

The Innovative PSS Design of Urban Transportation Based on Sharing Style

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Abstract. The ever-degrading traffic situation has become one of the major factors that check the sustainable development of cities, as well as threaten people's well-beings. Thus, proceeding from the concept of Sustainable PSS, the design of sharing transport system aims at pursuing a holistic measure to ease the traffic tension and create a new fashion of urban commuting. The design was inspired by 'car-pooling' and fuse public transit with the private one, involving the design of the exterior, the interior, the Internet platform, etc. Harboring the idea of 'Social Innovation', our group creates a new urban transit service system by combining the folk wisdom with professional originality and maximizing the current transportation resources.

Keywords: Product Service System, PSS, Sustainability, Transportation Design, Urban Transportation, Sharing Style, Social Innovation.

1 Introduction

'Better City, Better Live', the theme of Shanghai Expo, 2010, echoes the wishes that has long cherished by the urban residents. According to the 'World Census Report' of UNFPA, the current world's population is drawing close to 7 billion, half of which dwell in the urban area, 35 years later, the percentage will rise to 2/3. The urban livability, though widely deemed as the symbol of modern civilization and a highly condensation of intelligence and inventiveness of human, has been losing its glamor of 'the good old days' with the emergence of the various problems that come with the city's development, especially the transportation impasse.

Being the major component of the modern transit system, the vehicle is the basic guarantee of the urban functioning, such as daily commuting, cargo transportation, business operation, etc. The private vehicle, besides boasting the above-said strength, satisfies people's psychological demand of pursuing high speed, freedom, style and the development of individuality to the utmost. However, with the skyrocketing rise of the automobile ownership in the limited urban space¹, the negative aspect has come

¹ The U.S. prestigious journal of auto industry, *Wardsauto*, reported that, according to the number of vehicle registration and vehicle population historical records released by the governments of all countries and regions, the total number of vehicles around the world exceeded 1 billion by August 16th 2011.

under the spotlight. The automobile ownership in China is 104 million, accounting for 10 % of the world's, making China the second largest automobile ownership country only to America, which has 240 million in 2010². And according to William J Mitchell, 2010, with the annual marketing increase ratio maintaining at 3%, China is expected to surpass America in 2030. The corollary of the above-said phenomenon is the inevitable dispute between the increase of automobiles and the limited resources as well as enumerable problems, such as the lasting increase of the consumption of fossil fuels³, the serious pollution, the exacerbated green-house effect⁴, the economic lost caused by traffic congestion⁵, the casualties brought by traffic accident, the debates of the equality of transportation and the according social issues, the unreasonable usage of automobiles, the flamboyant consumption and lifestyle, etc., which pose the vital menace to the city's sustainable development, as well as people's living standard and well-being.

The transit system is the subordinate of the city system, and the improvement of a certain system not just calls for the change of a single party, but the adjustment and the reconstruction as a whole, therefore speaking, to truly solve the traffic problem, we have to combine the design of automobile, the improvement of manufacture techniques as well as the application of the eco-friendly products with the re-plan and re-design of the commuting mode of people as well as the profit modes of the automobile manufacturers, and the intervening of the latter counts more because of the fact that the contribution made by the improvement of the techniques are largely offset by the greater product consumption. For instance, the environmental gain archived through the improvement of car efficiency in the last 15 years (10%) has been more than offset by the increase in the number of cars and by the consequent increase (30%) in the overall number of km covered [European Environmental Agency (EEA), 2008]. Thus speaking, PSS, aiming at deducing the material consumption, improving the ecological interest of the system in a carpeting manner while paying due consideration to the business profits, indicates a brand-new orientation for our design of the transit system.

Based on a long-term research plan and proceeding from sustainable PSS, this project aims at seek the solution of the future transport problems. The design of the Sharing-Move system, which gets inspiration from the 'Car-pooling' activities, counts the most in this project. Harboring the idea of 'social innovation', our group combines

² Data was provided by Traffic Administration of the Ministry of Public Security in November 2012.

³ Currently, the Fuel engine vehicle is taking the dominant position. Around the world, 18 million barrels of oil are consumed by cars every day. China has long way to go to realize the large scale application of clean energy driven cars.

⁴ Annual carbon emissions by vehicles around the world reach 2.7 billion tons, which greatly increases the greenhouse effect. A research in Beijing shows that, the contribution of motor vehicle exhaust emission to the PM2.5 in ambient air has reached 38%, which is listed in the first place among various pollution sources.

