Capillary Static Policy Setup and Multisensory Dynamic Feedback in Modern Cars

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HCI-CPT 2025

IMT | SCHOOL FOR ADVANCED STUDIES LUCCA

SICILIAE STVDIVM GENERALE · 1434 ·
Università di Catania

22/06/25 – Gothenburg, SE

It's Official: Cars Are the Worst Product Category We Have Ever Reviewed for Privacy

By **Jen Caltrider, Misha Rykov** and **Zoë MacDonald** | Sept. 6, 2023

cybernews®

Smart cars vs. privacy: a driverless car could generate 100 GB of data per second

T⌐

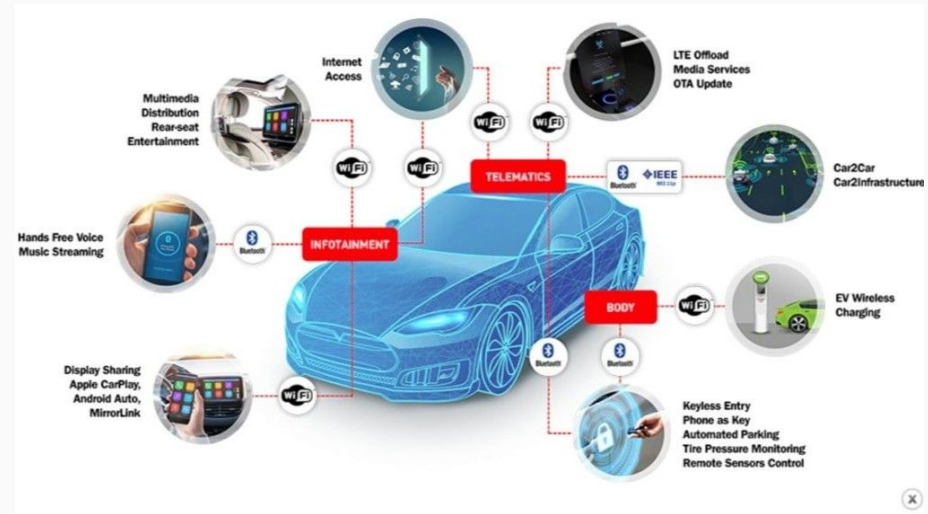# Toyota Japan exposed millions of vehicles' location data for a decade

Introduction

Modern vehicles collect **extensive personal data** (e.g., location, behaviour, media usage)

GDPR compliance remains <u>limited</u> in the automotive sector

Lack of transparency and real-time **user control** undermines *privacy and trust*

Existing Solutions

PRICON: Privacy control system with policy presets

Privacy4Cars: Post-hoc data deletion and privacy reports

Gamified consent UIs: Improve understanding and transparency

Literature Gap

Lack of *fine control* and *real-time multisensory feedback* for privacy

RQ: *How can we enforce user control and awareness on data privacy in modern automotive systems?*
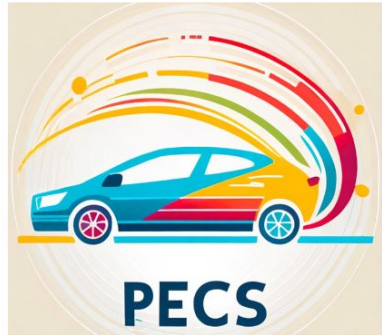
Agenda

1. Introduction
2. **PECS**
3. PECSi
4. Conclusions

Privacy Enrooted Car Systems

The **Privacy Enrooted Car Systems (PECS)** prototypes pioneer privacy-enhancing technologies (*PETs*) tailored for **modern automotive** systems

PECS addresses systemic challenges in *data protection* for car drivers

Privacy Enrooted Car Systems

PECS is composed of two main components:

PECSi — PECS Multisensory-Media Car Interface
(*Soft Privacy*)

PECSo — PECS Obfuscation Technologies
(*Hard Privacy*)

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PECSi in a Nutshell

PECSi aims to provide an innovative approach to **privacy management** in vehicles by combining <u>fine-grained privacy policies</u> with <u>dynamic multisensory feedback</u>

PECSi is composed by a *frontend* and a *backend*: the **PECSi Client** and the **PECSi Service**
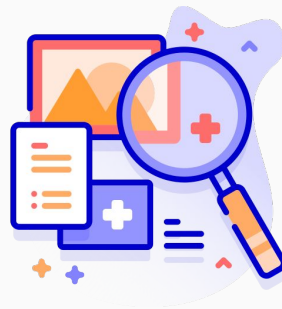
PECSi Contributions

Capillary Static Policy Setup

Fine-grained privacy configuration

Per-app and global policies, including engine data

Multisensory Dynamic Feedback

Alerts via audio, video, and haptic feedback

Real-time, user-defined violation notifications

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4. Conclusions

PECSi Client

Android app with 3 screens:

