Genie vs. Jarvis: The 1st Workshop on Characteristics and Design Considerations of In-vehicle Intelligent Agents

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Intelligent agents (IAs) have been widely used at home and have been gradually introduced into driving contexts. While many studies researched agent features and their influences on user perception toward in-vehicle agents (IVAs), what attributes make IVAs unique and how people perceive them differently from at-home agents remain unclear. Therefore, the proposed workshop with multiple sessions for different time zones aims to bring up a discussion among researchers and practitioners worldwide to contribute insights to a list of characteristics and design considerations for in-vehicle intelligent agents. Features specialized in IVAs will also be discussed in the workshop, along with the preference for the agent form. We expect to extract innovative research and design considerations to benefit IVA research and the AutomotiveUI community.

CCS CONCEPTS • Human-centered computing • Human computer Interaction (HCI) • HCI theory, concepts, and models

Additional Keywords and Phrases: Intelligent Agent, In-vehicle Agent, Automated Driving, user experience

1 INTRODUCTION

An intelligent agent (IA), which acts intelligently when performing user-given tasks [12], is a robust but also flexible computing system that is autonomous and situated in an environment [13]. Intelligent agents (IAs) have penetrated our daily lives in recent years, mainly in the form of voice assistants such as Apple Siri, Microsoft Cortana, Google Home, or Amazon Alexa. Driving is another promising context of IA implementation, where drivers' visual attention resources are mainly occupied by driving tasks. Therefore, using an in-vehicle agent (IVA) can largely benefit drivers from utilizing the auditory channel to communicate with agents for both driving-

related and non-driving-related tasks.

A wide range of studies has proposed and researched IVAs. Functional objectives, as well as design features, have been discussed intensively. IVAs can support driving and non-driving related tasks [3,8], provide information and assist tasks to reduce drivers cognitive demand [9], offer feedback to mitigate the influence of drivers' affective status on driving safety [4,14], and promote overall driving experiences [10,11]. The form factor of agents, such as voice-only agent [11], virtual agent [3], and embodied agent [9,11], is a widely discussed characteristic of in-vehicle agents. Other design features such as speech characteristics (e.g., voice gender [1], voice age [6]), speech style (e.g., informative vs. conversational [11], assertive vs. non-assertive [15], simplified vs. sophisticated commands [2]), and agent attitude (e.g., driver-blame vs. environment-blame [5], egoistic vs. altruistic [7]) were also discussed in previous studies.

The previous research has provided valuable views of characterizing IVAs and inspired us to hold this workshop and its series to further discuss how to optimize IAs to fit driving contexts and what additional considerations should be taken. To achieve such optimization, differentiating features of IVAs in the driving setting will be discussed first. We compare an IVA to Jarvis in the Marvel Universe, who is able to handle a various range of tasks even without user commands, including safety alerts and route planning. On the other hand, we compare an at-home agent to Genie in Disney's animated feature film, *Aladdin*, who is capable of almost everything per request. In other words, IVAs are ***proactively*** engaged in driving tasks for monitoring and notifying road safety conditions, while at-home agents only ***passively*** respond when users ask for information or make a command. This workshop also aims to discover other specialized characteristics of IVAs, distinctive from at-home agents. In addition, design considerations could be derived from these identified characteristics in this workshop. Finally, we will also explore user preference towards the form of agents under different use cases.

2 GOALS AND TOPICS

The primary goals of this workshop are:

1. To integrate a definition and/or a list of characteristics and design considerations of IVAs.
2. To understand the way people perceive two types of agents (at-home vs. in-vehicle agents).
3. To collect a cluster of features required for IVAs under representative use case scenarios.

Corresponding to the primary goals, the discussion topics will be on the following broader levels, some with specific sub-topic examples.

1. What makes an agent an agent?
2. What are the special characteristics of IVAs?
    - What are the unique functions or the roles of in-vehicle agents?
    - What are the unique design considerations for in-vehicle agents?
3. How do drivers and passengers perceive or distinguish these two types of agents, separately and together?
    - Do drivers perceive the agents as a continuous agent no matter at home or in the vehicle?
    - If their appearances or form factors change, do drivers perceive them as the same agent? Under what conditions?
4. What are people's preferences towards the form of the agents?
    - A "one-for-all" agent vs. multiple agents for different **use contexts**; which is preferred?