⁵ "Annual Report of Beijing Traffic Development in 2011," shows that, the annual economic losses caused by traffic jam in Beijing exceeded 105.59 billion Yuan, equivalent to 7.5% of the GDP of the city.

the folk wisdom with professional originality and makes the most use of the current transit resources to create a new transit service system.

2 PSS Innovation and Transportation Design

PSS (Product Service System) can be interpreted as ‘the result of an innovative strategy that shifts the center of business from the design and sale of (physical) products alone, to the offer of product and service systems that are together able to satisfy a particular demand’ (UNEP, 2002). In other words, a PSS innovation focuses on offering satisfaction rather than selling products and it can be described as an integrated mix of products and services, delivered by one or more socio-economical actors and capable to fulfill a given demand of satisfaction (Ceschin and Vezzoli, 2010). Just as what the consumers need is clean clothes, rather than cleaning machine, what the urban transit system needs is convenient and fast commuting mode, rather than cars, in fact, provided a proper way, PSS can not only reduce the consumption of resource efficaciously and lessen the cost of the enterprise, but also achieve new growth point of profit, which can better answer the consumers' demand. Apparently, the strategy can facilitate the transition of the enterprise to a new profit model and reach the goal of multi-winning (including enterprise performance, environmental protection, consumers' interest as well as social welfare) by solving various kinds of problems (including traffic one) we confronted during the process of city developing effectively.

PSS can be simply classified in to the following 3 categories:

- *Product-oriented services*: It can guarantee the consummate functioning of the product during its life circle and achieve additional benefits, such as after-sale service, which may include maintenance, parts exchange, upgrading, replacement, recycling, etc. To put in other words, the product, which is perfected by the service, still remain to be core.
- *Result-oriented services*: It can provide the customers with terminal service, such as effective transit, heating and power supply, etc. In this way, with the service being the core, consumers don't bother purchasing, maintaining, even operating by themselves before enjoying the best service.
- *Use-oriented services*: It provides customers with a platform on which product, instrument, opportunity, even qualification are available to satisfy people's demand. Car renting is a perfect example, by amalgamating product with service proficiently, the customers can use the product without owning it, and they just need to pay the rental fee according to the agreement.

In fact, the implementation or the planning of trial of the PSS in the traffic field has already become prevalent around the world. For instance, the ever-consummating after-sale service of automobiles, various forms of value-adding services (including the replacement of the old vehicle, the sending of the message of safe driving, fuel saving and traffic jam, etc.), the ever-convenient, fast and economic package commuting service of air, railway and buses, the rental service of cars and bicycles, as well as the 'pooling services', etc. All of the above-said strategies aim at the goal of answering

people's expectation of commuting, improving the efficiency of the urban transportation, as well as lessening the waste of resource and environmental pollution.

The urban transit system possesses many intricate factors and involves different stakeholders, such as car manufacturers, policy-makers, traffic organizers, insurance companies, the suppliers of the transportation equipment, drivers, common users, etc. Therefore, based on PSS thinking and starts from different requirement of the stakeholders, the transportation design comes up with an innovative solution which integrates vehicles and service system to effectively deal with the current transportation problems, meanwhile, the win-win situation will be stricken between the user and all the stakeholder that in the chain of the system. 'Car sharing', originated from daily life, constitutes one of the effective solutions.

3 The Concept Design of Car Sharing

The essence of social innovation is to perceive the collective wisdom and integrating it with the design thinking to solve the existing problems. Car sharing, the carrier of this innovative concept, prevails in some certain areas in China and it releases the traffic tension and lessens the cost of transportation to some degree. Despite its profound potential, it doesn't receive its due popularity and is still labeled as illegal operation for the lack of the effective management, the technical support, as well as the fair pricing system and the credit organism. The following passage analyzes the feasibility of the Car Sharing system design in the aspects of society, economy and technology.

