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Literature Review
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Do Explanations Matter? Proactive Communication and Trust in Fully Autonomous Taxis in Saudi Arabia

Introduction

Autonomous vehicles (AVs) are moving rapidly from concept to real-world pilot deployments. The rapid deployment of autonomous vehicle technologies, particularly *robotaxis*, offers numerous benefits such as improved mobility and traffic efficiency (Zhao, et al., 2025). There are current pilots of *robotaxis* in Saudi Arabia through collaborations with the Transport General Authority (TGA) and industry partners (e.g, , Uber, WeRide, and AiDriver). Despite significant progress in perception, decision-making, and control technologies, public acceptance remains uncertain. A major obstacle is the *trust gap*: passengers may feel unsafe or anxious when vehicle behavior is opaque or unpredictable. This challenge is particularly acute in *fully autonomous taxis (robotaxis)*, where there is no human driver to reassure passengers through explanations or visible intent.

One promising design approach is *proactive communication of driving intentions*, a feature that enables, for example, announcing an upcoming lane change, stop, or reroute before the maneuver occurs. By making the system's behavior transparent, proactive communication can enhance passengers' sense of safety and confidence. However, it may also increase cognitive load if delivered excessively or at inappropriate moments. Therefore, careful study is required to determine whether proactive intent communication improves trust, safety perception, and willingness to use autonomous taxis.

Problem Statement

Although autonomous vehicles have reached a level of technical maturity sufficient for pilot operations, their widespread adoption hinges on *human trust* and *perceived safety*. Current systems often provide limited feedback, offering only status updates such as "turning" or "slowing down." This minimalist style may leave passengers uncertain about what the vehicle is about to do, especially during complex maneuvers. Research indicates that proactive interaction, where the system communicates its intentions in advance, can potentially bridge this gap.

This study addresses the problem of whether proactive communication of driving intentions in autonomous taxis in Saudi Arabia leads to higher levels of passenger trust, perceived safety, and willingness to use, compared to minimal communication.

Related Work

The transition from human-controlled to autonomous driving requires rethinking how vehicles communicate with passengers. Existing studies highlight that trust plays a central role in the acceptance and proper use of automated systems. Building on this foundation, relevant previous work is examined in the subsequently through key themes that inform the present study. These thematic sections are: (1) the role of trust in technology use, (2) the evolution of human–vehicle interaction and the emergence of proactive communication, and (3) recent frameworks that conceptualize proactive interaction in autonomous vehicles.

Trust and Technology

Trust is central to the acceptance of automated systems, especially in safety-critical domains. Sheridan (2019) highlighted that correct use of modern technology depends strongly on trust, which shapes user reliance and willingness to delegate control. In the context of automation, trust also mitigates negative emotions and anxiety (Zhang et al., 2021), making it a crucial factor in passenger acceptance of autonomous mobility services.

Trust lies at the heart of how people accept and use modern technological systems, particularly those that are critical and may influence safety and personal well-being. Sheridan (2019) noted the appropriate use of use of modern technology and advanced systems depends strongly on users' trust and their confidence in them. This is essential in shaping both reliance and willingness to delegate control. From automated transportation to medical diagnosis, all recent developments across fields show that technology increasingly performs tasks once reserved for humans (Schuetz & Venkatesh, 2020; Schuetz et al., 2025). This expansion of machine capability has transformed how individuals live, work, and interact, making trust in technology a pervasive issue that affects nearly every domain of life (Schwab, 2016).

There is a consensus which cofirms that humans' trust in technology becomes a factor that enters virtually every domain. However, trust in technology operates as a double-edged concept. While modern systems can deliver remarkable efficiency and convenience, they may also introduce new categories of risk, such as misinformation, flawed recommendations, or biased decision-making. Consequently, maintaining an appropriate level of trust, neither over-trust nor under-trust, is essential to ensure safe and responsible use. In the context of autonomous transportation, cultivating well-calibrated trust is especially critical: passengers must feel assured that the vehicle's decisions are reliable and transparent, yet remain attentive enough to intervene or disengage when necessary (Zhang et al., 2021).

