

AI Companions in Ride-Hailing: Enhancing Sense of Safety with Voice Chatbots

Rocio E. Alvarado Contreras, Lizbeth Escobedo, Jessica Beltrán *

Published: 30 November 2024

Abstract

In this paper, we present the development and formative evaluation of AI Companion, a voice chatbot based on Artificial Intelligence Large Language Models designed to enhance users' perception of safety and control during transportation using ride-hailing apps or similar services. We conducted a study with 10 participants to understand their travel experiences and evaluate the AI Companion's ability to maintain coherent conversations, simulating a phone call. Our findings indicate that participants generally liked the system. However, we provide several recommendations for significant improvements to the AI Companion.

Keywords:

People's safety; Ride-hailing; Large Language Models; System Evaluation; Voice chat bot; Artificial Intelligence.

1 Introduction

Personal security while commuting, whether by walking, using taxi services, public buses, or any other means, is a critical concern for individuals worldwide. Incidents of crime, harassment, and emergencies can profoundly impact people's confidence in public spaces and transport systems, influencing their daily routines and overall well-being [1] [2].

Various preventive measures are adopted by individuals to address these persistent concerns such as engaging in cell phone call, utilizing surveillance devices, traveling by pairs, not travel at all and or selecting preferred gender options on ride-hailing apps [3], exemplify proactive steps taken to enhance personal safety. However, the effectiveness of these measures can vary significantly based on individual and situational factors, underscoring the need for innovative solutions that bolster a sense of security.

Technological advancements offer promising avenues to augment safety measures and perceptions of safety. From a study [4] involving 197 females on how mobile phones affect safety perception in public spaces, the following findings were reported: the use of mobile phones enhances the feeling of public safety for women, giving a sense of a tool for self-defense in case of emergencies. Many women feel that being seen using a cellphone can deter potential assailants, as those devices can track location, persons can ask for help, and the offender could be identified. Women reported that sharing their location known through their phone makes them feel safer, as it signals to others that they are not alone in. Additionally, some women expressed that while being alone talking to someone on the phone increases their sense of security. Some women even pretended to be on a call when they want to avoid conversations or feel uncomfortable.

The United Nations's campaign *You are not alone* proposed safety communities and provided phone help lines to accompany women in emergency situations¹. This kind of strategy to support women in need of assistance has been proved to be a key factor that could save lives.

In non-emergency situations where confidence and a sense of safety are desired; it has been proposed to use digital companions to enhance women's sense of safety through technology [5]. These companions can be either human or non-human entities, providing reassurance to individuals and signaling to drivers that the passenger is not alone.

Tracking communication while commuting as a crucial protective behavior and leveraging new technologies based on Large Language Models (LLMs), can empower women in these scenarios. In this work, we propose designing a system utilizing conversational agents (bots) or AI-voiced companions to provide support calls to individuals while in transit. Through this innovative approach, our aim is to contribute to ongoing efforts to enhance personal security measures within transportation environments.

2 Related work

There have been different approaches of using technology focused on supporting the safety of people during transportation. For example, some ride-hailing apps, such as Uber or Didi, include features that allow passengers to share their location to chosen contacts and even to record audio during the travel. Other apps offer services to enhance security, like *Silent Beacon*², that works alongside an additional panic button device allowing to connect with predetermined contacts in emergency situations and to share

Alvarado Contreras, R. E., Beltrán, J. *
Centro de Investigación en Matemáticas Aplicadas, Universidad
Autonoma de Coahuila
Saltillo, México.
Email: [r-alvarado, jessicabeltran]@uadec.edu.mx

Escobedo, L.
Dalhousie University
Halifax, Canada.
Email: lizbeth.escobedo@dal.ca

* Corresponding author

¹ <https://www.un.org/en/observances/ending-violence-against-women-day>

² silentbeacon.com

GPS location. Another interesting app is *bsafe*³, that also provides emergency alert and integrates audio and video streaming, sharing of incidents, two-way communication that could even contact with emergency centers, although is only available on the United Kingdom. These types of approaches provide security measures that must be activated by the users when feeling the need and in some cases, they might not be able to activate them since an assaulter could incapacitate them.