3.1 The SET Analysis of Car Sharing in China

- *Social sphere*: 'Sharing', a social behavior, bears a long history and undergoes a resurgence of popularity in recent years. The main body of sharing ranges from acquaintance, friends, to total strangers, who cherish the major purpose of sharing cost, experience, happiness, as well as expanding and consolidating the social circle. Nowadays, the popular style includes flat sharing, meal sharing, credit-card sharing, car sharing, travel sharing, group-buy sharing, entertainment sharing, etc. The research shows that the majority participating in the 'sharing' activities are the youth aging between 20 and 30, well-educated and familiar with the Internet. Most of them are students, new employees and SOHOs, mostly dwelling in the developed cities like Beijing, Shanghai, Dalian, Chengdu, Hangzhou, etc., they receive medium or low salary and have a stable living style, and are characterized as valuing interpersonal relations, the enjoyment of life, being optimistic and willing to be the forerunner of fashion. Despite the unacceptability of the 'sharing' concept by the Chinese consumers, who underwent the intolerable tough days and still enjoying the phase of completely owning properties, the belief of sharing consumption, led by the youth, is destined to become the mainstream of the society. Thus, the futuristic 'Car Sharing' boasts a promising social foundation.

- *Economic sphere:* The high living cost in the major cities in China has witnessed the fact that the consumption level of the cities like Beijing, Shanghai and Shenzhen has surpassed New York and that the rising price (especially the fuel price) is far outrunning the raise of the ordinary employees' salary⁶, aggravating the burden on the young office workers, however, the choice of sharing a car can greatly ease the tension. Besides, China has become the second on the list of automobile ownership, in Beijing, there are about 3 million automobiles on the roads, 2.4 million among which are occupied by only 1 person, with 1 person taking the space of 5, the traffic congestion, as well as the huge waste of resources is self-evident. In this circumstance, provided the great effort to impel the construction and the organization of the urban bus system, leading the private car owner to apply car sharing, even part of it, can reduce the traffic circulation by millions of vehicles, relieving traffic pressure, as well as lowering economic lost.
- *Technological sphere:* Under the pressure of the concerns of resources and environment and the brunt of the revolution the technology, the automobile technology is incubating an unprecedented revolution. For instance, the mobile Internet and tele-communications is doomed to profoundly influence the car industry, by now, people can enjoy the intelligent info-service such as GPS, GIS, LBS, etc. The mobile communicating technology of American CarCloud, the Sync open platform of Ford and the Audi's Connect are all precursors of this revolution, their daring trials provide the design of the sharing transportation system with reliable technological support. It is foreseeable that the futuristic automobile can not only offer the customers with the "riding" function, the strong human-computer interaction, navigation, entertainment and working, but also make the functions, such as interpersonal communication, etc., prevalent.

3.2 The Definition of the Sharing-Move System

The design of Sharing-Move system pays close attention to the joint of the public transportation and the private one and aims at solving the daily transportation and commuting problems confronted by the young urban office workers. As a package solution, the design will involve the part of info-interactive design of service platform and the part of product design, including the exterior and the interior of the car. The former, whose function includes info-searching, matching, valuing and paying, safety authentication, organization, etc., can connect and register through PC or the mobile terminal; and the latter can pay dual consideration to the two properties of transportation system: the privacy and publicity, adding some certain necessary features when reserving the requirement of an individual or a family.

To solve the major problems in the process of car sharing, such as the compliance of traffic regulations, the safety, the responsibility of the accident, the charging standard, and our group has come up with the corresponding designing principles. (see Fig. 1).

⁶ According to the "Worldwide Cost of Living Survey 2012 city ranking" report issued by Merce, an USresearch institute, Beijing and Shanghai were listed in the 16th and 17th in the world, with a raise compared with previous years. In addition, the living costs of Shenzhen and Hangzhou have exceeded that of New York, and listed in 30th and 31st respectively.



Fig. 1. Function Map

- *Traffic regulation:* According to the current law and regulation, 'Car-sharing' is deemed as illicit behavior. Thus, the Sharing-Move system should cooperate with the government to keep the car-sharing on record, controlling the scope and the quantity of the activity in a coordinated manner. Besides, being a non-profit deed, car-sharing should apply a strict charging standard
- *Safety concerns:* the Sharing-Move system will impose a stringent real-name mechanism and a rigorous authentication of the information of the car that is going to be shared, GPS tracking and inner-seated video surveillance will also be conducted during the process of sharing, which ensures the safety of the customers.
- *The responsibility of the accident:* It has been a conundrum to confirm the responsibility of the traffic accident in the process of car-sharing, which necessitates the intervening of the insurance company. The fare paid by the passages should include the insurance fee.
- *Charging standard:* Only the driving cost of the mileage during car-sharing is required, including part of the fuel fee, system management fee and insurance fee. The car-sharing fare should be cheaper than the taxi fare. The service platform will be in charge of the calculating and paying.

