Group-1: Infotainment System HMI Design: Concepts and Use Cases

Revolutionizing the in-car experience through intuitive, safe, and engaging

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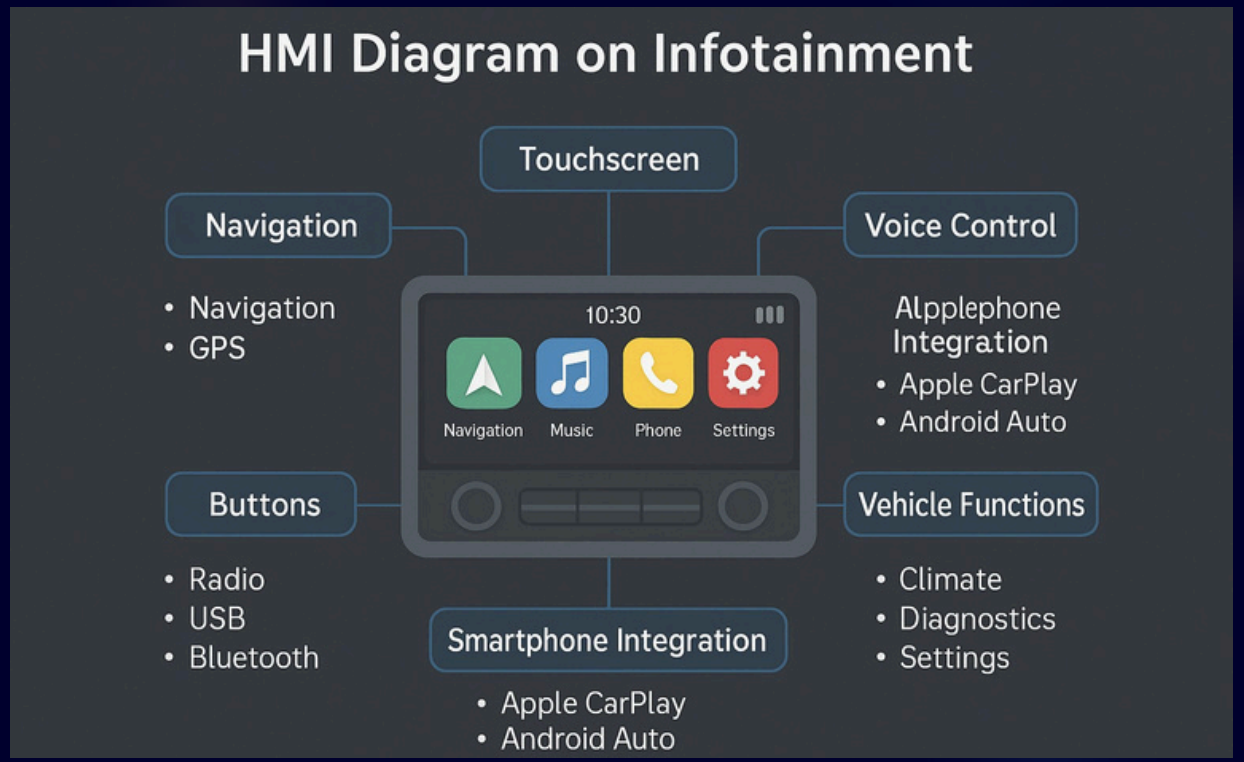
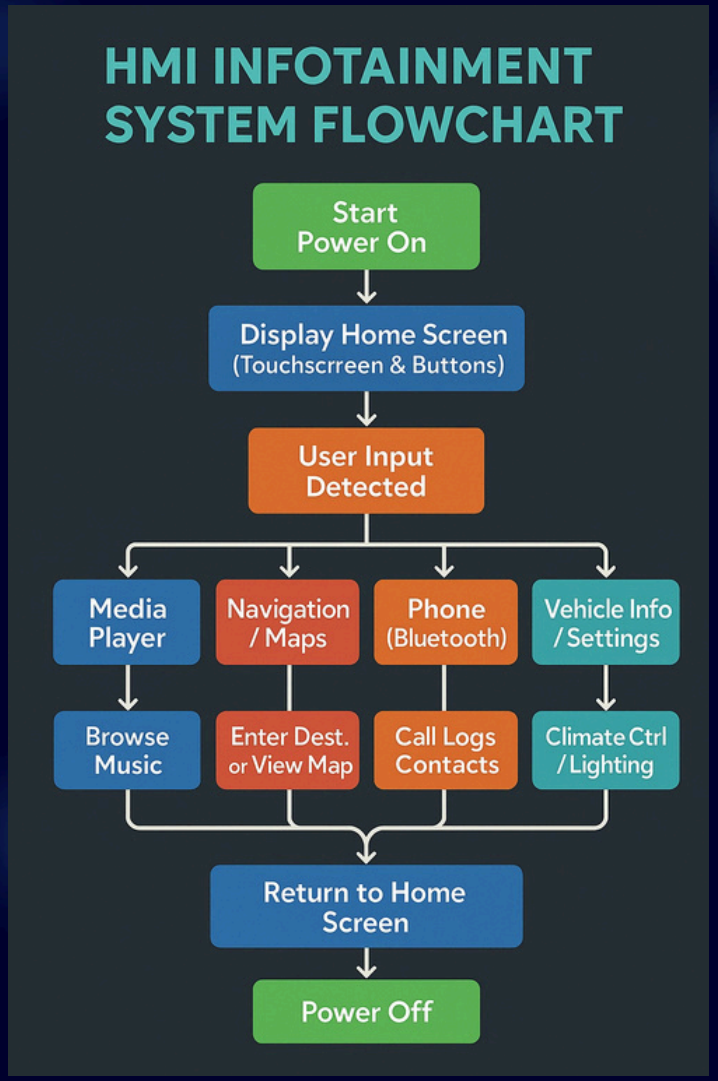


