Design Ethics and the Sharing Economy: Frontier Explorations and Innovative Developments from an Interdisciplinary Perspective

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***Abstract*—This paper focuses on the frontier areas of design ethics and the sharing economy, delving into their theoretical connotations, practical applications, challenges faced, and future development trends from an interdisciplinary perspective. By integrating ethical considerations in automated vehicle control with the moral logic within the sharing economy, this study analyzes the connections and distinctions between the two in terms of market construction and societal impact, revealing the pivotal role of ethical factors in emerging technologies and economic models. The research findings indicate that in automated vehicle control, ethical frameworks can guide engineering decisions to align vehicle behavior with societal expectations; participants in the sharing economy, on the other hand, attempt to construct markets based on morality, pursuing social connectivity and autonomous creation. However, both face numerous challenges, such as technological complexity, ethical dilemmas, and market regulation. Future research should deepen interdisciplinary collaboration to promote theoretical innovation and practical development, thereby fostering the sustainable development of design ethics and the sharing economy, and providing robust support for societal progress.**

Keywords—Design Ethics, Sharing Economy, Interdisciplinary Research, Moral Logic, Technological Innovation

I. INTRODUCTION

In the context of the rapid technological advancement and profound socio-economic transformation of today's era, design ethics and the sharing economy have emerged as cutting-edge fields of significant attention (George et al., 2024). Automated vehicle control, as a quintessential example of emerging technology, encompasses not only technological progress but also complex ethical issues (Nguyen et al., 2024); the sharing economy, on the other hand, is transforming people's production and lifestyles through innovative economic models, prompting a deep contemplation of the relationship between morality and the market (Iqbal et al., 2024). This study aims to dissect the intrinsic mechanisms, interrelationships, and challenges of these two domains from an interdisciplinary perspective, providing theoretical foundations and practical guidance for their sustainable development (Tang et al., 2024).

A. Research Background and Significance

With the continuous progress of technology, automated vehicle control technology is becoming increasingly sophisticated, offering the potential to significantly improve traffic efficiency and safety (Madhavaram et al., 2024). However, the decision-making processes during vehicle operation encompass a multitude of ethical considerations. For instance, in the event of an unavoidable collision, should the priority be to protect the occupants within the vehicle or pedestrians? These questions pertain not only to individual life safety but also to the allocation of social justice and moral responsibility (Gros et al., 2024). The emergence of the sharing economy has introduced a novel model for resource allocation and economic development, achieving efficient utilization of resources and sustainable economic growth through the sharing of idle resources (Gupta et al., 2024). At the same time, the sharing economy also faces moral dilemmas such as platform monopolies, safeguarding workers' rights and interests, and the establishment of trust mechanisms (Tang et al., 2024). Conducting in-depth research on design ethics and the sharing economy is conducive to preserving the core values of human society during the processes of technological development and economic innovation, and promoting the development of society towards greater equity, harmony, and sustainability (Yan et al., 2024).

B. Research Status Domestically and Internationally

In the field of automated vehicle control, scholars both domestically and internationally have conducted extensive research on its ethical issues (Yan et al., 2024). Some studies have focused on the construction of ethical frameworks, attempting to integrate moral principles into vehicle control algorithms to guide decision-making in complex traffic scenarios (Madhavaram et al., 2024). For instance, some scholars have proposed deontological frameworks based on rules and consequentialist frameworks based on outcomes, exploring the morality of vehicle behavior from the perspectives of action rules and decision consequences (Hind, 2024). However, existing research still falls short in balancing different ethical principles, addressing cultural differences, and resolving moral dilemmas in practical applications (Liu et al., 2024).

Regarding the sharing economy, research primarily revolves around its economic models, social impacts, and regulatory policies (Gupta et al., 2024). Scholars have discussed the impact of the sharing economy on traditional industries, its effects on the job market, and the motivations of consumers to participate in the sharing economy (Tang et al., 2024). However, there is a need for further in-depth research on the moral foundations of the sharing economy, the ethical behavior norms of market participants, and how to construct a sustainable sharing economy ecosystem.

C. Research Methods and Innovations

This study employs an interdisciplinary research approach, integrating theories and methods from ethics, engineering, sociology, economics, and other disciplines to conduct a comprehensive and in-depth analysis of design ethics and the sharing economy (Moral-Pajares et al., 2024). Specifically, the study uses literature review methods to collate domestic and international research findings, clarifying the cutting-edge issues in the field (Klimczuk et al., 2024); employs case study methods to delve into actual cases in automated vehicle control and the sharing economy, revealing the mechanisms by which moral factors operate within them (Blazic, 2024); and utilizes empirical research methods to collect data, validate theoretical hypotheses, and provide solid empirical support for the research conclusions (Feng, 2024).

