



# Research on Interactive Strategy for Boosting Novice Drivers' Confidence Based on Internet of Vehicles

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**Abstract.** With the economic growth and the realization of technology, the development of Internet of Vehicles (IoV) further facilitates People's Daily traffic. But numerous problems in driving are also gradually emerging, especially for novice drivers. In the IOV system composed of people, vehicles and the environment, people are one of the factors causing system instability as a core of controlling and balancing the whole interaction process. The driver of different human-car interaction stages has different behavioral characteristics. Interactive strategies connect novices and experienced drivers in an effective way. Experienced drivers can be purposeful and effective in guiding novices. It also provides intelligent guidance for novice drivers to drive independently. At the evaluation stage, three experts were invited to give comments and suggestions on the interactive strategies. This purpose of this paper is to explore the driving style, pain points and requirements of novices, and propose interactive strategies specifically, to help novice drivers improve interactive experience, improve driving confidence, and effectively practice driving.

**Keywords:** Internet of Vehicles (IOV) · Novice drivers · Interactive strategies · Interactive experience · Driving confidence

## 1 Background

### 1.1 A Subsection Sample

With developing of economy technology, automobile industry is also improving. According to the China National Bureau of Statistics, China's automobile production in 2016 was 28.119 million, an increase of 14.8% over the previous year. By the end of 2016, the national civil vehicle ownership. The number reached 194.4 million, of which 165.59 million were private cars, an increase of 15% [1]. The increase in car ownership in the country has brought a great convenience to people, but it also brought waste gas pollution. So, the automotive industry, especially in the field of Internet of vehicles, is booming.

Internet of Vehicles is a branch of the Internet of Things. That refers to the integration of vehicles, pedestrians, roads and infrastructures into an organic information system using advanced information and network technologies to provide a variety of services for vehicles, for instance, driving safety, traffic control, road maintenance, life entertainment, and comprehensive Information and Internet access [2], so as to achieve the purpose of reducing traffic accidents and improving traffic efficiency [3]. At present, USA, Canada, UK, etc. has basically realized vehicle location sharing, traffic situation perception, intelligent navigation system and intelligent parking management system. Chinese research of vehicle network starts later than these contrived but in fast speed. The researchers learned how to address low transportation efficiency and poor driving safety, unbalanced driving resources [4]. Nevertheless, popularity of Internet of Vehicles also brought new problems, for instance, information systems of vehicles are more and more complicated, drivers have new approaches to interact with vehicles.

So how to adapt vehicles to Internet of Vehicles context? In this context, drivers, vehicles combined with the environment into an interactive system. Drivers drive vehicles. Meanwhile receive information from the road system. They control and balance the system. research shows that human behaviors took a large proportion in traffic accidents. Based on traffic accident liability data analysis from 2006 to 2014, researchers found that 70%–80%'s responsibility lay with drivers [5]. Driver's accident factors show that driver's experience and confidence have an important impact on the driving process. As a result, there has been research and system design aimed at enhancing the potential hazard prediction ability of drivers. For instance, automatic driving assistance system is developed for expressway context, including many assistant systems, such as emergency braking, automatic cruise, lane detection, etc. [6]. A novel technology to increase the control mode of adaptive system that aiming at the defects of automobile adaptive system [7]. Although driving assistance systems can help drivers avoid certain dangers, most of researches are focusing on how to acquire new features in auxiliary systems, while ignoring the psychological factors of drivers in the driving.

Based on this, this paper makes an in-depth study on Chinese novice drivers from the perspective of psychological factors, aiming at putting forward reasonable interaction schemes and strategies to help novice drivers improve their driving self-confidence.

## 2 Research Contents and Process

### 2.1 A Subsection Sample

The key research questions in this paper are shown in Fig. 1. By exploring the driving behavior and driving style of novice drivers, analyzing the mental model, pain points and user needs of novice drivers. Finally, it will put forward new interactive strategies that increase the driving confidence of novice drivers.

This research process is divided into four stages and progressively. In the first stage, this paper will do desk research, literature review and quantitative researches. After analyzing, it will determine the driving style of novice drivers in the Chinese context. In the second stage, it will do qualitative analysis and translate results into design languages that can provide a theoretical basis for the interactive scheme. In the third stage, it will put forward interactive scheme by visualizing approaches, and iterate the scheme based on user test outcomes. And in the fourth stage, it will discuss and reflect the scheme based on evaluation outcomes, as showed in Fig. 2.

