

Public Perception regarding Autonomous Vehicles in Developing Countries: A Case study of Pakistan

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Abstract

Autonomous vehicles are not only revolutionizing the automotive industry throughout the world, but also shaping a new form of safe, convenient and homogeneous transport system. However, the acceptance of this innovative technology depends on public perception. This issue of acceptance becomes more complex in developing countries, like Pakistan, due to completely different socio-economic conditions and values. This study aims at understanding the acceptance of autonomous vehicle technology from the perception of the youth of Pakistan. A questionnaire containing various questions regarding awareness, concerns, anticipated benefits and scenario settings were distributed among 356 students from three universities in Lahore namely University of Central Punjab, University of Engineering and Technology and University of Management and Technology. Results revealed that most of the participants are aware of this technology, although autonomous vehicles are not yet launched in Pakistan. Further, respondents showed serious concerns regarding the idea of travelling in a driverless public vehicle as well as encountering driverless trucks on road, while accepting most of the advantages associated with autonomous vehicles. The results also depicted a sense of distrust in autonomous vehicles used for unattended movement of kids.

Key Words: Autonomous Vehicles, Driverless, Pakistan, Public Perception, Questionnaire Survey

1. Introduction

Although autonomous vehicles (AVs) have not been fully integrated into modern lifestyles, their impact on politics, economy, industry and society of industrialized countries is evident. With worldwide acceptance of SAE level 1 and level 2 vehicles, and positive response to SAE level 3 vehicles in industrialized countries, anticipation is quite high for introduction of SAE level 4 and level 5 vehicles. Figure 1 presents the progressive automation stages of all six SAE Levels. Numerous technologies have already been introduced in vehicles, like Adaptive Cruise Control, Traffic Jam Assist, Lane Keep Assist, Valet Park Assist, which are providing comfortable and safe driving experiences. It is estimated that such technologies will be included in all new vehicles made available in the US and EU markets by 2022 [1, 2]. It is further estimated that by 2030, SAE level 5 vehicles will have more than 30% share of automotive fleet [3].

Autonomous vehicles are expected to completely transform both the automotive industry and the general travel behavior [4, 5], and are probably the biggest revolution in transportation since the inception of conventional cars [6]. In their final forms, autonomous vehicles

will provide considerably better transport dynamics, and drastic decrease in road accidents caused by human error [7]. With better fuel efficiency, the impacts will be felt not only at personal level but also at society level owing to improved environmental sustainability [8-10]. This technology will surely decrease many external costs associated with conventional cars, such as congestion and traffic accidents [11].

Causes of vehicular crashes can be grouped into three major clusters, i.e. related to vehicle, related to infrastructure and environment, and related to human factor [4].

However, 80% of the crashes result from the third group related to human factor [3]. One of the major objectives of autonomous vehicles is to improve road safety by addressing the human factor involved in vehicular operations. Nevertheless, public is skeptical about this ability of AVs, especially when determining the legal and financial responsibility in case a crash occurs [12]. As with other innovations, the penetration of autonomous vehicle technology will depend on its perception and acceptance level among public. Public concerns are the major hindrance to widespread acceptance of autonomous vehicles.