Recently, the use of Internet of Things (IoT) devices for enhancing women's safety has garnered significant attention. The work in [6] reviews recent approaches using different types of sensors, such as pulse rate and pressure sensors, alongside technologies like GPS, GSM that along with Machine learning algorithms allow to detect and prevent potential threats. In addition, Human Computer Interaction studies have been developed oriented to design smart city technology for women safety [7]. However, more work must be conducted to develop technology that can provide robust security measures in various contexts, including transportation scenarios.

A relevant study for our proposed work, focused on understanding the security needs of women when riding in shared automated vehicles. The authors categorized these needs into four areas: security, control, information, and self-efficacy, and suggested design features to address them. One of the proposed features is a digital companion to enhance security and control by providing women with a sense of company and conversation. The study's outcomes suggest that this companion could take the form of a human tele-assistant, an avatar, a hologram, or even a chatbot. Authors stated that selecting the appropriate modality requires further research and raises questions about designing a non-human digital companion. Considerations include whether to use audio, video, or chat and how the interactions should be structured [5].

Based on the potential use of current technology, and on the identified needs of women when using ride-hailing services, we are heading towards the development of an AI-based companion. Our proposed system uses LLMs, capable of processing and generating human-like text based on large amounts of data. LLMs have shown a revolutionizing impact since has improved AI capabilities for understanding and producing human language, opening new possibilities to interact with people [8].

3 Methods

We designed an AI companion with voice interaction capabilities and conducted an initial study to assess its functionality and potential areas for improvement. Participants completed a demographic survey, answered questions about their transportation habits and perceived sense of security and evaluated the AI companion using the System Usability Scale (SUS) [9] and responded an interview. All surveys and conversations were held on Spanish; however, we translated to English for more readability of the paper. Our institutional ethics review board approved the study.

3.1 Participants

Over a two-day period, we recruited 10 participants (3 males, 7 females, age $\mu=25.9$, age $std=12.58$) conveniently students in our institution. The researchers provided an explanation of the study's

purpose, and each participant signed a consent form agreeing to share their data.

Participants completed a demographic survey detailing their age, gender, education level, and smartphone usage. Additionally, they answered questions regarding their transportation routines and indicated their level of agreement on a Likert scale for specific statements. Lastly, participants interacted with the AI companion and evaluated the system using a SUS adapted for voice interaction system and provided recommendations.

3.2 AI companion system

The proposed system is developed in Python using the Flask framework and incorporates several key libraries: Flask to create the web application and define routes, request to handle HTTP requests, render_template to render views, and OpenAI to generate text responses and convert these text responses into audio responses. It utilizes a single-button initiation to start receiving voice input, which is then processed using Google's *WebkitSpeechRecognition* for speech-to-text conversion. The system leverages OpenAI's ChatGPT to generate responses and employs the *audio(prompt)* method to synthesize voice output accordingly. This interaction continues until the user issues a "bye" command to shut down the system. The whole text of the conversation, both the speech to text and the ChatGPT responses were saved in a text file for further analysis.

The ChatGPT-3.5 model is based on a Generative Pre-trained Transformer, which consists of 96 layers and has 175 billion parameters [10]. For training the ChatGPT-3.5 model, we used the libraries tiktoken⁴, and langchain⁵. We fine-tuned the ChatGPT model with more than 100 created examples in json format containing interactions between the human and the assistant under casual conversations scenarios that resemble phone calls. We trained the model for 10 epochs. We configured the role settings of ChatGPT as: "You are the user's best friend and should simulate everyday conversation with clever responses that are in line with what the user says. Use exclamation marks where necessary. For example, to show surprise, use ¡wow!, I find it surprising." The participants used the AI companion system using a Huawei 10 phone connected to the Internet to simulate the calls.

4 Results

We analyzed the collected data and derived the following insights concerning participants' perceptions of safety during transportation and their evaluation of the AI companion.

4.1 Demographic information

Of all participants, 2 have a doctorate as their highest level of education, 2 have completed high school, and 6 have completed secondary education. It is important to note that within the campus where the data was collected, there are individuals studying at the high school and bachelor's degree levels, as well as administrative, cleaning, and faculty staff. Additionally, 5 participants are currently studying, 3 are working, and 2 both work and study. Only one participant does not use a smartphone.