3.3 Service System Design

In the service-design part, Sharing-Move would have a mobile service platform for the users. By referring to the strong database (including consumer registering, car information, road map, fare, credit evaluation, etc.), the users can conduct timely communication with other users to realize their sharing transportation.

The Internet service platform of Sharing-Move possesses 5 major function modes, being 'the detection and matching of the users' information, 'safety organization', 'positioning and navigation', 'valuation and payment', and 'evaluation and feedback' respectively. Based on them, the typical process of the Sharing-Move service system is as follows: (see Fig. 2)

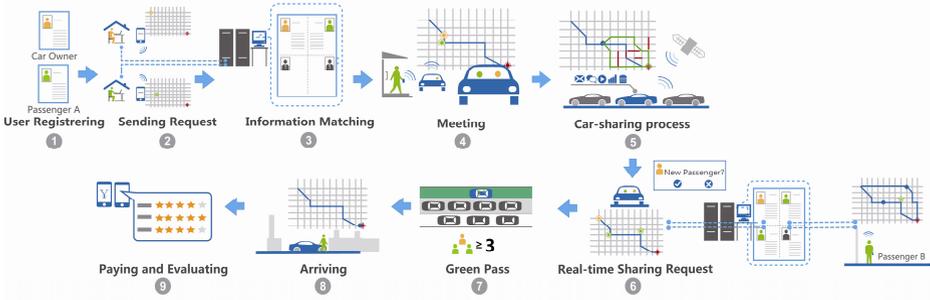


Fig. 2. Sharing-Move Service System Flow Chart

- *Registering:* The users should register on the service platform of the Sharing-Move, the identity authentication, the credit card information, the common-used route and time, as well as other predilections should be included, and the car owner should provide the information of the car. (Such as step①)
- *Sending the request of car-sharing:* The two parties are required to send the sharing request on the service platform (including destination and time), the system will then match the request automatically and provide several choices, the passenger A will make his or her choice according to the route and his or her preference, and a car-sharing agreement will be formed after the car-owner's confirmation. (Such as step②③)
- *Car-sharing process:* The sharing of the car will take place at the arranged time and spot, the two parties can identify each other quickly by the position-searching of their mobile phone, During the journey, the service platform will provide the services such as navigation, route optimization, music, video clips, etc. (Such as step④⑤)
- *Real-time sharing:* By then the passenger sends a real-time sharing request, the system matches his or her request automatically and provides couple of choices. The passenger B make a choice, then the car owner confirm the request after getting the agreement of the passenger A. (Such as step⑥)
- *Priority:* When the number of the car sharers surpasses 3, the car can use the specific green pass (or bus lane) and the toll can also be spared in order to encourage sharing by more people. (Such as step⑦)
- *Arriving:* The cars will arrive at the destinations respectively, by then; the system will automatically calculate the fare of the sharing according to the car-sharing mileage of each and the number of the then passengers. After the car-sharing, the users will evaluate and grade the ride according to the experience and the system will accumulate the credit records of both the car owner and passengers then replenish them in to the database. (Such as step⑧⑨)

3.4 The Exterior and Interior Design

Being one of the components of the Sharing-Move system, the design of the commuting vehicles emphasizes the effective transmitting and interaction of information as well as the reasonable layout of the inner space of the car, which is achieved by the adoption of the single carriage structure. The dual features of private and public endow the vehicle's style with artlessness and simple beauty. The explicit distinction and display of the information also constitutes a curtail feature of the exterior design of the Sharing-Move. (see Fig. 3)