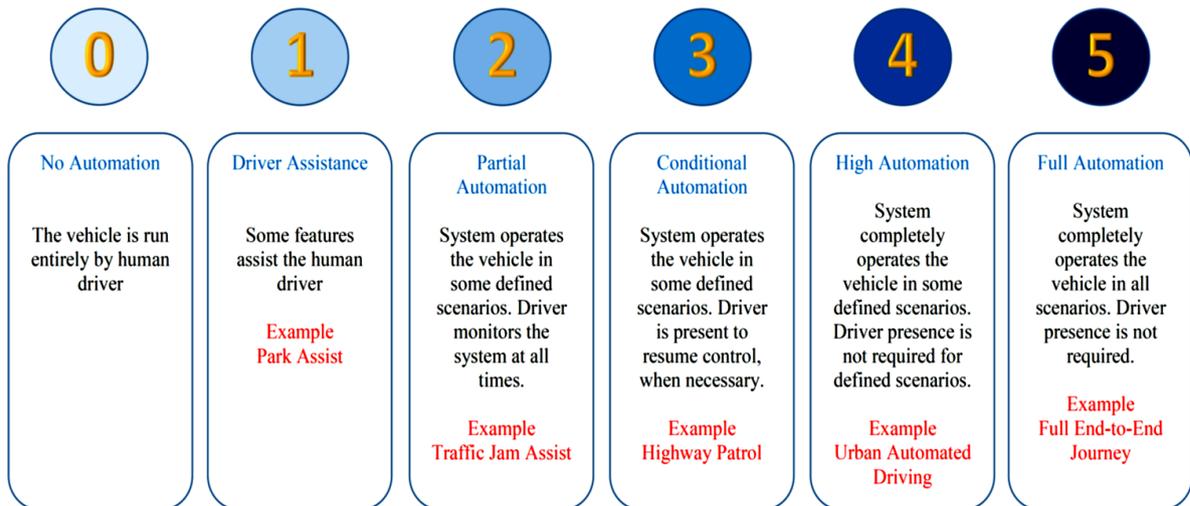


Fig. 1: SAE Levels of Automation

A recent study focusing on the public perception of anticipated benefits of AVs found out that only half of the survey participants believed in its advantages such as congestion reduction, pollution reduction, and safety improvement [13].

Pakistan is a country where autonomous vehicles are yet to be introduced. However, the traffic-related issues are severe and require innovative solutions including introduction of AVs. This study aims at understanding public perception towards AVs in Pakistan.

2. Data Collection

Since Pakistan is a developing country, therefore a new technology such as autonomous vehicle will take some time before being introduced in its market. Moreover, any new technology is always adopted by tech savvy youth first. So due to these two reasons, opinion about autonomous vehicles was requested from university students only. Consequently, responses to a paper survey questionnaire were collected from 356 students, affiliated with three different universities, namely University of Central Punjab (UCP), University of Engineering and Technology Lahore (UET) and University of Management and Technology (UMT), all located in Lahore the industrial hub of Pakistan. Demographic aspects of the respondents are summarized in Table 1.

3. Questionnaire Design

A survey questionnaire was designed based on forms available in literature. Several

important topics were investigated using the questionnaire including

1. Awareness of autonomous vehicles
2. Concerns regarding autonomous vehicles
3. Perceived benefits of autonomous vehicles
4. Scenarios that require the use of autonomous vehicles

Each topic was probed by way of multiple questions. The survey was performed in January 2019.

3.1 Awareness

Respondents were asked whether they have heard about several functionalities of autonomous vehicles. The inquired utilities included

- Automatically change speed based on changed speed limits
- Automatically stay within the lane
- Automatically park itself
- Automatically avoid crashes on road

3.2 Concerns

Ranging from ‘unconcerned’ to ‘very concerned’, responses were recorded against following apprehensions regarding autonomous vehicles.

- Security of vehicle (e.g. vehicle hacking)
- Privacy (e.g. continuous vehicle tracking)

- Legal and financial responsibility for crashes and mistakes
- Unoccupied vehicles moving on road
- Taking a driverless taxi
- Taking a driverless public transport vehicle
- Sharing road space with driverless trucks

3.3 Perceived Benefits

Respondents were asked to estimate the following benefits of autonomous vehicles, ranging from ‘very unlikely’ to ‘very likely’.

- Fewer Crashes
- Reduction in severity of crashes
- Shorter travel time
- Lower vehicle emissions
- Better fuel economy

3.4 Scenarios

Following five scenarios were presented to the respondents, and their opinion regarding use

of autonomous vehicles were recorded ranging from ‘strongly disagree’ to ‘strongly agree’.

- When I am unable to drive myself due to physical or mental ailment
- When the weather is bad
- When kids travel without the presence of any elder
- When I am too tired to drive
- When traffic congestion occurs

• Results and Discussion

The survey results for each of the section are exhibited as Figures 2-5. Results depict that majority of the respondents were aware of various functions that are included in autonomous vehicles (Figure 2). The results showed an unusual outcome; more people have heard about cars automatically adapting to changing speed limits (78%) as compared to self-parking cars (64%), which is strange since many of the imported Japanese vehicles (like Toyota Prius) present in Pakistani market have self-parking features, although they are not fully-autonomous vehicles.