³ getsafe.com

⁴ <https://pypi.org/project/tiktoken/>

⁵ <https://python.langchain.com>

4.2 Perception of safety during transportation

Seven participants stated that their primary reason for transportation is commuting to school, while 2 participants cited work as their main reason, and one mentioned performing household chores. Regarding smartphone usage, 8 participants reported using their phones while traveling, 1 indicated occasional use, and 1 reported not using their phone at all. In terms of the main mode of transportation, 3 participants stated they usually use their own car, with waiting times ranging from 0-11 minutes. Three participants indicated using the bus, with two of them waiting 11-20 minutes and one waiting 31 minutes or more. Two participants mentioned traveling with friends or family; one typically waits 0-10 minutes, while the other waits 31 minutes or more. Lastly, concerning the number of people accompanying them during their travels, 2 participants stated they usually travel alone, 3 travel with one other person, 1 travel with 2-3 people, and 4 participants typically travel with more than 3 persons.

In Figure 1, we present responses on a Likert Scale across 11 questions concerning safety perception, transportation habits, and phone usage. The data reveals that most participants feel insecure when traveling at night (Q1) compared to during the day (Q2). Regarding smartphone use for calls or other features, opinions were evenly split among the 10 participants, showing no clear bias (Q4, Q5). Most respondents feel safer in crowded spaces (Q3), remain vigilant during waiting periods or journeys (Q8), maintain communication with their family (Q10), and ensure the driver is familiar with the city (Q11). Interestingly, their contacts often perceive their transportation as unsafe (Q9), and a significant number of participants reported feeling at risk during their trips (Q7). A few individuals (2 females, 1 male) admitted to pretending to be on a call (Q6).

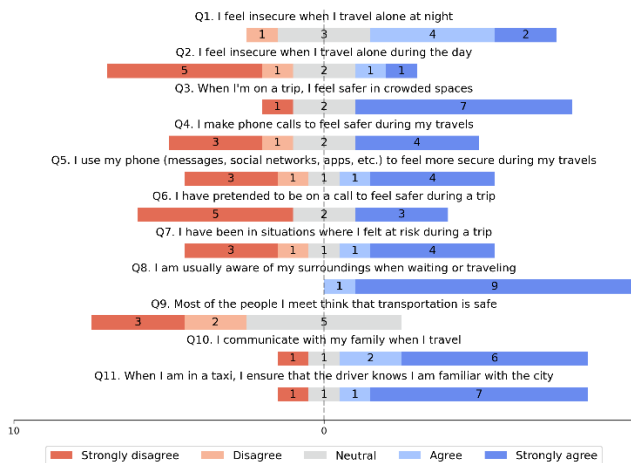


Figure 1. Frequency of responses for each Likert scale question regarding perceptions of safety.

We also asked to participants about how they perceive the safety when traveling alone at night:

- *It depends on the neighborhood. But I don't usually go into dangerous neighborhoods.*
- *I feel that it is safe, especially if it's through an app; I don't feel unsafe.*
- *There's a sense of risk depending on the time. Because of things friends or family have told me that have happened to them, or things that have happened to me. I feel at risk mainly*

because of that, because things have happened to me and to my family and friends too.

- *Well, I would like the driver not to be a man, but a woman. In a car, I go with the seatbelts on and the windows up.*
- *I would like there to be more police surveillance; it's necessary because the streets are empty, and if you walk around the city feeling afraid and insecure everywhere.*
- *Mostly because of the people around me, I don't know if they're good or bad, if I don't know them. I feel safer if there's a woman there, but there's also that insecurity that she could also be bad.*
- *It's not that I'm at risk, but I'm scared.*
- *It seems very dangerous to me because there are times when they harass girls. We don't know who to trust anymore.*
- *I am more alert with the people around me.*

We found the following strategies enhancing safety during transportation,

Showing the user is not alone

- *Always staying in touch with someone so they know where you are and how long it will take you to arrive and keeping them informed if something about the journey doesn't seem right or how it's going.*
- *Sharing location and always letting others know where they are or where they are going.*
- *Traveling accompanied.*
- *Maybe looking busy on the phone sending messages or calling someone.*
- *Sharing location or making a call.*
- *Maybe with a video call or some family member tracking you.*
- *Maybe, for example, being on a call with a friend or family member, so they can keep you company on the way.*
- *Having more surveillance.*

The user knows places around, users are local to the town

- *To look secure, to know the city and where we are going.*
- *Going through a well-lit and crowded area.*

Fast help

- *Having speed dial numbers or something like that.*
- *That on the phone there's a quicker way to send an alert. Because from here to unlock it takes a long time.*
- *A safety kit, a personal defense kit that has like a keychain, like a GPS, and that you press it if you feel in danger, and the closest people, who are your family, know where you are.*
- *Having in the phone something like an alert message*

4.3 AI-companion system's evaluation

Regarding the AI companion evaluation, the outcomes are illustrated in Figure 2. Generally, participants liked the system and found it easy to use. They perceived the system as novel, some were impressed, and the majority even enjoyed using it.

