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Document Version

Final published version

Citation (APA)

Rege, A., Kim, E., Kim, S., Sirkin, D., & Currano, R. (2024). Designing Generative AI User Interfaces for Automobiles. In *AutomotiveUI '24 Adjunct: Adjunct Proceedings of the 16th International Conference on Automotive User Interfaces and Interactive Vehicular Applications* (pp. 264-267). Association for Computing Machinery (ACM).
<https://doi.org/10.1145/3641308.3677393>

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Please check the document version above.

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Designing Generative AI User Interfaces for Automobiles

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ABSTRACT

As the development of Generative AI technology continues to progress, the opportunity for innovation with AI in the form of user interfaces, products and services within vehicles is expanding. Furthermore, automobiles are undergoing major transformations in design due to changes in the underlying technology resulting in evolved user needs, behaviors, activities and aspirations. This workshop is aimed at providing the participants hands-on experience of designing novel Generative AI interfaces for vehicles. While working on the design challenge as the connecting thread, we will introduce and weave together modules of knowledge domains focusing on Human-centered design, Ethical and Responsible behavior, and Autonomy in vehicles. Participants will learn about and engage collaboratively in employing design methods such as Co-creation using Activity Canvases, Enactment, Wizard of Oz, Bodystorming and inter-group discussion. As the outcome, we aim to publish participant's design concepts as a booklet and a research paper, and seek new research collaborations.

CCS CONCEPTS

• **Human-centered computing** → **HCI design and evaluation methods.**

KEYWORDS

Generative AI, Automotive User Interfaces, Design Methods for AI, Human-AI Interaction

ACM Reference Format:

Akshay Rege, Euiyoung Kim, Soyeon Kim, David Sirkin, and Rebecca Currano. 2024. Designing Generative AI User Interfaces for Automobiles. In *16th International Conference on Automotive User Interfaces and Interactive Vehicular Applications (AutomotiveUI Adjunct '24)*, September 22–25, 2024, Stanford, CA, USA. ACM, New York, NY, USA, 4 pages. <https://doi.org/10.1145/3641308.3677393>

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AutomotiveUI Adjunct '24, September 22–25, 2024, Stanford, CA, USA

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ACM ISBN 979-8-4007-0520-5/24/09

<https://doi.org/10.1145/3641308.3677393>

1 INTRODUCTION

AI is the science and engineering of making intelligent machines, computer programs and using computers to understand human intelligence [5]. Artificial Intelligence can be employed in any field that seeks to emulate systematic (human-like) thinking such as learning, reasoning, problem solving, etc. and has data resources available or are procurable for the technology to function. Generative AI tools allow users to provide a set of initial requirements or examples, such as keywords, images, or videos, that are processed with neural networks and the outcome can be a synthesis or an optimization [7]. Technological advancements in machine learning architectures such as GANs, VAEs, and transformers have enabled Generative AI to be commercially available to people [8]. Multi-modal AI generation model such as Stable Diffusion or DaLL-E 2 enable untrained people to elicit high-quality digital paintings or designs with simple text prompts, and large language models like GPT and LLaMa demonstrate the possibility to have free flowing text generations and conversations[9]. These developments in AI enable the design of data-enabled interfaces which can engage humans through sensorial interactions.

Further, the development of innovative concepts such as autonomous, automated and electric vehicles as well as mobility as a service would fundamentally change the nature of user interaction with vehicles as passengers expect to undertake diverse activities for spending their time productively and leisurely [4], which will in turn inspire new forms of automobile and Human-vehicle interaction designs [6]. Furthermore, research has found that intelligent in-vehicle systems provide a more personalized and reassuring user experience, by contributing significantly to building trust, safety and above all an entertaining user experience [2].

