	Describes a haptic intent (effect) and provides instruction to execute (without needing to know the specifics of the hardware)	Interaction Designers, Product Designers, UX specialist
Developer	Implements and connects the effect with the appropriate library / protocol / endpoint for execution (without needing to know the specifics of the hardware)	Game Developers, Software Developers
Middleware Developer (Platform, 3rd Pty SDK)	An easy way to ingest the haptic intent of Developers, understand the hardware capabilities and generate optimized control signals for the hardware	Framework developers, engine developers
Firmware Engineers	An easy, well documented way to ingest haptic intents, and optimize the control signals for the haptic hardware (motors) employed.	Embedded engineers
Hardware Developers	Ability to tap into existing haptic commands using new hardware (backwards compatibility with haptic signals)	Electrical engineers, Mechanical engineers
End Users	A plug-and-play haptics experience that works on a large variety of hardware, new and old	

Applications

Applications	**Description**
Gaming	Games (various types, including sports, racing), Interactive multimedia, audio to haptics
GUI Interaction	Navigating Menus, web browsing, accessibility
Consuming Linear Content (media)	Movies, Cinema, wellness
Remote control	Remote control of medical, industrial devices, and/or simulations thereof, kinesthetic feedback, force feedback, telecommunication, robotics
Wellness	Wearable feedback, medical, meditation, sleep aids, subliminal, textile

Devices

Device	Description
Smartphone, tablets	Portable computing devices, typically with a visual display
Peripherals	Keyboards, mice, gaming controllers, gaming controllers, VR / XR input
HMI (touch surfaces)	Touch screens, touchpads, tables, in-car (Stationary/ fixed interface)
HMI (physical component)	Buttons, knobs, sliders, switches
HMI (force feedback)	Steering Wheels, levers
Wearables	Goggles, AR/VR headsets, wristbands, necklaces, vests, smart watches, earphones
Seat, chair	Seat, Home Theatre, automotive