The novelty of this research is found in its systematic investigation of design ethics and the sharing economy from an entirely new interdisciplinary perspective, transcending traditional academic boundaries to uncover the intrinsic connections and synergistic development mechanisms between the two fields (Zhang, 2024). Moreover, by integrating avant-garde theories with empirical cases, the study formulates targeted and actionable development strategies, providing fresh perspectives and methodologies for theoretical research and practical applications in related domains (Gupta et al., 2024).

II. Ethical Considerations in Automated Vehicle Control

A. Application of Ethical Frameworks in Vehicle Control

Automated vehicle control confronts a multitude of complex ethical issues, the resolution of which is crucial for ensuring the safe and efficient operation of vehicles, as well as gaining widespread societal acceptance (Thaker, 2024). Traditional vehicle control systems have primarily focused on technical performance indicators, but with the advancement of automation, vehicles are required to make decisions that align with societal expectations in various complex traffic scenarios, involving deep ethical considerations (Gros et al., 2024).、

Deontological ethical frameworks provide significant guiding principles for automated vehicle control. For instance, akin to Asimov's three laws of robotics, vehicles should adhere to a series of strict rules during operation, such as not harming humans and obeying traffic regulations. These rules are manifested as constraints in vehicle control algorithms, ensuring that the vehicle's behavior meets basic moral standards (Adewale, 2024). In practical applications, a vehicle's control system can prevent dangerous or immoral actions by setting constraints, such as limiting vehicle speed and maintaining safe distances from the vehicle in front (Birkstedt, 2024).

Utilitarian ethical frameworks assess vehicle control decisions from the perspective of consequences. The goal of the vehicle is to maximize traffic efficiency while ensuring safety, that is, to pursue the optimal overall benefit (Patil, 2024). For example, when facing traffic congestion, vehicles can reduce overall traffic delay and enhance road capacity by optimizing driving routes and adjusting speeds. However, utilitarianism faces numerous challenges in practical application, such as accurately assessing the consequences of different decisions and balancing the interests of various stakeholders (Kester et al., 2024).

B. Ethics-Based Vehicle Control Algorithm Design

To effectively implement ethical frameworks in automated vehicle control, researchers have integrated them with Model Predictive Control (MPC) to design vehicle control algorithms capable of real-time decision-making (Hindoriya & Talele, 2024).In terms of path tracking, the primary objective of the vehicle is to follow a predetermined path. However, in actual traffic scenarios, various obstacles or emergencies may be encountered, necessitating a certain degree of flexibility from the vehicle (Mu et al., 2024). Consequently, researchers have adopted a flexible strategy, treating path tracking as an optimization problem by minimizing the deviation between the vehicle and the predetermined path (Sethi, 2024). Specifically, the vehicle acquires environmental information through sensors, predicts its trajectory for a certain period in the future, and selects the optimal path based on these predictions. In this process, the vehicle considers multiple factors, such as the location of obstacles, traffic flow, and road conditions, to ensure safe and efficient travel (Sankaranarayanan, 2024).

Vehicle steering control involves multiple objectives, including operating within actuator limits, aiding in path tracking, avoiding obstacles, and ensuring ride smoothness (Cabanela, 2024). Regarding actuator constraints, such as maximum steering rate, they are incorporated into the control algorithm as constraints to ensure that the vehicle's operations comply with physical limitations. This is because exceeding actuator limits may lead to loss of vehicle control, potentially causing safety incidents (Hindoriya & Talele, 2024). On the basis of meeting these constraints, to enhance passenger comfort, steering smoothness is considered an optimization objective, achieved by minimizing changes during the steering process. For instance, the vehicle can adjust steering angles and speeds to make the steering process smoother, reducing passenger discomfort (Mu et al., 2024).

C. Manifestation of Ethical Considerations in Actual Driving Scenarios

In real-world driving scenarios, automated vehicles must make decisions based on varying traffic conditions and ethical considerations. For instance, when encountering road construction or traffic accidents that cause lane blockages, vehicles need to choose an appropriate detour path while adhering to traffic regulations and ensuring safety (Bayan, 2024). This may involve crossing double yellow lines or entering emergency lanes, situations where the vehicle must weigh the moral consequences of different decisions (Ding, 2024). If traffic regulations are regarded as absolute deontological rules, the vehicle might opt to wait for the road

to clear, even if this exacerbates traffic congestion; whereas from a utilitarian perspective, the vehicle might choose to violate traffic regulations to bypass obstacles quickly, reducing overall traffic delay (Khanh et al., 2024).