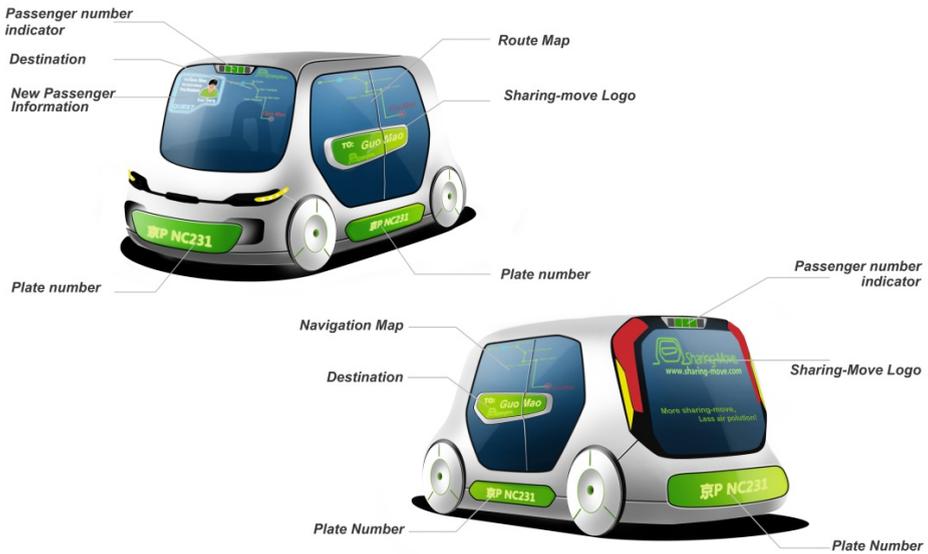


Fig. 3. The Exterior Design

The sense of safety, multi-functioning, and publicity are the key words of the interior design of the car, so the design adopts the latest technology to convert the marginal area of the windscreen into the info-display screen, with the uninterrupted driving vision being the prerequisite, the important information such as navigation, car-sharing request, etc., can be displayed. The inner body will be equipped with a panorama camera, which can supervise the driving situation; and the assembled seats arrangement can be so flexible as to answer the different demand, such as of going on a family trip or of car-sharing. Armed with Wi-Fi reception and the video and music playing facilities, and taking advantage of the sharing mode, the design can also enhance the communication between social members. (see Fig. 4)

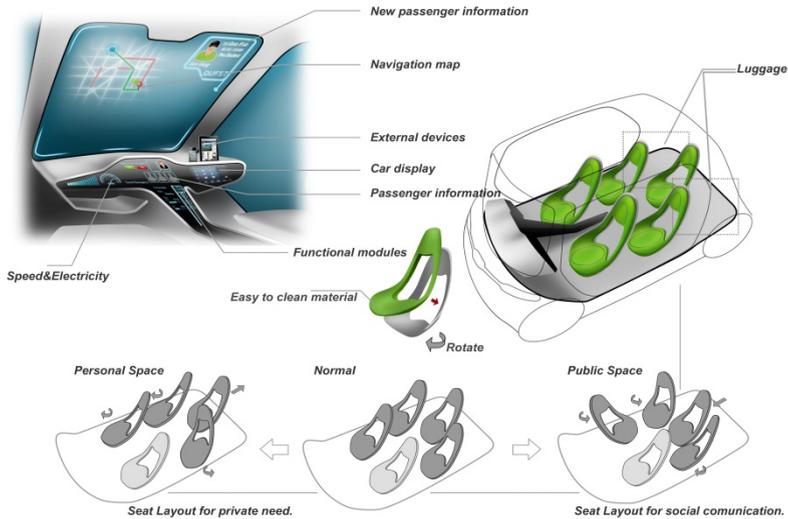


Fig. 4. The Interior Design

4 Conclusion

To solve or ease the problems of urban transportation system, multifarious effort is required, including various kinds of innovative PSS design (Sharing-Move included), the improvement of policies and regulations, the adjustment of the thinking of urban planning, the development of road building, the moderation of the profit mode of the car enterprises, as well as the advocacy of the urban dwellers' green means of transportation and consumption belief.

Nowadays, the transportation designers are facing a problem that is way more complicated than the ones in the past, their work scope is not confined in gracious and dynamic car modeling, eye-catching color combination, original appliance of material or the high-tech and intelligent human-computer interaction, their work has entered a new phase-the challenge of design is the challenge of society (Anne & Paul, 2011) . Therefore, despite all the cluelessness, the designers have to confront the sustainable development of the urban transportation system and find a way to reshape the overly materialistic outlooks of well-being.

The design and the implementation of the sharing PSS require teamwork, especially through the collective intelligence and energy, which are also the belief and methods of Social Innovation and an effective way for the designers to seek role-exchange and breakthrough. There still exist more details about the Sharing-Move design to be perfected in the future.

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