Accordingly, though Generative AI technology holds the potential to be designed into data-enabled creative applications for users, most designers lack the technical skills and knowledge to fully understand the underlying workings of the technology [1]. Further, there is a low awareness and accessibility surrounding the methods and tools available for designing AI interfaces. Furthermore, designers often tackle wicked problems and consider user perspectives [3], due to which they can be very valuable while designing socio-technical systems such as AI interfaces. In our workshop, we want to address these aspects and answer the following research questions:

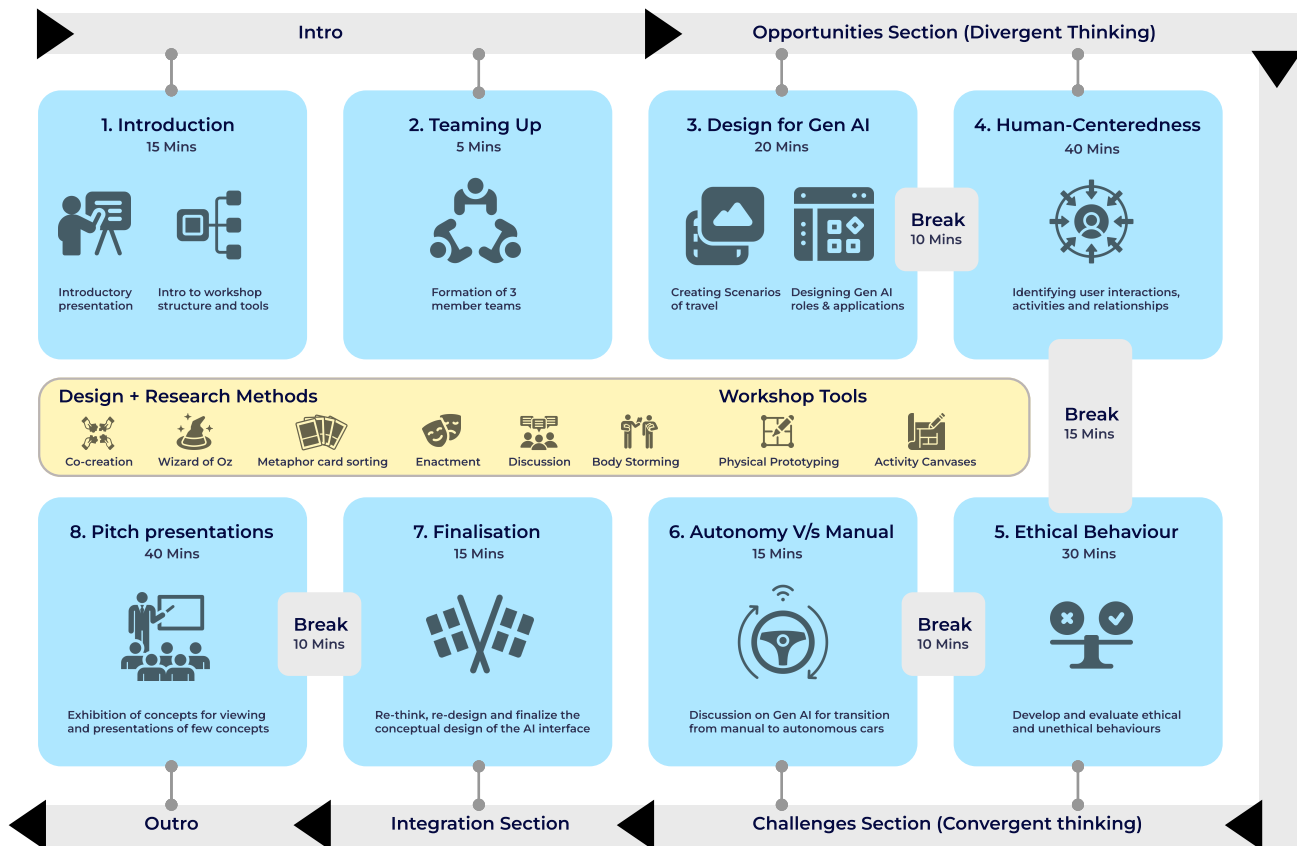


Figure 1: Structure of the workshop

- RQ1: What Generative AI roles and user interface designs can be developed for automobiles?
- RQ2: What in-vehicle user activities, interactions and relationships can Gen AI interfaces mediate in vehicles?
- RQ3: How can designers tackle challenges related to ethics and autonomy that may be encountered while implementing Generative AI interfaces in vehicles?