human-machine interface (HMI) design. This presentation delves into core principles, key technologies, and a practical use case for a modern automotive infotainment system.

HMI Infotainment System Flowchart

- The user interaction journey within a modern vehicle.
- Once the system powers on, the home screen is displayed via touchscreen or physical buttons.
- Based on the user's input, they can access various features such as the media player to browse music, navigation/maps to enter destinations, phone connectivity through Bluetooth for calls and contacts, or vehicle settings for climate control and lighting.
- After using any feature, the system returns to the home screen and can be powered off.
- This flow ensures intuitive and convenient interaction between the driver and vehicle systems.



Core HMI Principles: Ensuring a Seamless Experience

Usability & Consistency

Designfor ease oflearningand efficient task execution, with uniform layouts and interaction patterns across all functions. This ensures a predictable and user-friendly system.

Safety & Feedback

Prioritise minimising driver distraction. Enable "eyes on the road" and "hands on the wheel" operations, supported by clear, immediate feedback for every user action.

Flexibility & Accessibility

Allowusers topersonalisetheinterface to their preferences. Design with considerations for varying abilities, ensuring inclusivity for all drivers and passengers.

Aest het ics

Craft a visually appealing and modern design that enhances the overall in-car experience, aligning with contemporary automotive design trends.

Key HMI Concepts: Multi-Modal Interaction

Modern infotainment systems leverage diverse interaction methods to enhance user experience and safety.

Touchscreen

The primary interface for detailed selections and browsing content, offering a rich visual experience.

Voice Control

Essential for hands-free operation of frequent tasks like navigation, music selection, and phone calls, minimising visual distraction.

Steering Wheel Controls

Physical buttons for quick, commonly used functions such as volume adjustment, track skipping, and voice assistant activation.

Rotary Controller (Optional)

A physical jog dial provides precise control for scrolling, zooming, and menu navigation, reducing the need to look away from the road.

Visual Design Principles for Infotainment

Clear Information Hierarchy

Important informationisprominently displayed, with secondary details accessible on demand to avoid clutter.

Legible Fonts & Icons

Large,clear fonts and intuitive icons ensure readability at a glance, crucial for driver safety.