Another significant scenario involves the vehicle's decision-making in emergency situations, such as when facing an inevitable collision, whether to prioritize the protection of passengers inside the vehicle or pedestrians (Mangone, 2024). This is an extremely challenging ethical dilemma, with different ethical frameworks potentially providing different answers (Singh et al., 2024). From a deontological perspective, the vehicle may have a primary responsibility to protect the lives of passengers within the vehicle; whereas from a utilitarian standpoint, it might be necessary to weigh factors such as the number, age, and health status of passengers and pedestrians to achieve the minimization of overall harm (Poszler et al., 2024).

D. Automated Vehicle Control Ethic2s Experiment

1) Experimental Objective

The experiment aims to simulate the behavioral decision-making of vehicles in various traffic scenarios to validate the operability of ethical frameworks within vehicle decision-making and to assess the impact of different ethical frameworks on the safety and social acceptance of vehicle decisions.

2) Experimental Scenarios

The simulation of vehicle behavioral decision-making in diverse traffic scenarios, including avoiding pedestrians, managing emergencies (such as inevitable collisions), and addressing complex conflicts in traffic regulations.

3) Experimental Variables:

Independent Variables: Types of ethical frameworks (deontological, utilitarian), types of traffic scenarios (regular commute, emergency events, regulatory conflicts).

Dependent Variables: Safety scores of vehicle decisions, social acceptance scores.

4) Experimental Tools

Virtual simulation platforms (such as CARLA or SUMO) equipped with autonomous driving algorithms that incorporate ethical decision-making models.

5) Experimental Procedures:

Setting up three typical traffic scenarios in the simulation environment, designing decision logic based on different ethical frameworks, and recording the vehicle's behavioral decisions, time required to complete tasks, and interactions with other traffic agents under each framework.

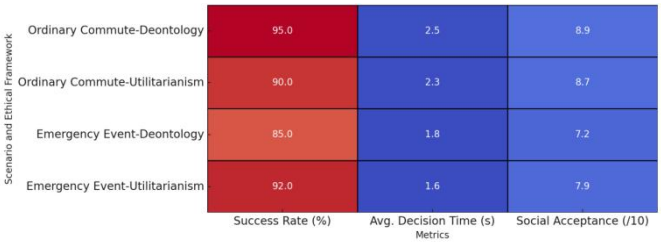
6) Data Collection:

Decision Success Rate: The proportion of successful task completions by the vehicle under different ethical frameworks.

Decision Time: The time it takes for the vehicle to make a decision from the moment the task is received.

Social Acceptance of Decision Outcomes: Obtained through subject rating surveys.

TABLE I. PPERFORMANCE METRICS FOR ETHICAL FRAMEWORKS IN DIFFERENT SCENARIOS



7) Figure Explanation

Table 1 is a scientific table with a heatmap background, presenting experimental data under different scenarios and ethical frameworks, including success rates, average decision times, and social acceptance scores:

a) Table Structure

Horizontally displays key indicators (success rate, decision time, social acceptance score).

Vertically displays combinations of scenarios and ethical frameworks.

b) Visual Optimization

The heatmap uses color intensity to represent the magnitude of values, aiding in the quick identification of high and low values.

Adds gridlines and textual annotations to enhance aesthetics and readability.

8) Data Processing and Analysis

Data Preprocessing: Cleansing the experimental data, removing outliers. Transforming qualitative data (such as types of ethical frameworks) into quantitative data (such as coding of decision types).

Statistical Analysis: Employing one-way analysis of variance (ANOVA) to compare whether there are significant differences in the safety and social acceptance scores of vehicle decisions under different ethical frameworks.

Visualization Analysis: Plotting bar charts comparing scenario types with ethical frameworks to intuitively display the performance of different ethical frameworks under various scenarios.

9) Results Presentation and Discussion

Experimental Results Figure: Figure 1 demonstrates a comparison of social acceptance scores for automated vehicles under different ethical frameworks.

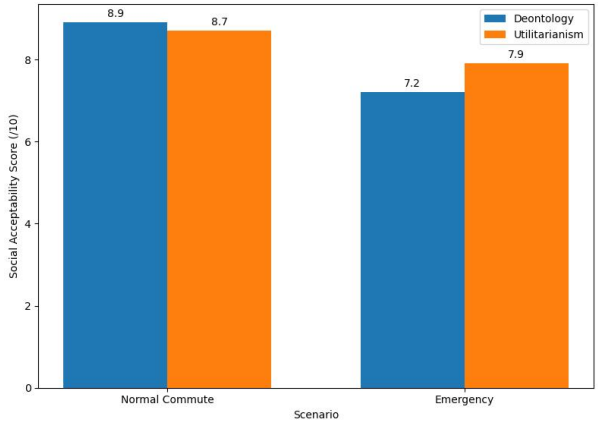


Fig. 1. Social Acceptability Scores under Different Ethical Frameworks

Figure 1: A grouped bar chart displaying the social acceptability scores under different ethical frameworks and scenarios.