Table 1: Demographic Aspects of Respondents

Demographic Aspect		Percent			
		UMT (N=53)	UCP (N=233)	UET (N=70)	Total (N=356)
Age Group	15-20	60.38	24.03	10.00	26.69
	21-25	33.96	72.96	81.43	68.82
	26-30	5.66	2.58	2.86	3.09
	Above 30	0.00	0.43	5.71	1.40
Gender	Male	62.26	37.77	87.14	51.12
	Female	37.74	62.23	12.86	48.88
Enrolled Degree Program	BSc/BA	77.36	96.57	88.57	92.13
	MSc/MA	22.64	3.00	8.57	7.02
	PhD	0.00	0.43	2.86	0.84
Car Owner	Yes	41.51	38.63	38.57	39.04
	No	58.49	61.37	61.43	60.96

As the technology is still to be introduced in Pakistan, the respondents showed major concerns regarding autonomous vehicles (Figure 3), with an exception for unoccupied moving cars where 20% were unconcerned. On the other hand, the respondents were mostly concerned with autonomous trucks moving in the same traffic stream. This stems from human psyche of feeling unsafe and uncomfortable in the presence of large vehicles, and that too in the absence of a human driver. Figure 4 demonstrates that respondents mostly understood and accepted the benefits that the autonomous vehicles have to offer. However,

a few of the respondents were skeptic about the reduction in vehicle emissions.

This doubt will be automatically addressed once autonomous vehicles are introduced in Pakistan, and the public can witness as well as gauge the benefits. In all of the scenarios provided to the respondents (Figure 5), the use of autonomous vehicles was strongly favored except when autonomous vehicles are supposed to transport unsupervised kids. This may be due to the inherent sense of protecting the young ones and the risk of leaving kids unattended in an apparent unsafe environment.