High Contrast & Adaptive Themes

Ensuresreadabilityin diverselightingconditions, with automatic brightness and day/night mode adjustments.

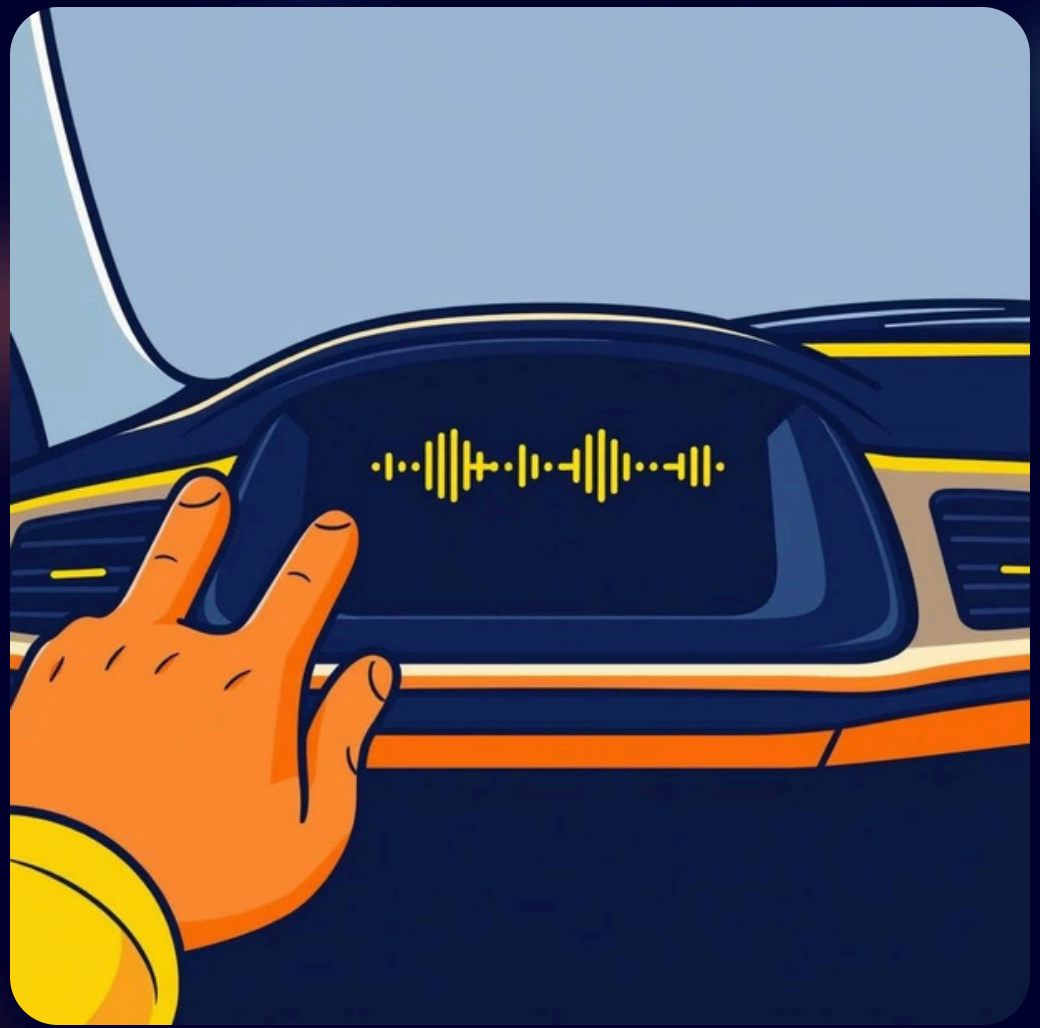
Minimally Distracting Visuals

Avoid excessive animationsorcluttered layouts, especially for the driver's primary view, to maintain focus on the road.

Enhancing Interaction: Audio & Haptic Feedback

Audio feedback provides immediate confirmation and guidance, while haptic feedback offers tactile reassurance for touch interactions.