Results Discussion: In regular commuting scenarios, the deontological framework exhibits greater social acceptance, likely because its decisions align more closely with people's everyday moral intuitions and adherence to established rules. Meanwhile, the utilitarian framework demonstrates a higher decision success rate in emergency events, due to its ability to rapidly weigh the consequences of different decisions and select the option that maximizes overall benefits. However, decisions made by the utilitarian framework may, in some cases, conflict with traditional moral values, leading to relatively lower social acceptance. This suggests that in practical applications, it is necessary to flexibly choose or integrate different ethical frameworks based on specific scenarios to achieve a balance between the safety, efficiency, and social acceptance of vehicle decisions.

III. Moral Logic in the Sharing Economy

A. The Moral Foundation of the Sharing Economy

The development of the sharing economy is based on a series of moral principles that encourage participants to actively engage in sharing practices and attempt to construct a new economic model (Xue, 2024). The sharing economy emphasizes the sharing and reuse of resources, with its moral foundation lying in the pursuit of social equity, sustainable development, and community building (Sankhala, 2024). By sharing idle resources and reducing waste, the optimization of resource allocation is achieved, which aligns with the moral requirements of sustainable development (Lu, 2024). Moreover, the sharing economy disrupts the absolute dominance of ownership in traditional economic models, promoting interaction and cooperation among people and contributing to the construction of more equitable and inclusive social relationships (Libasci, 2024).

In the sharing economy model, trust between participants is a crucial foundation for its operation. This trust is based on the moral principle of reciprocity, where participants believe that others will adhere to sharing rules, use shared resources responsibly, and return or provide appropriate compensation after use (Miranti, 2024). For instance, on sharing accommodation platforms, hosts trust that guests will take care of the property, while guests trust that hosts will provide a safe and comfortable living environment (Kuanova et al., 2024). The establishment of this trust mechanism relies not only on the platform's credit evaluation system but also on the moral constraints within the hearts of the participants (Tiwari et al., 2024).

B. Moral Motivations of Sharing Economy Participants

In-depth interviews with sharing economy participants reveal that their moral motivations primarily include the desire for social connection, the pursuit of autonomous creation, and the reasonable acquisition of economic benefits (Hamari et al., 2020). Many participants believe that the sharing economy provides them with a platform to establish genuine and meaningful connections with others. For instance, in ride-sharing, the interaction between drivers and passengers is not merely a simple transaction but also a social experience where both parties can share life stories and exchange cultural backgrounds, thereby enhancing mutual understanding and trust (Dillahunt et al., 2019).

Autonomous creation is also one of the significant motivations for sharing economy participants. Under the sharing economy model, participants can autonomously choose the sharing activities they engage in based on their interests, skills, and schedules, maximizing their self-worth (Sutherland & Jarrahi, 2021). For example, artisans can display and sell their creations through sharing platforms, gaining economic benefits while also achieving freedom and a sense of accomplishment in their creations (Mayya, 2019). Furthermore, the sharing economy offers participants a flexible economic model, allowing them to secure additional sources of income outside traditional employment and enhance their financial independence (Chi et al., 2020).

C. Moral Challenges in the Sharing Economy

Despite the sharing economy's many moral advantages, it also faces a series of ethical challenges in its actual development process. Among them, the issue of platform monopolies has become increasingly prominent, with some large sharing economy platforms using their significant market power to control market resources, limit competition, and harm the interests of consumers and providers. For instance, some platforms manipulate prices through algorithms, increase service fees, and reduce the revenue share of providers, which has sparked widespread concern and controversy due to these unfair business practices .

The protection of workers' rights and interests is also an important issue faced by the sharing economy. Under the sharing economy model, many workers are considered "independent contractors" rather than traditional employees, which results in their ineligibility for a range of rights stipulated by labor laws, such as minimum wage protection, social insurance, and paid leave. Additionally, workers face safety risks and high workloads, which threaten their rights and well-being. For example, food delivery riders often need to drive at high speeds on busy roads to complete orders within the specified time, increasing the risk of traffic accidents; ride-hailing drivers, in order to accept more rides, work continuously for long hours, which can lead to fatigue driving, endangering not only their own safety but also the safety of passengers.