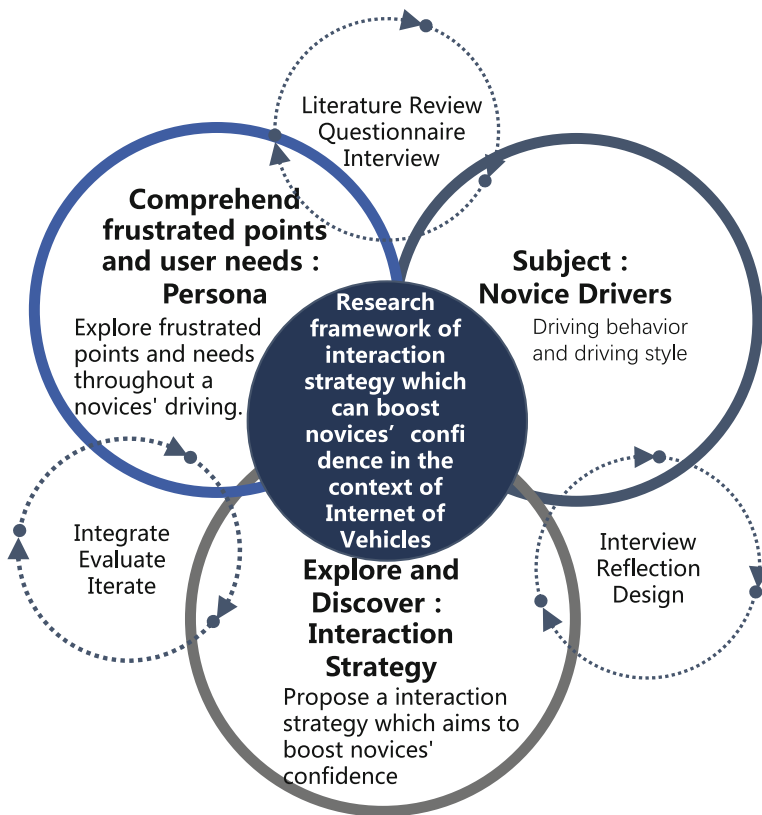


Fig. 1. Research contents of this paper.

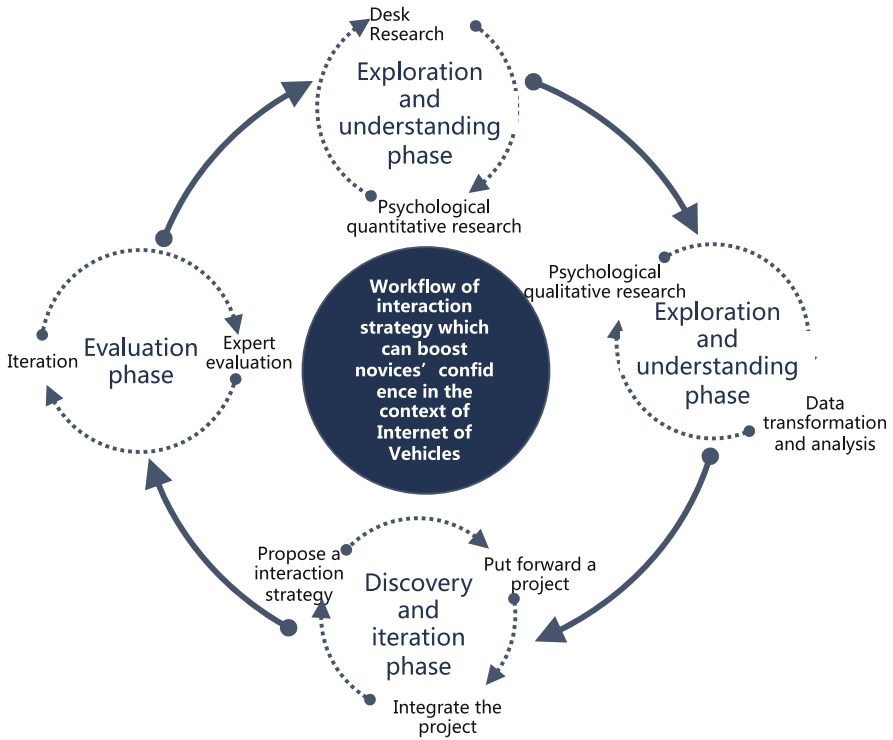


Fig. 2. Research process of this paper.