2 WORKSHOP GOALS AND OBJECTIVES

The goal of the workshop is to identify design innovation opportunities and explore the design of novel Generative AI user interfaces, products and services for automobiles, while providing the participants an opportunity to gain topical knowledge and hands-on experience of using relevant design methods and tools. Accordingly, this workshop has the following objectives:

- (1) To identify new concepts and applications for Generative AI User interfaces in automobiles
- (2) To identify new forms of Human-AI interactions, roles, and relationships in the context of vehicles

- (3) To identify opportunities and challenges in designing Generative AI interfaces to mediate in-vehicle human activities at various levels of vehicular autonomy (0 to 5).
- (4) To identify ethical challenges in incorporating Generative AI in Vehicles.

Our workshop differentiates itself from others by introducing the underexplored topic of Generative AI interfaces for automobiles to the community, emphasizing on user involvement through Human-centered design practices, engaging participants in hands-on usage of design methods to foster a creative output, and make unique contributions through tangible outcomes such as publication of the workshop work and forming collaborations for future work.

3 SCHEDULE, STRUCTURE AND ORGANISATION

The structure and organisation of workshop is described below and in Figure 1. The schedule is mentioned in Table 1.

Table 1: Proposed workshop schedule (3H 45Mins).

Duration	Module	Description
15 Mins	Introduction	Introduction to the workshop's topic, structure of the session, and the supporting tools / materials to be used in the workshop.
5 Mins	Team Formation	Time for formation of teams consisting of 3 members each.
20 Mins	Design for Gen AI	Session for designing Generative AI roles, scenarios of travel, develop AI applications and be introduced to design methods, tools and guiding activity canvases.
10 Mins	Break	Time for networking, rest and recuperation.
40 Mins	Human-Centeredness	Session around using human-centred design methodologies for developing Generative AI interfaces to take into consideration human factors and user insights.
15 Mins	Break	Time for networking, rest and recuperation.
30 Mins	Responsible / Ethical Behaviour	Session for reflecting on and taking into consideration Ethical considerations for designing Generative AI interfaces.
10 Mins	Break	Time for networking, rest and recuperation.
15 Mins	Autonomy V/s Manual	Session for discussing at what level of Autonomy (0 to 5) in vehicles would the participants' designed concept add most value at.
15 Mins	Integration and Finalisation	Session for integrating learning from all modules into a final design concept
10 Mins	Break	Time for networking, rest and recuperation.
30 Mins	Pitch presentations	Session for exhibiting and pitching final concepts.
10 Mins	Feedback and future work	Session for receiving feedback, and for ideating future work and collaborations.

3.1 Pre-Workshop

- (1) **Publicity and Development of Supporting Material:** A website for publicizing the workshop will be created and featured on the website of our universities. We will promote the call for participation through various channels, including the CHI mailing lists, AutomotiveUI social media platforms, and through personal contact lists. Simultaneously, the organizers will develop workshop materials such as activity canvases, metaphor cards, prototyping materials, etc. to ensure a smooth flow of activities and aid the participants.

3.2 During the Workshop

Participants will journey through modules of knowledge domains interspersed with breaks as described below.