The development of the sharing economy also poses challenges to traditional regulatory models. Due to the innovative and complex nature of the sharing economy, existing laws and regulations struggle to fully adapt to its development needs, leading to regulatory lag. For example, in the sharing accommodation sector, there is a lack of clear regulations regarding the safety, hygiene standards, and tax collection of properties, which poses potential risks to consumers and affects the healthy development of the market . In the sharing finance sector, P2P online lending platforms have experienced chaos, with some platforms engaging in illegal fundraising and absconding, causing significant losses to investors, while regulatory authorities initially lacked effective regulatory measures and standards (Sun et al., 2020).

D. Sharing Economy Participant Motivation Analysis Experiment

1) Experimental Objective

To delve into the behavioral motivations of sharing economy platform participants and the impact of moral logic on platform operational efficiency and user satisfaction,

providing a basis for optimizing the operation of sharing economy platforms

2) esearch Design

a) Experimental Scenario:

A study of the behavior of users and drivers on ride-sharing platforms (e.g., Uber or Didi).

b) Experimental Variables:

Independent Variables: Participant type (drivers, passengers), motivation type (economic, social, autonomy).

Dependent Variables: User satisfaction scores, platform usage frequency, economic earnings.Experimental Tools: Survey research, behavioral tracking data analysis platform.

c) Experimental Steps:

Recruit 100 drivers and 200 passengers as the experimental sample.

Obtain participants' motivation information through surveys, covering aspects such as the purpose of participating in ride-sharing, expectations for social interaction, and feelings about autonomous work.

Analyze actual user behavior through platform data, including drivers' acceptance rates, passengers' ride frequencies, evaluation situations for both parties, and their respective economic earnings.

Analyze the correlation between motivation and behavior, using statistical analysis methods to identify the intrinsic connections between different motivation types and platform usage behaviors.

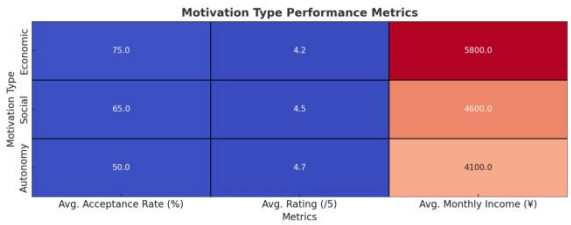
d) Data Collection:

Motivation Distribution: Proportions of motivation types based on survey responses.

Platform Usage Data: Number of orders, average rating scores, economic earnings.

User Satisfaction Scores: Results based on a 5-point scale rating.

TABLE II. MOTIVATION TYPE PERFORMANCE METRICS



E. Figure Explanation

The above heatmap-style table visually presents the performance metrics for different motivation types:

1) Metrics: Includes average acceptance rate, average rating, and average monthly income.

2) Design Features:

a) Rows represent motivation types (Economic, Social, Autonomy).

b) Heatmap colors indicate the relative performance across metrics, with annotations showing precise values.

F. Data Processing and Analysis

1) Data Preprocessing: The collected data will undergo cleansing to remove invalid or erroneous data. Qualitative data, such as motivation types, will be quantified to facilitate statistical analysis.

2) Statistical Analysis: Multivariate linear regression analysis will be used to examine the correlation between the motivation types of sharing economy participants and their platform usage behaviors (e.g., acceptance rates, rating scores, usage frequency, etc.), thereby determining the extent to which different motivations influence behavior.

3) Visualization Analysis: Scatter plots will be created to visually display the correlation between motivation types and user satisfaction, providing an intuitive representation of the relationship trends.

G. Results Presentation and Discussion

Experimental Results Figure: Figure 2 presents the regression analysis chart of the sharing economy participants' motivations and platform usage behaviors.

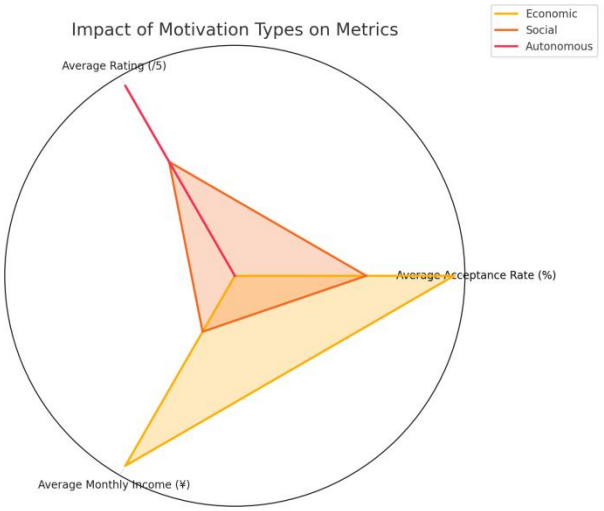


Fig. 2. A radar chart showing the normalized impact of different motivation types on key performance metrics.