A study by Zhao, et al., (2025) investigated the challenges such new innocation may present for traffic management and law enforcement in China. The study explored how traffic law enforcement officers in Chinese cities with active robotaxi fleets perceive the introduction and operation of autonomous taxis. The research explored their views on safety, compliance, and daily management issues related to robotaxis, and used an online survey with more than 4,000 officers from major cities such as Beijing, Shanghai, and Shenzhen

Findings indicate that most officers hold generally positive attitudes toward robotaxis, recognizing their potential to enhance road safety and improve traffic flow compared to conventional taxis. Nonetheless, many respondents expressed ongoing concerns about rule adherence, accident

liability, and cybersecurity risks. Statistical analysis showed that officers with greater exposure to automation technologies and previous experience with robotaxis were more likely to support their deployment. The study highlights the importance of frontline perspectives for shaping regulations and public policy on autonomous transport, emphasizing the need for continuous training, clear operational guidelines, and improved coordination between law enforcement and technology operators.

Human–Vehicle Interaction and Proactive Communication

As autonomous driving capabilities increase, the human role has shifted from direct control to supervisory oversight. Reviewing the literature from the past five years, a study by Sun et al. (2024) was found to be closely aligned with the scope of the present research in its purpose, methodology, and research questions. Sun et al. (2024) showed that *proactive interaction (PI)*, which originated from sociological concept of proactive behavior, has measurable effects on trust in AVs.

The study experimented in a controlled virtual reality environment using the *Wizard-of-Oz method*. It simulated three degrees of PI: low interaction (i.e., direct action without communication), medium interaction (i.e., informing the driver before action), and high interaction (i.e., seeking driver confirmation before action). The researchers found that higher levels of proactive communication generally increased trust, though effects varied by context, gender, and personality. In specific, communication style significantly affected perceived trust and system acceptance. When participants were not multitasking, higher levels of proactive communication increased their trust in the vehicle and improved perceptions of its capability. However, under multitasking conditions, drivers expressed greater trust in low-interaction systems, indicating that excessive or poorly timed communication could reduce comfort and confidence.

Moreover, gender and personality traits moderated these effects. Female participants and moderately extroverted individuals tended to show higher trust in proactive systems, whereas male participants reported lower trust under medium interaction levels. Additionally, systems without PI were the least trusted when extroverted and less extroverted participants, which can be attributed to to situational awareness (Petersen, et al., 2019). The study concludes that trust in autonomous vehicles depends not only on technical reliability but also on how the system communicates with its users. It highlights the importance of adaptive interaction strategies that respond to contextual and personal factors—an insight particularly valuable for understanding how users in emerging robotaxi markets may develop or withhold trust toward self-driving vehicles.

More recently, Chang, et al., (2025) investigates how pedestrian trust, receptivity, and behavior evolve during interactions with Level-4 AVs. The researchers conducted a real-world experiment in a commercial Robotaxi operation zone on 33 participants when they repeatedly crossed an uncontrolled intersection with frequent Level-4 Robotaxi traffic, and used behavior questionnaires and different other scales to meet their aims. Results showed pedestrians' trust would increase after interacting with the Avs, and that personality factors can moderate the formation of trust in AVs.

Similarly, Kraus et al. (2020) demonstrated that proactive dialogue strategies in automated assistants can significantly shape trust and user engagement. They classified the PI levels in robot

assistants from low to high as none, notification, suggestion, and intervention. The results indicated proactive dialogue showed strong effects on cognition-based trust (system's perceived competence and reliability) depending on task difficulty.

Li et al. (2025) propose a framework for studying proactive interaction in automated vehicles. According to Li et al's study, proactivity can be organized along multiple dimensions such as timing, modality, and informational content. Building on this framework, the present study focuses on proactive intent announcements, testing whether anticipatory communication improves passenger trust and perceived safety compared to minimal communication.

Other existing research has investigated a similar aim of the effectiveness of proactive behavior but on social robots (e.g., Satake, 2009) or users' perceptions of anthropomorphic attributes at five levels of proactive behavior in a social robot (e..g, Tan, et al., 2020).

Gaps in Existing Research

While studies confirm that proactive communication influences trust in AVs, most experiments have been conducted in driving simulators or VR settings with licensed drivers**.** Less is known about passengers in real or simulated robotaxis. Furthermore, to the best of my knowledge, the current research study will be the first to conducte in the context of Saudi Arabia, where autonomous mobility pilots are underway. Moreover, few studies explicitly test the balance between proactive intent announcements (transparent, anticipatory communication) versus minimal status updates **(**concise but opaque).

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