

# Exploring the acceptance of shared follow-me delivery robots: An extended UTAUT2 approach

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## EXTENDED ABSTRACT

In response to pressing challenges such as climate change, air quality concerns, growing urban populations, and overloaded transport networks, autonomous vehicles (AVs) are increasingly seen as a promising solution [1, 2]. Among these AVs, follow-me delivery robots (DR follow) represent a novel and underexplored application that autonomously track and follow a human operator, using camera and/or LiDAR sensors [3]. Designed for pedestrian and cycling infrastructure, they reduce physical strain and integrate smoothly into dense urban environments [1, 3, 4]. Despite their growing technological maturity, the acceptance of DR follow robots remains largely unstudied [1].

To investigate this, the present study focuses on a use case where DR follow robots are part of a sharing system. In such a scenario, individuals can temporarily borrow a robot to transport goods or personal items over short distances, enhancing active transport.

To examine user acceptance in this context, this study applies the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) a widely used framework in technology acceptance research. In recent years, UTAUT2 has been increasingly applied and extended to investigate acceptance of various autonomous transportation solutions [5, 6, 7], demonstrating the model's adaptability and relevance for capturing behavioural intention and use behaviour across diverse contexts of autonomous transport.

To explore the acceptance of SDR follow, five focus groups were conducted with 22 non-experts and 11 experts in urban goods transport in Weiz and

Feldkirchen (Austria) between April and June 2024. In all groups, semi-structured interview guides ensured a balance between comparability and openness to new insights.

Sessions were moderated and recorded with consent. Non-expert discussions lasted 160–180 minutes, expert discussions 105–125 minutes. All discussions were transcribed, anonymized, and analysed in MAXQDA24 using thematic content analysis, combining deductive UTAUT2-based coding with inductive identification of additional constructs. In total, 748 coded references were identified.

The analysis of the focus group discussions revealed that acceptance of SDR follow seems to be influenced by nine key factors: (1) product features, (2) facilitating conditions, (3) performance and (4) effort expectancy, (5) perceived risk, (6) service availability, (7) perceived reliability, (8) hedonic motivation and (9) price value.

Regarding (1) product features, participants emphasized that the robot should accommodate everyday mobility and shopping needs. Participants highlighted the importance of size, load capacity, and practical loading-surface design. Terrain adaptability was considered essential, with the expectation that the SDR follow can operate on various surfaces and under different weather conditions. A range of about 10–15 km, reliable battery life, and appropriate speed were considered necessary for daily use. Additional features such as thermal insulation, weather protection, active cooling, and anti-theft measures were viewed as factors that could further increase acceptance.

(2) Facilitating conditions were the most frequently mentioned construct of the original UTAUT2 framework. Participants emphasized that aspects of road and mobility infrastructure, including narrow paths, paving blocks, public transport connections, and bike-sharing co-location, influence acceptance. The type of sharing station was also seen as important, with distinctions between retailer-based and public models. Participants further mentioned the importance of assistance, particularly for older or less tech-savvy users, and raised concerns about unclear legal conditions. Urban areas were generally considered more suitable than rural ones due to distance and topography, and snow was noted as a potential limitation, underscoring the need for winter operability.

Moreover, the (3) performance expectancy was discussed as an influencing factor for acceptance. Participants highlighted increased independence, easier transport of heavy goods, everyday convenience, and greater efficiency in daily routines. Potential health benefits and shifts toward more active

lifestyles were noted. Experts further emphasized business advantages, including faster deliveries, increased sales through improved transport options, and the innovative appeal. Societal benefits, including reduced car traffic, calmer streets, better air quality, and more liveable urban spaces, were also seen as enhancing acceptance.

Participants also emphasized that the (4) effort expectancy, in terms of intuitive, low-effort operation, is important for acceptance, whereas concerns about tasks such as returning the SDR follow made the system seem potentially inconvenient. Learning barriers for older adults were highlighted while participants stressed a low usage threshold and complementary support services as well as multilingual interfaces to accommodate tourists and linguistically diverse users.

Focus group participants further highlighted several (5) risks that appeared to affect their willingness to adopt SDR follow. Key concerns centred on potential misuse, vandalism, and theft. Additionally, the risk of accidents, including property damage and injuries to users or others, was frequently mentioned. Urban environments were considered particularly risky due to complex traffic conditions and crowded areas. In response to these concerns, many participants called for clear regulations and comprehensive insurance policies to mitigate risk and enhance trust.

Experts and non-experts agreed that acceptance of SDR follow may also depend on its reliable and convenient (6) service availability via a well-designed sharing infrastructure. Crucial factors included on-demand accessibility without requiring detours. High usage potential was expected in densely populated residential areas and pedestrian-heavy zones. Suggestions also included integration with existing sharing systems and placement at Park & Ride facilities. The option to reserve robots in advance was seen as an important feature to enhance user convenience.

Acceptance of the SDR follow was further linked to its technical reliability (7), particularly regarding the follow-me function and smooth operation in real-world environments. Participants expressed expectations of consistency and dependability, including regular maintenance and cleanliness. Availability was considered a key aspect of reliability, with participants emphasizing the need for multiple robots to be accessible simultaneously and for shared stations to be easy to locate and clearly marked.

Participants moreover highlighted that (8) hedonic motivation, including pleasure, enjoyment, curiosity, and interest, could positively influence

acceptance of the SDR. Some specifically described positive emotional experiences as important for user engagement.

Finally, (9) price-value was perceived as a critical factor influencing the acceptance of SDR follow. compared it to the costs and effort of private cars, cargo bikes, or delivery services, noting that acceptance would be higher if SDR follow were cheaper and more convenient. Many suggested that offering the service free of charge could further support acceptance.

This study identified nine key factors shaping the acceptance of SDR follow. While the UTAUT2 model provides a solid starting point for understanding the acceptance in this context, it requires additional extended constructs and contextual adaptations. Since SDR follow has not yet been introduced into everyday life, participants largely referred to anticipated functions and contextual fit rather than established habits or social influences.

Future research might seek to validate the findings using survey-based and experimental approaches with larger sample sizes, ideally incorporating real-world applications of functional SDR prototypes to capture actual user behaviour.

Overall, the findings in this study offers a nuanced and context-sensitive framework for understanding how individuals form intentions to adopt SDR follow.

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