### 3 Interactive Strategies Research

#### 3.1 Quantitative Research

In this research stage, it mainly through the questionnaire method to explore Chinese drivers' driving styles, possibly driving behavior of novice drivers, influencing factors, and collected 365 questionnaires through network tools, of which 302 were valid. Then compiles an interview outline according to the influencing factors and behavioral tendencies. Questionnaire contents are based on literature review outcomes. The purpose of the questionnaire is to screen participants, record the basic information, investigate the driving style and find out the reasons for the driving influence factors. The questionnaire contains the Chinese version of the Multidimensional Driving Style Scale, which can well confirm the driving style of Chinese drivers, and its multiple dimensions have a good predictive function for the possible actions of drivers [8, 9].

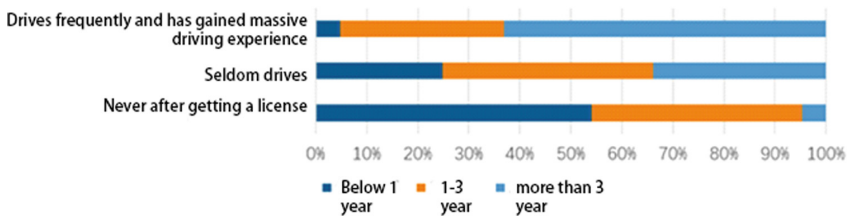
Based on the analysis of variance and cross-correlation of the valid data collected, it is concluded that the driving styles of Chinese drivers are mainly divided into three types: risk-taking, anger and anxiety. Gender and driving experience has a significant impact on the driving style of Chinese drivers. The driving style of novices and less experienced drivers is mainly anxious type style. The Chinese version of the Multidimensional

Driving Style Scale predicts driving behavior well and predicts the driving behavior of novices mainly in anger, anxiety and distraction dimensions.

Table 1 shows the impact of gender on driving style. The results show that there are significant gender differences in risk-taking driving style,  $F(1,3.494) = 5.69$ ,  $P = 0.018$ . The gender difference of angry driving style is significant,  $F(1,9.381) = 12.37$ ,  $P = 0.001$ . The gender difference of anxious driving style is significant,  $F(1,7.070) = 12.49$ ,  $P < 0.001$ . Male drivers are more risk-taking driving style and angry driving style, while female drivers are more anxious driving style. Figure 3 shows the influence of driving experience on driving style. The results show that the longer a driver has a license, the less anxious, distracted and sensory seeking behavior he or she has during driving.

**Table 1.** Comparison of mean values in the scale ( $M \pm SD$ ) tables.

	Risk-taking	Anger	Anxious
Male (N = 146)	2.38 ± 0.79	2.62 ± 0.92	2.31 ± 0.76
Female (N = 156)	2.17 ± 0.78	2.27 ± 0.82	2.62 ± 0.74



**Fig. 3.** Cross analysis of driving experience and getting license years.

### 3.2 Qualitative Research

Quantitative research confirms that the driving style of Chinese novices is mainly anxious driving style and divides driving behavior into various dimensions. Combining predicted driving behavior of novices and the reasons obtained in questionnaires. This paper put forward a 1 on 1 interview outline. Depending on the interview outline, interviewed selected participants. Through information comparison and supplement of the interviews between novices and experienced drivers, confirmed the characteristics of novices, found out pain points and user needs of novices. The results obtained in this part will assist in the next stage of this paper.

In this stage, interviewed 32 participants, and 31 effective participants were selected, including 14 females and 17 males. 10 novices and 21 experienced drivers. The number of novice drivers is lower than that of experienced drivers. Because novice drivers have less practical experience and have a relatively shallow view of human-vehicle interaction, the number of experienced drivers is increased to get more opinions.