Results Discussion:The data results indicate that participants driven by economic motivations exhibit a higher acceptance rate,as they focus more on obtaining economic income through the platform and are therefore more actively engaged in order acceptance.However,social and autonomy motivations have a more significant impact on user satisfaction and long-term platform loyalty.Participants with social motivations pay more attention to interactions and social experiences with others;they may place greater emphasis on communication and relationship building with passengers during the service process,leading to higher rating scores.Although their acceptance rate is relatively lower compared to those driven by economic motivations,their long-term loyalty to the platform may be higher.Participants with autonomy motivations pursue work autonomy and self-actualization;they may be more invested in their work and provide more personalized services.While their average monthly income may be relatively lower,user satisfaction is higher.This suggests that sharing economy platforms should not only focus on economic incentives during their operation but also pay attention to meeting participants'social and autonomy needs to improve the platform's overall quality and

sustainable development capabilities.For instance,platforms can organize social events to promote interactions between drivers and passengers;provide participants with more autonomy in choices,such as work schedules and service types,thereby enhancing user satisfaction and loyalty.

IV. Interdisciplinary Study of Automated Vehicle Control and the Sharing Economy

A. Commonalities and Differences in Ethical Decision-Making Across Domains

Automated vehicle control and the sharing economy, though belonging to different domains, share some commonalities and differences in ethical decision-making. The commonality lies in the fact that both require decision-making in complex environments, where these decisions impact not only individual interests but also public interests such as social equity, safety, and sustainable development (Jagan et al., 2023). For instance, automated vehicles must consider the safety of pedestrians and other vehicles during operation, while sharing economy platforms must safeguard the rights and interests of consumers and providers during their operations (Sidorenko, 2024).

However, there are also significant differences in ethical decision-making between the two. Ethical decisions in automated vehicle control are primarily focused on instantaneous behavioral choices, such as the direction of avoidance in emergency situations, and the outcomes of these decisions directly affect life safety and traffic order (Jagan et al., 2023). In contrast, ethical decisions in the sharing economy involve more long-term market rule formulation, platform operational strategies, and coordination of relationships among participants, with a broader impact that spans economic, social, and cultural dimensions (Sidorenko, 2024).

B. Interdisciplinary Integration of Technology and Ethics

With the continuous advancement of technology, the technological integration between automated vehicle control and the sharing economy is deepening, which also provides opportunities for the integration of ethics. For instance, in intelligent transportation systems, automated vehicles and ride-sharing platforms can achieve data sharing, thereby optimizing vehicle dispatching and route planning to enhance traffic efficiency, reduce energy consumption, and achieve a win-win situation for economic and environmental benefits (Bijalwan et al., 2024). Throughout this process, ethical considerations should be pervasive, ensuring that the application of technology aligns with moral principles such as social equity and privacy protection (Muharam et al., 2024).

Furthermore, the application of blockchain technology in the sharing economy offers new avenues for ethical safeguarding. The decentralized and immutable characteristics of blockchain can enhance the transparency and trustworthiness of sharing economy platforms, effectively addressing issues such as information asymmetry and fraud (Ertz & Boily, 2019). For example, in the sharing finance sector, blockchain technology enables peer-to-peer transactions, reducing intermediary costs and improving transaction efficiency, while ensuring the security and traceability of transactions, protecting the rights and interests of participants (Jain et al., 2021).

C. Constructing a Comprehensive Ethical Evaluation System

To thoroughly assess ethical behaviors in automated vehicle control and the sharing economy, it is necessary to construct a comprehensive ethical evaluation system. This system should encompass multiple dimensions, including the safety, fairness, sustainability of actions, and their impact on social relationships (Jagan et al., 2023). When evaluating the behavior of automated vehicles, not only should adherence to traffic regulations be considered, but also the impact of their decisions on pedestrians, other vehicles, and the entire traffic system (Zhou et al., 2021). For sharing economy platforms, factors such as the efficiency of resource allocation, protection of worker rights, consumer satisfaction, and contributions to community development should be taken into account (Lin & Chen, 2020).

Moreover, the ethical evaluation system should be dynamic and adaptable, capable of adjusting and improving in response to technological advancements and societal changes. For instance, as automated vehicle technology continues to evolve, new ethical issues may emerge, and the evaluation system should promptly incorporate these new concerns to ensure that the moral evaluation of vehicle behavior remains accurate and comprehensive (Ertz & Boily, 2019).

V. Research Conclusions

This study, through an in-depth analysis of ethical considerations in automated vehicle control and moral logic in the sharing economy, as well as a discussion of their interdisciplinary intersections, arrives at the following significant conclusions.