In Q5 (Figure 2) we found only 3 participants perceived AI-generated responses to be clear and understandable and in the same way answers from Q6, we further investigated with the system's log and the interview. During interactions with the AI system, there was at least one instance where the synthetic voice spoke too quickly. Initially, we thought the voice was speaking in another language, but upon reviewing the recorded text, we realized it was simply too fast. Adjusting the playback speed to a slower setting resulted in a bizarre-sounding voice. These instances of rapid speech occurred both when running the system locally and, on the

server, indicating that more work is needed to identify and address the root cause of the problem.

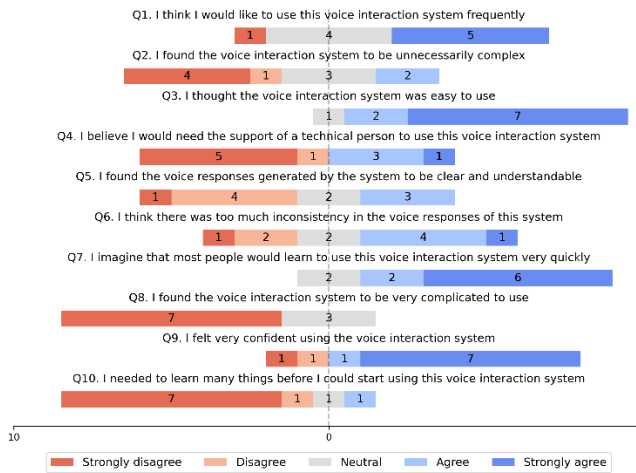


Figure 2. Frequency of responses for each Likert scale question regarding the SUS.

Additionally, we found that AI-responses were sometimes out of context, causing the conversation to lack a coherent flow. While some participants found these out-of-context responses amusing and continued interacting with the system in a playful manner, others felt confused and questioned why the system responded in such a way. Below, we highlight an example of a conversation extract where the system gets out of context and recommends a heavy song instead of heavy meal. In addition, a participant indicated that s/he is out of town and asks for recommendations (still talking about food) and the system recommended a place for vacations.

User: What can I eat at night?

AI companion: Something light, like a sandwich, salad, or fruit.

User: And if I want something a bit heavier?

AI companion: Try listening to "Enter Sandman" by Metallica, it's good for running.

User: Something heavier in terms of food, something stronger.

AI companion: Some suadero and pastor tacos.

User: Very good idea, excellent.

AI companion: Thanks, I'll get the ingredients. Any special cravings?

User: Well, I'm from out of town. What do you recommend?

AI companion: A quiet beach, like Playa Delfines.

We noted that one participant talked for an extended period before allowing the system to respond. The system was unable to keep up with the user because the phrases were too long, resulting in out-of-context responses.

We asked the participants for feedback to improve the AI companion.

- *I think the system should have demographic data loaded and should have context marked to prolong the interaction as long as possible.*
- *The accent, modulating its voice, and understanding the questions better.*
- *Maybe suggest questions in the user manual that can trigger some simple conversation.*
- *It struggles a bit when sending words. When I asked, it didn't quite understand, and I had to rephrase the question in a different way.*
- *A little delayed and short. Responses should be extended to prolong the conversation, not cut it short.*
- *It needs to be more fluent or have more response options.*
- *It didn't sound good, and some weren't understood.*
- *The responses are not very coherent, but it was funny, and I think it's a good idea.*

5 Conclusion and future directions

Based on our initial assessment study with 10 participants, we have identified a notable perception of safety concerns during transportation, underscored by specific incidents in our locality. Participant feedback highlighted the critical need for technological advancements to enhance safety perceptions, with the AI companion potentially playing a supportive role. Our evaluation revealed the need for more fluent and contextually appropriate responses, achievable through further refinement and exploration of alternative strategies if persistent issues arise. A key area for enhancement is enabling the system to facilitate ongoing conversations with focused responses.