- (1) **Introduction:** The workshop starts with a brief presentation on the topic enabling the participants to gain a clear understanding of the topic and context of the workshop. The presentation will explain the structure of the workshop, introduce supporting tools and materials, seed the audiences with a couple of ideas and conclude by providing time for team formation.
- (2) **Design for Gen AI module (Opportunities Section):** After forming teams, the first module is introduced where participants will work on designing Generative AI roles, creating 4 scenarios of travel, and identifying AI applications, all of these for passengers of vehicles. In this module, the method of co-creation will be introduced along with tools of activity canvases and physical prototyping for guidance and support in this creative process. The module will end in a break of 10 minutes.
- (3) **Human-Centeredness module (Opportunities Section):** Participants here will work on designing Generative AI interfaces to be human-centered by bringing in user insights and human-factors. They will identify in-vehicle user interactions and activities that could be mediated by AI interfaces. Participants will then ideate different forms of relationships passengers might form with the in-vehicle AI interfaces. Ultimately, the participants have to evaluate the user experience provided by their concepts, take feedback from peer groups and select one concept. Methods of Wizard of Oz, Body Storming and Metaphor Card Sorting will be introduced. This session will be followed by a 15 minute break.
- (4) **Responsible / Ethical Behaviour Module (Challenges Section):** Here, the participants have to evaluate the user experience of the designed AI interface from the perspective of its ethical and responsible behavior towards users, by prototyping four ethical and unethical behaviors. Next, they will design solutions to mitigate them by identifying design features and personality characteristics that the AI interface should ideally possess. For this purpose, design research methods of enactment and body storming will be introduced along with reference materials (Canvases / Cards) with Ethical theories. The session will end in a break of 10 minutes.
- (5) **Autonomy v/s Manual (Challenges Section):** Participants will use inter-group discussion as a design method to enrich their perspectives and gain new understandings surrounding the transition from manual cars to fully autonomous cars (Level 0 to 5), and each group will select one level based on their research where it would be the most desirable to introduce their designed AI interface. Here, though supporting reference material with information will

be provided, different groups will have the freedom to choose different levels based on their knowledge and preference.

- (6) **Finalisation (Integration Section):** After the discussion, participants in this session will re-think, re-design and finalize their conceptual design of the AI interface for vehicles by incorporating the knowledge gained from all sections. They should simultaneously work on creating prototypes or posters for sharing their work with all participants. The session will end with a 10 minute recess.
- (7) **Exhibition and Pitch presentations:** All the concepts will be exhibited for viewing, and five groups will be asked to volunteer to pitch their concept to everyone. Following each pitch, free discussion will be encouraged amongst the participants to express their thoughts and knowledge gained. Lastly, audience feedback and ideas for future collaborations will be taken, and the workshop will be concluded with a vote of thanks.

3.3 Post-Workshop Outcomes

- (1) **Documentation and Publications:** On conclusion, the organisers will document the participant's design concepts and create a publication quality booklet displaying them. Further, we intend to develop a research paper from our learning by inviting interested participants as collaborators.
- (2) **Collaborations and Community building:** The authors would like to seek collaborations from interested members to continue researching on this topic for publishing in suitable journals / conferences. Further, we would welcome interesting proposals and ideas from attendees for collaboration of diverse forms.

4 ATTENDANCE AND SUPPORT

The organizers welcome twenty-five to thirty interested researchers, practitioners and enthusiasts. No special support is required.

5 AUTHOR BIOGRAPHIES

- **Akshay Rege** is a Design Engineer and a HCI Researcher trained from TU Delft, Stanford University and SPA - India. He focuses on Human-AI, Human-Automobile and Human-Robot interaction design and research.
- **Euiyoung Kim** is an Assistant Professor and a Co-director in the Automated Mobility Lab at TU Delft. He has a Ph.D. in Mechanical Engineering from UC Berkeley and he researches the future of mobility.
- **Soyeon Kim** is a research scientist specializing in HMI design for automated vehicles at TU Delft. She has worked with Hyundai Motors and is skilled in human-centered design, human factors, and data analysis.
- **David Sirkin** is a Research Associate at Stanford University's Center for Design Research, where he focuses on design methodology, as well as the design of physical interactions between humans and robots, and autonomous vehicles and their interfaces. He teaches students how to break and make things.
- **Rebecca Currano** is a Research Associate at Stanford University's Center for Design Research. Her focus is on design

methodology, and on human-vehicle and human-robot interaction design. She has a background in understanding creativity and teaching students how to engage and expand their engineering design skills.

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