In the field of automated vehicle control, the integration of ethical frameworks with engineering design provides an effective approach to addressing moral decision-making issues in complex traffic scenarios. By mapping deontological and utilitarian ethical principles onto vehicle control algorithms, an initial alignment of vehicle behavior with societal moral expectations at the technical level has been achieved. Experimental results indicate that this integration enables vehicles to make reasonable decisions in various driving scenarios, such as choosing the appropriate avoidance path when encountering obstacles, while also considering traffic regulations and safety factors. However, the study also finds that current ethical frameworks still face numerous challenges in practical applications. For instance, when facing cultural differences, different regions and groups may have varying understandings and weight allocations of moral principles, necessitating further refinement and adjustment of ethical frameworks to ensure their applicability on a global scale. Additionally, as automated vehicle technology continues to evolve, new ethical issues such as collaborative decision-making among vehicles and interactions with intelligent transportation infrastructure will continue to emerge, requiring ongoing research and innovation to address.

Research in the sharing economy reveals participants' active moral motivations and expectations for new market models. The sharing economy is not only an innovation in economic models but also a practice where participants attempt to construct a moral market. They pursue a balance of social connection, autonomous creation, and economic benefits through resource sharing, attempting to break free

from the constraints of traditional markets and establish more equitable and sustainable economic relationships. However, the development of the sharing economy has also exposed numerous ethical issues. Issues such as platform monopolies, labor rights protection, and regulatory lag seriously hinder the healthy development of the sharing economy. Addressing these issues requires the joint efforts of governments, businesses, and society. Governments should strengthen regulation, formulate laws and regulations adapted to the characteristics of the sharing economy, protect labor rights, and promote fair market competition; businesses should enhance their sense of social responsibility, establish fair and reasonable platform rules, and protect the interests of consumers and providers; all sectors of society should actively participate in supervision and promote self-regulation in the sharing economy industry.

In the interdisciplinary field of automated vehicle control and the sharing economy, both have commonalities and differences in ethical decision-making. The commonality lies in the need to consider public interests, but the focus and scope of decision-making differ. The integration of technology and ethics provides new ideas and methods for solving problems in each field, such as data sharing in intelligent transportation systems and the application of blockchain technology in the sharing economy. In the future, further interdisciplinary cooperation and research should be strengthened to explore how to better integrate technological and ethical resources for collaborative development. Constructing a comprehensive ethical evaluation system is key to ensuring the sustainable development of both fields. This system should assess moral behaviors comprehensively and dynamically, providing clear ethical guidance for technological innovation and market development.

VI. Limitations of the Study and Future Directions

While this study has achieved certain results in its in-depth exploration of design ethics and the sharing economy, it inevitably has some limitations. In the ethics experiments of automated vehicle control, although virtual simulation platforms can simulate various traffic scenarios, there is still a gap compared to real-world traffic environments (Jagan et al., 2023). For instance, the unexpected situations in real traffic are more complex and diverse, and the behavior of pedestrians and vehicles has higher uncertainty, which are difficult to fully simulate in experiments and may affect the external validity of the experimental results (Yesikova, 2023). Additionally, the experimental sample lacks diversity, mainly focusing on specific regions and populations; vehicle decision-making patterns may vary under different cultural backgrounds, driving habits, and social values. Future research needs to expand the sample range to enhance the universality of the research conclusions (Supriya et al., 2023).

In the motivation analysis experiment of sharing economy participants, the survey research may be affected by participants' subjective factors, such as memory bias and social desirability bias, which limit the accuracy of the motivation information. At the same time, platform usage behavior data, while reflecting some actual situations, cannot fully cover all behaviors and experiences of participants in sharing economy activities and may overlook some potential influencing factors (Ertz & Boily, 2019). Subsequent studies can combine various data collection methods, such as field observations and in-depth interviews, to obtain more comprehensive and accurate information.

In response to these limitations, future research can be carried out in the following directions. In the field of automated vehicle control, further deepen the study of ethical frameworks, combine real traffic big data and machine learning technology to develop more adaptive and intelligent ethical decision-making models. For example, by analyzing a large number of real traffic accident cases through machine learning algorithms to mine the moral decision-making patterns and provide richer decision-making basis for vehicle control algorithms (Zhou & Wang, 2021). Strengthen cross-cultural research to explore the differences in moral principles under different cultural backgrounds and their impact on vehicle decision-making, in order to formulate more global and universal ethical guidelines (Lin & Chen, 2020).

In the sharing economy,strengthen research on the mechanisms and impacts of platform monopolies,and explore effective antitrust measures,such as establishing a fair market access mechanism and strengthening platform data regulation(Chen&Zhou,2023).Conduct in-depth studies on the protection of workers'rights and promote the establishment of more reasonable labor relations between sharing economy platforms and workers,clarifying the rights and obligations of both parties.At the same time,accelerate the construction of a regulatory system adapted to the development of the sharing economy,strengthen cooperation between governments,businesses,and society,and form a diversified regulatory model(Sun et al.,2020).