Home – dashboard of current settings

Policy Settings – wizard-based configuration

Alert History – list of detected violations
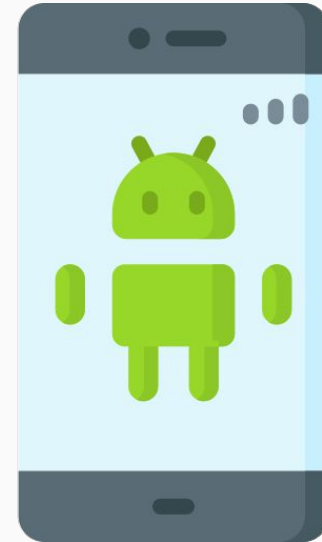
PECSi Client — UX Workflow
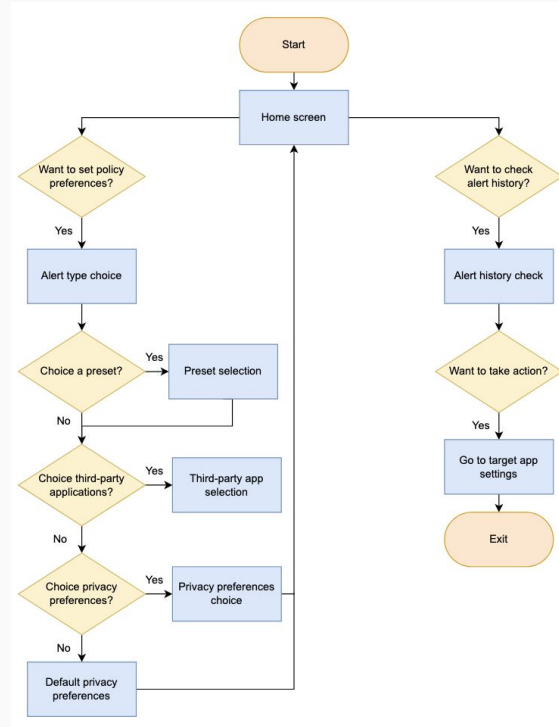
PECSi Client — Home Screen

PECSi Client — Policy Settings Screen

PECSi Client — Policy Settings Screen

PECSi Client − Alert History Screen

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PECSi Service

Implements full **PBAC (Policy-Based Access Control)** using *XACML 3.0*

Key components:

PAP – generates and logs policies

PEP/PDP – enforce and detect violations

PRP/PSIR* – retrieve policies and monitor system status
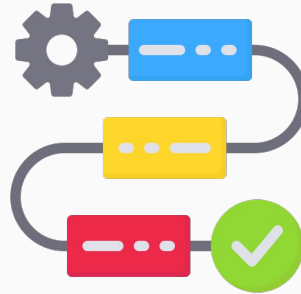
Real-time feedback loop with client

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1. Introduction
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PECSi Workflow

1. User sets policy → **2.** Policy generation → **3.** Policy enforcement →

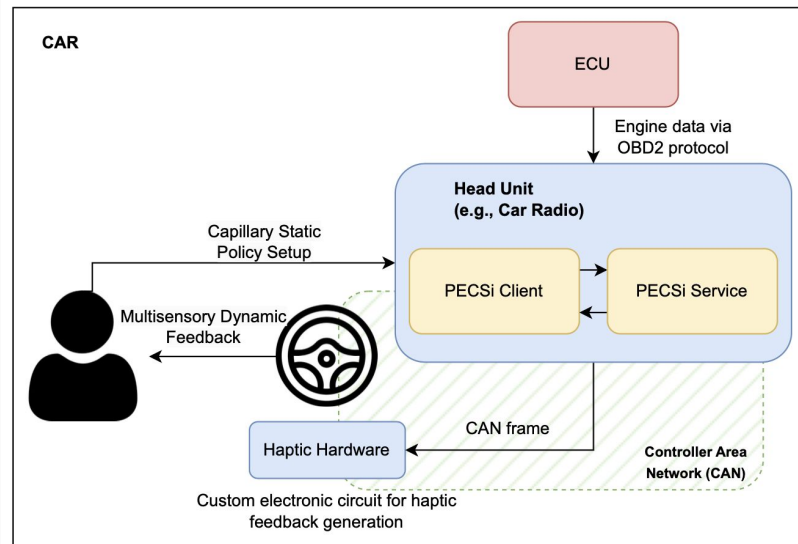→ **4.** Periodic permission checks → **5.** Alert generation → **6.** User notification

PECSi Prototype

Installed on *SXAUTO PX6* (Android 12 head unit)

Custom circuit for **steering wheel vibration feedback**

Integrated **CAN bus** for engine data

TRL 7 prototype tested in real-world *MASA* setting

Takeaways

\+ Innovative use of haptic feedback

\+ Modular and adaptable (tools for OEMs)

\- Manual user action needed post-alert

\- Usability needs refinement

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Conclusions

PECSi presents a novel, **GDPR-aligned privacy control interface** for vehicles

Empowers users with *proactive, sensory-rich* privacy management

Bridges significant **gaps** in the current *automotive privacy landscape*

Future work:

- Usability improvements (UI/UX)
- TRL 8 readiness
- Natural language policy configuration via LLMs
- Broader OEM adoption
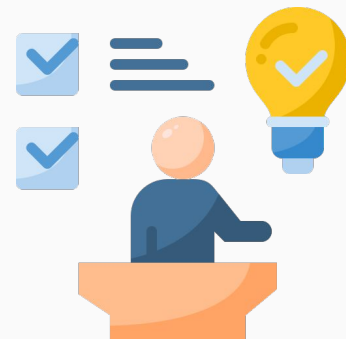
References

PECS Project Website
https://pecs-project.dmi.unict.it/

PECS SDK and Docs (GitHub)
https://github.com/NGI-TRUSTCHAIN/PECS/tree/dev/pecsi/policy_engine/docs

Thanks for your attention!

For more information or questions:

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Non-malicious QR (maybe)