- **Confirmation Tones:** Subtle sounds when a selection is made.
- **Voice Prompts:** For turn-by-turn navigation and voice assistant responses.
- **Haptic Feedback:** Gentle vibrations on touch screens to confirm input, improving tactile experience.



Contextual Awareness & Information Prioritisation

- **Proximity Sensors:** Display more detailed information as a hand approaches the screen.
- **Vehicle Speed:** Limit functions like keyboard input when the vehicle is in motion for safety.
- **Location-Based Services:** Offer relevant points of interest or traffic alerts based on current location.
- **"Glanceable" Information:**Key datalikenextturn or current song displayed prominently.
- **Progressive Disclosure:** Reveal additional detail only when requested by the user.
- **Critical Alerts:** High-priority warnings or navigation instructions temporarily override other displays.

Use Case: Planning a Road Trip

Scenario:Driverplansaroadtrip,findsarestaurant,andmanages music.

Phase 1: Initial Setup & Destination Entry

Driver uses voice commandfornavigation.Systemconfirms, loads route, and displays primary navigation view.

Phase 2: Music Selection

Voice command plays a playlist. Navigation remains primary, with a small overlay showing music details. Steering wheel controls adjust volume/tracks.

Phase 3: Finding a Restaurant

Voice command searches forrestaurants along the route. A list appears with details, allowing selection via voice or rotary controller. Route updates automatically.

Phase 4: Managing Calls

Incoming call notification. Steering wheel controls answer/end call. Navigation audio adjusts. System returns to full view after call.

Design Considerations: Minimising Cognitive Load

Designing infotainment systems to reduce cognitive load on the driver is paramount for safety. This involves using simple language, implementing predictive input for faster data entry, and leveraging smart defaults to pre-select common options.

Best Practices: Driver vs. Passenger Focus & OTA Updates

Driver-Critical Information

Navigationand critical alerts are prioritised on the primary display. Complex inputs or extensive browsing functions are disabled when the vehicle is in motion to prevent distraction.

Passenger Engagement

Passengers canfreelybrowse media, input navigation details, or adjust climate, potentially on a secondary screen or when the vehicle is stationary.

Over-The-Air (OTA) Updates are crucial for continuous improvement, adding new features, and bug fixes, ensuring the system evolves with user needs and technology.

Key Takeaways & Future Outlook

Seamless Integration

Achieve seamless connectivity with smart devices through Apple CarPlay and Android Auto, mirroring apps and contacts effortlessly.

Safety Interlocks

Implement strict safety interlocks that disable complex text inputs or extensive browsing features when the vehicle exceeds a certain speed.

Learnability & Aesthetics

Provide intuitivetutorials, clear error messages, and maintain a modern, clean, and brand-consistent design.

Enhanced Driving Experience

Byadhering to these HMI concepts,infotainment systems can become powerful, enjoyable tools that enhance driving without compromising safety.

Conclusion

By integrating core HMI principles—usability, safety, feedback, consistency, flexibility, accessibility, and aesthetics—with advanced, multimodal interaction technologies, this infotainment design delivers an experience that is intuitive, engaging, and inherently safe. Contextual awareness and information prioritization ensure the driver's focus remains on the road, while adaptive visuals, audio, and haptic cues provide clear, glanceable feedback.
Key takeaways:

1. Prioritizes "eyes on the road, hands on the wheel" operation through voice control, steering-wheel buttons, and optional jog dials.
2. Offers progressive disclosure and critical alert overrides to minimize cognitive load while driving.
3. Empowers personalization via user profiles, customizable layouts, and OTA updates for continuous improvement.
4. Balances driver requirements with passenger freedoms, allowing secondary interactions when safe.
5. Leverages context (speed, proximity, location) to tailor functionality and restrict unsafe inputs.
6. By adhering to these guidelines, the system not only enhances safety and efficiency but also transforms every journey into a seamless, personalized adventure—melding form with function to elevate the driving experience.

THANKYOU