According to the above, combining cognition and suggestions of novices and experienced drivers, it can find that the main concerns of novice drivers are driving awareness and driving behavior. Driving awareness includes safety awareness, attention awareness, pre-judgment awareness, logical thinking and planning awareness. Driving behavior includes practical practice, speed assessment, accompanying driving and attention. As showed in Fig. 4.

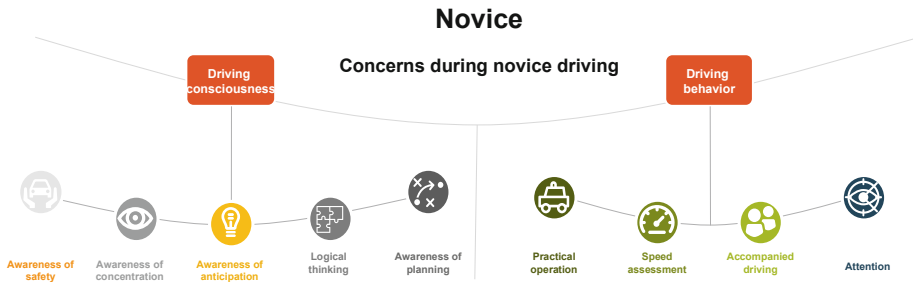


Fig. 4. Primary focus for novice drivers.

Depending on the above analysis results, this paper can get the driving pain points of novice drivers.

- (1) In the early stage of driving, environmental changes of novice drivers pose a greater psychological challenge to novice drivers.
- (2) Novice drivers are difficult to understand their driving situations in time.
- (3) Novice drivers are often confused about their driving behaviors.

Based on the above pain points, it put forward opportunities for research.

- (1) How to help novices choose the proper driving place at the early stage of driving?
- (2) How to help novices knows the details of their driving in time?
- (3) How to give time guidance/advice/helps to novices during driving?

### 3.3 Interaction Strategies for Novice Drivers to Increase Driving Confidence

**Come up with Schemes.** In view of the above research opportunities, through brainstorming, the scheme affinity diagram, classification and other design thinking methods. Eventually clustered same schemes and summarized and screened these schemes. The scheme after screening is presented in Fig. 5.

**Interactive Strategy Journey Map.** After screening, each scheme will be connected in series, and eventually form an interactive strategy scheme for novices to increase confidence. This strategy is convenient for drivers to practice, combined with self-efficacy factors affecting self-confidence, to cultivate driver self-confidence. Through this strategy, drivers are more likely to obtain a successful experience in the driving

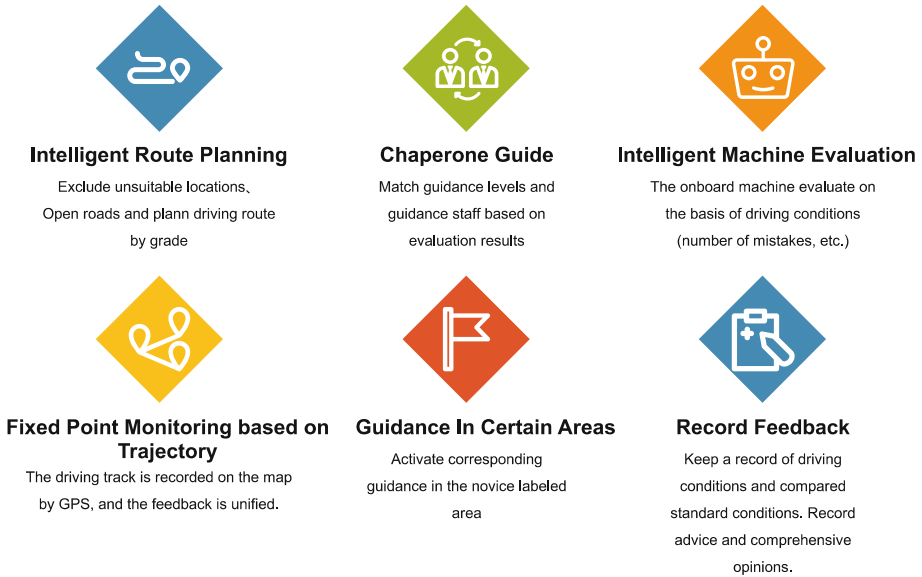


Fig. 5. Final solutions.