3 SCHEDULE AND ACTIVITY

This workshop is intended to have two one-hour live sessions stretched in two days for each of the two time zones. Session one mainly aims to achieve the first and second goals from the theoretical perspective, while session two aims to understand the third goal in a practical and interactive approach. Before the conference, a short survey will be sent out to the attendees to collect their research or real-life experiences with IAs and their expectations towards the workshop. Each attendee will also be asked to suggest at least one paper that is related to IAs. The list of recommended papers will be disseminated to attendees, and they can choose one paper from the list and read it before the workshop.

Table 1 shows the tentative schedule and activities during the workshop.

Table 1. Tentative workshop schedule

Time	**Activities**	
	Session 1 (Day 1)	**Session 2 (Day 2)**
Introduction (0:00 – 0:10)	- Introduction to the topic - Icebreaking	- Summary of discussions from the first session - Introduction to intelligent agent design activity
Group discussion (0:10 – 0:45)	- Group discussion on the topics	- Intelligent agent design under a given use case scenario
Presentation (0:45 – 1:00)	- Presentation about the outcomes from activities	

During the first session, a topic introduction, including the brief definition of agent scope, will be given first, followed by an icebreaking activity in the format of speed dating. Attendees will be divided into breakout rooms as pairs, and each attendee of the pair will have 30 seconds to introduce themselves. There will be two rounds of speed dating, the purpose of which is to allow attendees to know each other. Then, a 35-minute group discussion will be conducted to discuss the topic questions mentioned above. Each group can choose two to three topics listed from each theme. Finally, each group will present their discussion outcomes to all attendees.

The results from the first session will be summarized and reported briefly at the beginning of the second session, following the introduction to the agent construction activity. During this activity, attendees will be divided into groups of four and provided a use case scenario. The group will build an agent by selecting features from given categories (e.g., agent type, appearance, information type, verbal characteristics, etc.) to best fit the scenario. The given features consist of ones summarized from the discussion in Session 1 and those derived from existing research articles. Depending on the number of groups, they may be assigned to the same or different scenarios. After the discussion, the designed agent will be presented and discussed among all attendees.

4 ATTENDANCE

We estimate approximately 30 participants in total in this proposed workshop (six attendees per organizer). In each series of workshop sessions for a specific region, we expect to have 14 – 16 attendees.

5 EXPECTED OUTCOMES

Following the workshop, the organizers will obtain a wide range of perspectives and concerns regarding the discussion topics. Since we plan to have attendees from different time zones, discussions under international perspectives can help us better understand potential cultural differences in agent definition or agent feature selection.

With the analysis and interpretation from the group discussion and activity, our ultimate goal is to integrate the outcomes from the workshop and disseminate them to the researchers in and out of the AutomotiveUI community who are interested in this topic. The summarized outcomes will be drafted and prepared for a relevant journal or conference (e.g., next year's AutomotiveUI 2022 conference).

6 SUPPORT REQUESTS

No specific hardware or software is requested for this workshop. We plan to use Zoom if the conference does not provide/require any other online conferencing platforms for the workshop. Miro, an online visual collaborative whiteboard platform, will be used to facilitate discussion and brainstorming sessions.

7 BIOGRAPHIES

Manhua Wang is a first-year Ph.D. student in the Grado Department of Industrial and Systems Engineering at Virginia Tech. She is also a graduate researcher in the Mind Music Machine Lab, leading the in-vehicle intelligent agent research project group.

Philipp Hock is a Ph.D. student in the Human Factors Department at Ulm University. His research interests are human-machine interaction and cooperation, especially regarding automated driving and robots.

Seul Chan Lee is an Assistant Professor of the Department of Industrial and Systems Engineering at Gyeongsang National University. His research goal is to explore users' needs and requirements, to evaluate system artifacts, and to make systems and devices better based on the theories and methodologies of Human Factors and Human-Computer Interaction.

Martin Baumann is a professor for Human Factors at Ulm University since 2014. His main research interests are the cognitive processes underlying the comprehension of dynamic situations in traffic and in the interaction with intelligent machines, such as highly automated vehicles or robots, concepts of cooperative human-machine interaction, human-machine trust development.

Myounghoon Jeon is an Associate Professor of the Department of Industrial and Systems Engineering and the Department of Computer Science at Virginia Tech. His Mind Music Machine Lab tries to integrate different levels of research on human-automation (vehicles, robots, and agents) interaction, including neurological, psychological, and computational approaches. Dr. Jeon will serve as a General Co-chair for AutomotiveUI 2022.

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