One direction for future work is to enhance the naturalness of the interaction. Although the current voice synthesizer is based on OpenAI technology, which does not offer the most naturalistic voice, there are other (paid) platforms, such as ElevenLabs⁶, that could be integrated to achieve greater vocal realism. These platforms can even be trained to emulate specific voices, adding a personalized touch.

Our current approach is focused primarily on enhancing users' safety perception. However, we plan to implement measures for handling emergency situations as well. For example, we intend to incorporate keyword recognition, enabling the system to alert trusted contacts or trigger other safety protocols when it detects potential risks.

A limitation of our current study is the small and homogeneous sample size, which may restrict the generalizability of our findings. However, these preliminary results are valuable for refining our design. In future work, we aim to increase the sample size and diversity to enable a more comprehensive analysis. We also plan to include a control group and compare our approach with existing safety measures in ride-hailing apps. Further, we intend to conduct a longitudinal study to refine the AI companion's conversational capabilities and incorporate user-defined preferences and interaction styles. Moreover, it is crucial to address potential biases in the AI models, explore possible negative effects of the AI companion, and attend to privacy and ethical considerations for users.

6 Acknowledgments

We acknowledge participants in our study and our institution for approving the study.

⁶ <https://elevenlabs.io/>

7 References

- [1] N. Gardner, J. Cui, and E. Coiacetto, "Harassment on public transport and its impacts on women's travel behaviour," *Australian Planner*, vol. 54, no. 1, pp. 8–15, Jan. 2017, doi: 10.1080/07293682.2017.1299189.
- [2] B. Chaudhry, A. U. H. Yasar, S. El-Amine, and E. Shakshuki, "Passenger Safety in Ride-Sharing Services," in *Procedia Computer Science*, Elsevier B.V., 2018, pp. 1044–1050. doi: 10.1016/j.procs.2018.04.146.
- [3] S. Hu and Y. Yang, "Safety of female ride-hailing passengers: Perception and prevention," *Humanit Soc Sci Commun*, vol. 11, no. 1, Dec. 2024, doi: 10.1057/s41599-024-02740-z.
- [4] K. M. Cumiskey, "Simply Leaving My House Would Even Be Scarier': How Mobile Phones Affect Women's Perception of Safety and Experiences of Public Places," *Media Asia*, vol. 37, no. 4, pp. 205–214, 2010.
- [5] M. Schuß, C. Manger, A. Löcken, and A. Riener, "You'll Never Ride Alone: Insights into Women's Security Needs in Shared Automated Vehicles," in *Main Proceedings - 14th International ACM Conference on Automotive User Interfaces and Interactive Vehicular Applications, AutomotiveUI 2022*, Association for Computing Machinery, Inc, Sep. 2022, pp. 13–23. doi: 10.1145/3543174.3546848.
- [6] M. S. Farooq, A. Masooma, U. Omer, R. Tehseen, S. A. M. Gilani, and Z. Atal, "The Role of IoT in Woman's Safety: A Systematic Literature Review," *IEEE Access*, vol. 11, pp. 69807–69825, 2023, doi: 10.1109/ACCESS.2023.3252903.
- [7] M. Osipova and E. Hornecker, "Exploring the potential for Smart City technology for Women's Safety," in *ACM International Conference Proceeding Series*, Association for Computing Machinery, Oct. 2023, pp. 245–256. doi: 10.1145/3616961.3616988.
- [8] T. Wu *et al.*, "A Brief Overview of ChatGPT: The History, Status Quo and Potential Future Development," *IEEE/CAA Journal of Automatica Sinica*, vol. 10, no. 5, pp. 1122–1136, May 2023, doi: 10.1109/JAS.2023.123618.
- [9] S. C. Peres, "The Effect of Experience on System Usability Scale Ratings," 2011. [Online]. Available: <https://www.researchgate.net/publication/267411691>
- [10] D. Banik, N. Pati, and A. Sharma, "Systematic exploration and in-depth analysis of ChatGPT architectures progression," *Artif Intell Rev*, vol. 57, no. 9, Sep. 2024, doi: 10.1007/s10462-024-10832-0.



© 2024 by the authors. This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/> or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.