Li Mingxue: A novice who is not confident and has no driving experience after getting his driver'

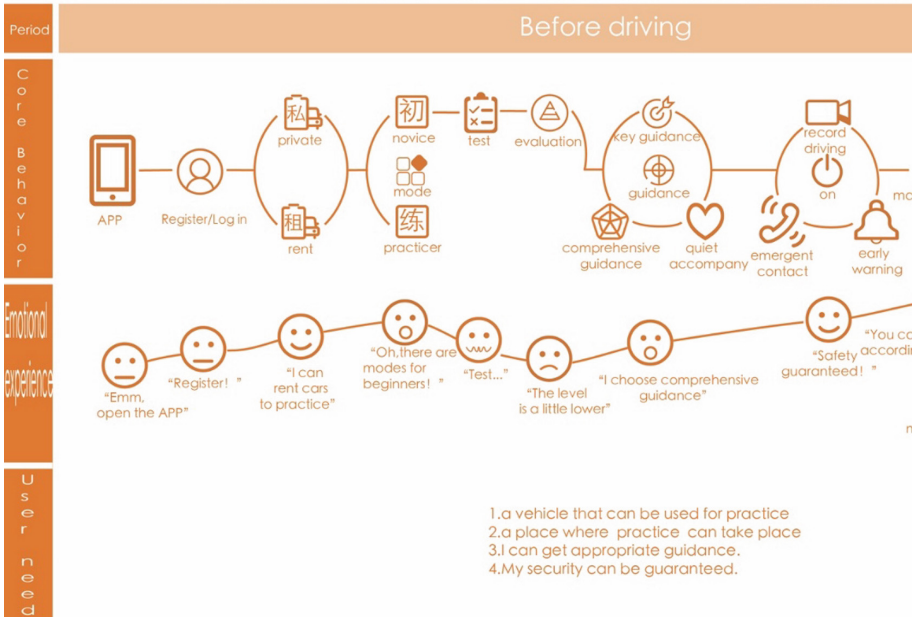


Fig. 6. Interactive strategies -Journey map1.

driver's license.

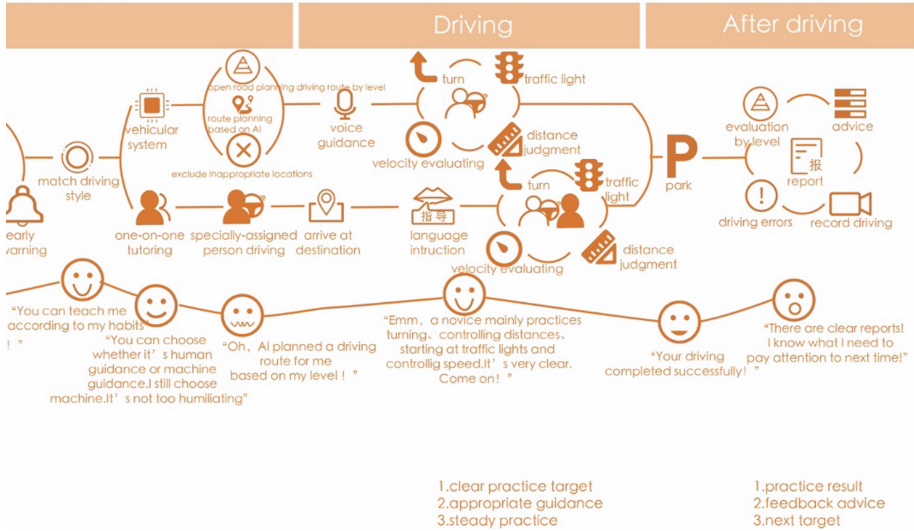


Fig. 7. Interactive strategies -Journey map2.

process and better predict difficulties to cope with. Both intelligent guidance and personal guidance can provide a good alternative experience for drivers, and help drivers absorb alternative experience. At the same time, with the assistance of guidance from all dimensions, drivers can keep a positive attitude. The interactive strategic scheme for novices who are not confident, and it is difficult for them to get on the road for the first time. It mainly combines six schemes: intelligent planning route, machine intelligent evaluation, personal accompanying guidance, trajectory fixed-point monitoring, specific area guidance and record feedback, it showed in Figs. 6 and 7.