VII. Perspectives on the Development of Related Fields

With the rapid advancement of technology,automated vehicle control and the sharing economy will continue to be significant forces driving social transformation,while also facing increasing opportunities and challenges(Saleh&Ahmed,2024).

In the field of automated vehicle control, technological progress will enable vehicles to achieve higher levels of intelligence, not only perceiving and responding to complex road conditions more accurately but also communicating and collaborating more efficiently with other vehicles and infrastructure (Kim, 2023). This will provide a broader application space for ethics-based vehicle control. For instance, vehicles can share information in real-time to collectively make ethical decisions, aiming to maximize overall traffic efficiency and minimize accident risks (Shanmugam & Rana, 2024). Moreover, as public acceptance of automated vehicles gradually increases, societal expectations for the moral behavior of vehicles will also continue to evolve (Lwoga, 2023). Future research needs to closely monitor these changes, continually refining ethical frameworks to ensure that the development of automated vehicles always aligns with societal moral standards (Milakis et al., 2017).

For the sharing economy, its development trends will become more diversified and globalized (Sutherland & Jarrahi, 2018). The sharing economy model will further penetrate various industries, such as healthcare, education, and energy, creating more innovative business models and services (Bonnefon et al., 2016). In this process, ethical considerations will become a key factor in the sustainable development of the sharing economy. On one hand, platform companies need to strengthen self-regulation, establishing

fairer and more transparent operational mechanisms to protect the rights and interests of participants, especially workers (Hamari et al., 2016). On the other hand, governments and all sectors of society should work together to formulate laws, regulations, and regulatory policies adapted to the characteristics of the sharing economy, guiding it towards fairer, more environmentally friendly, and more inclusive development (Simic et al., 2023). For example, in tax policies, adjustments can be made according to the characteristics of the sharing economy to encourage the efficient use of resources and sustainable consumption; in labor law, ensuring that sharing economy practitioners have reasonable labor remuneration, social security, and career development opportunities (Akhmedova & Marimon, 2023)

From an interdisciplinary perspective, the development of automated vehicle control and the sharing economy will promote the deep integration of ethics, engineering, sociology, economics, and other disciplines (Bagloee et al., 2016). Ethics will provide value orientation for technological development and economic model innovation, engineering will be responsible for implementing moral concepts in technical systems, sociology will study the impact of these changes on social structures and interpersonal relationships, and economics will focus on resource allocation and market efficiency (Kostakis & Bauwens, 2014). Interdisciplinary research teams will be better equipped to address future challenges and propose comprehensive solutions. For instance, when studying the ethical decision-making of automated vehicles, engineers, ethicists, and sociologists need to collaborate, considering technical feasibility, moral rationality, and social acceptance from multiple aspects (Sundararajan, 2017). In the development of the sharing economy, the combination of economics, law, and ethics will help build a more comprehensive regulatory framework and market mechanism (Arcidiacono & Duggan, 2019).

In summary,the future development of automated vehicle control and the sharing economy is full of infinite possibilities,but only by leading with ethical considerations and fully leveraging the advantages of interdisciplinary integration can sustainable and healthy development be achieved,creating greater welfare for human society.We look forward to continuous exploration and innovation in future research and practice,injecting more ethical wisdom and strength into the development of these two important fields.

VIII. Conclusion

This study has conducted an in-depth exploration of the frontier fields of design ethics and the sharing economy, revealing their intrinsic connections and developmental patterns from an interdisciplinary perspective. By combining theoretical analysis with empirical research, we have clarified the significant role of ethical factors in automated vehicle control and the sharing economy, as well as the opportunities and challenges they face in their development processes.

In the course of future development, we should continue to focus on the synergistic development of technological innovation and ethical construction, and actively promote interdisciplinary research and international cooperation. For automated vehicle control, we need to continuously optimize ethical decision-making models to better adapt to the complex and variable traffic environment. For the sharing economy, efforts should be concentrated on building a fair and sustainable market ecosystem that effectively safeguards the interests of all parties. Additionally, we must enhance public awareness and participation in design ethics to form a broad social consensus and collectively promote these fields in a direction that aligns more closely with human values and aspirations.

It is hoped that this study will provide a valuable reference for scholars, practitioners, and policymakers in related fields, stimulating further in-depth thinking and research on design ethics and the sharing economy. Let us join hands and make progress together, upholding ethical standards amidst the tide of technological advancement, actively exploring innovation, and working tirelessly to build a more intelligent, fair, and harmonious future society.

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