Novices can use a mobile phone application to login in the system and choose rental vehicles or connect to their vehicle system. As novices, the system will evaluate their driving grade, at the same time they can choose the preference guidance mode in application, such as a comprehensive guide, key guidance or quiet companionship. You can also choose recording driving, early warning and emergency contact features. By measuring the grade and driving style, the application will be matched to the same driving style guidance. It has two modes of guidance. One is to match the corresponding experienced drivers as a special coach to guide; the other is to provide intelligent guidance by the vehicle system. The coach will drive the vehicle to a suitable area for practicing, and then the novice will conduct driving practice under guidance. Intelligent guidance of a system is to remove inappropriate locations according to driving grades of novices, and to plan a suitable route for novices to drive. This sub features mainly guides beginners through voice assistance. As the first practical driving for beginners, its main purpose is to adapt to the road driving environment based on general driving skills that learned from driving school. After driving, the driver can check his report, including the results of the grade evaluation and the record of his driving process, the mistakes in driving and related suggestions.



Trajectory monitoring is realized by recording feature, and intelligent planning guidance will give early warning and certain guidance to novice drivers in time. These are all schemes to accomplish interactive strategy.

## 4 Interaction Strategy Evaluation and Iteration

### 4.1 Expert Evaluation

In this paper, using the heuristic evaluation method in expert evaluation, three experts are invited to test and evaluate the usability of interactive strategy schemes. After listening to descriptions, expert assesses whether contents presentation, user journey, operation of the interactive strategy is reasonable, whether users can understand it and hands on quickly, and so on. Three experts the interactive strategy schemes. The interactive strategy scheme can effectively help novice drivers to increase driving confidence, let them drive in practice, and build a bridge between experienced drivers and novices, to help novices get guidance easier and drive better.

At the same time, experts put forward some pertinent suggestions. These suggestions mainly for easy, including the modes combination, evaluation objects and visualize interactions.

- (1) Combine coach mode and intelligent mode. The system is separated from coach guidance and intelligent guidance.
- (2) Evaluation should on both sides. Evaluation system provides evaluation to service providers on the one hand and encourages service providers on the other hand. Provide users with evaluation to stimulate users 'self-intuitive perception.
- (3) Increase the interactive intuitive description or mode, so that novices can find their own location faster and seriously use the interactive feature.

### 4.2 Iteration

According to the evaluation contents put forward by experts, a scheme of automatically opening the intelligent guidance system when there is no special coach to give advice. Novice drivers can log on to the on-board interactive system according to their previous driving files. The system will set the driving route according to the information set up before, including the assessment area. After it, novice drivers can mark areas on the route that they think are difficult to drive (practice the novice's pre-judgment awareness, planning ability). When novice drivers to the marked area, the system will automatically turn on the guidance to assist novices to handle the driving situation at that time. In the process of novice driving, driving tracks and driving behaviors of novices will be recorded by GPS technology, which is convenient for later review and analysis. It also has the feature of collecting suggestions from other road users, and they can give corresponding suggestions. When the vehicle is driving the assessment area, the vehicle system will turn off the guidance function and turn on the recording function. If novices successfully pass the assessment area without emotional fluctuation, the system can consider upgrading the evaluation of novices. If there are large emotional fluctuations, help-seeking behavior or dangerous driving behavior, the guide

feature will be automatically activated, and rescue signals will be sent to other road users around. In the process of driving, if the novice has dangerous driving behavior or detects danger in front of the driving, an early warning system will be opened to provide guidance according to the situation and novices driving rating.

## 5 Conclusion

At present, the rapid development of the Internet of vehicles aims at helping people connect easily and quickly to all parts of life. As a necessary stage for a driver, novice drivers not only have safety problems, but is also given a tremendous impact on driving behavior after learning session. Built on the study of novice drivers, this paper puts forward an interactive scheme that can help drivers to get through this stage better and can promote road traffic safety. Through this interactive program, novices can constantly correct their driving, develop safe driving habits, and gradually improve the driving skills. In the future research, it can further study and classify how to get the driving behavior of novice drivers easier and how to get the help of novice drivers in driving.

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