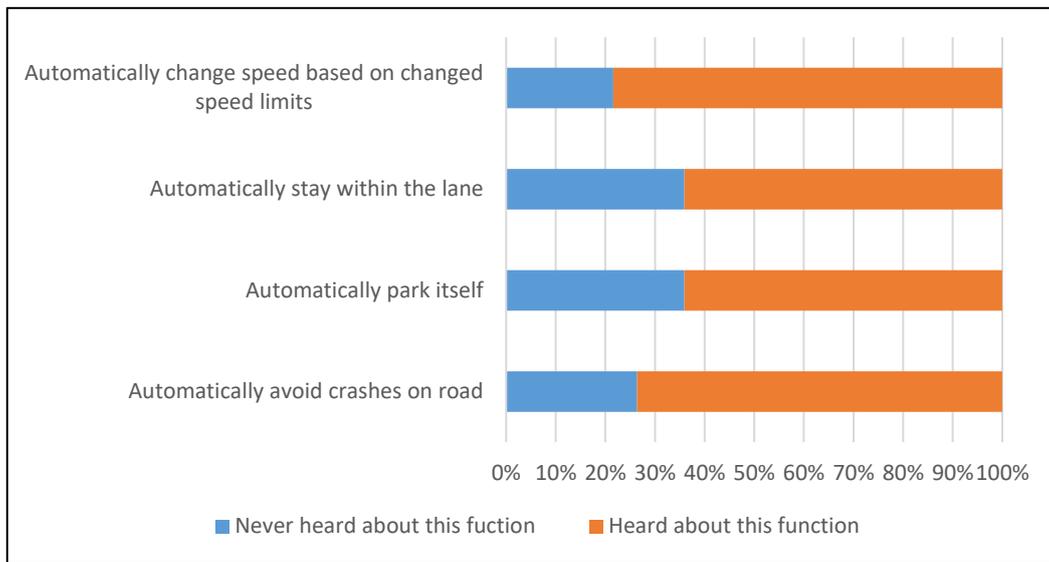


Fig. 2: Awareness of Autonomous Vehicles

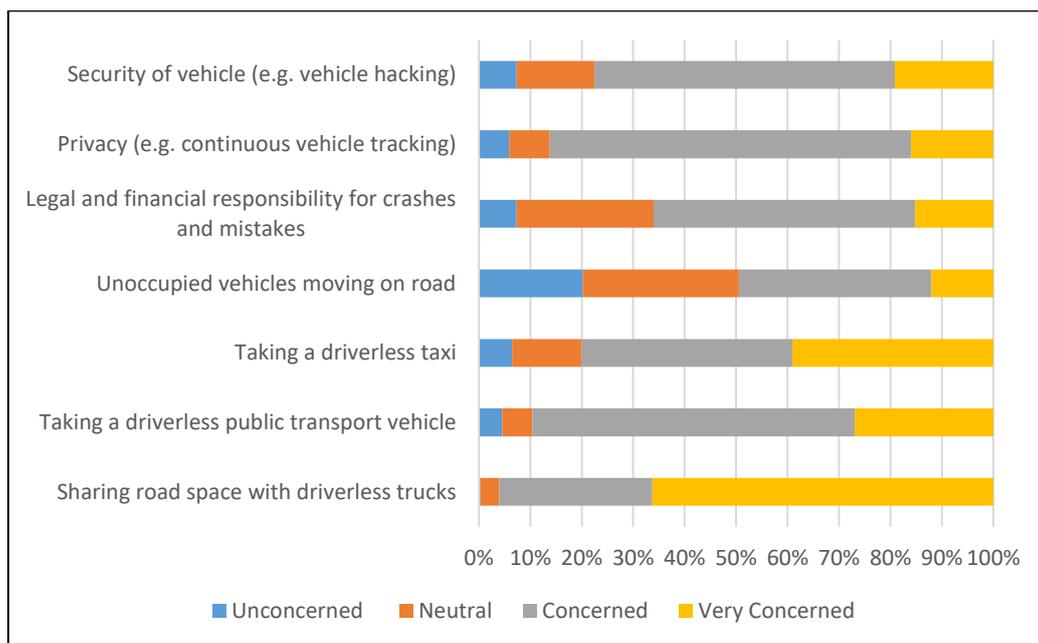


Fig. 3: Concerns regarding Autonomous Vehicles

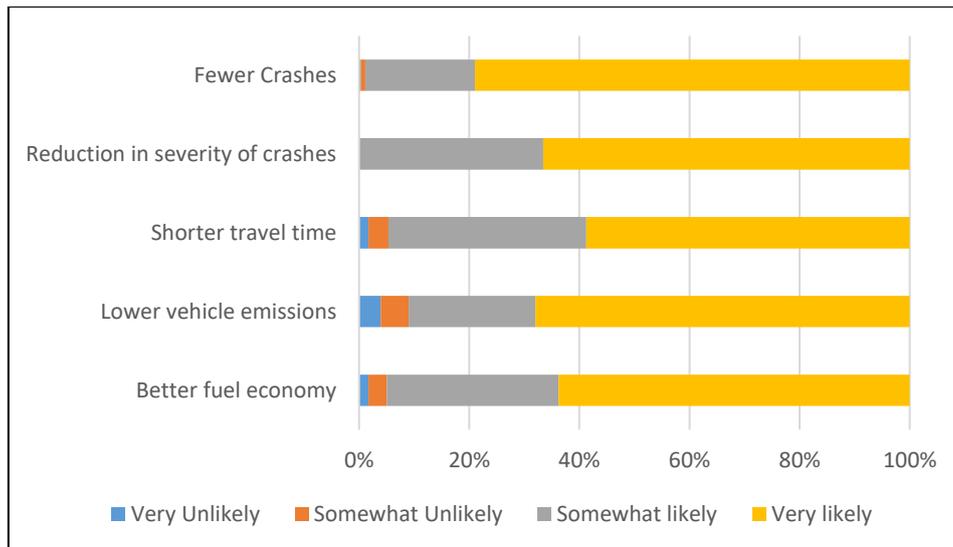


Fig. 4: Perceived Benefits of Autonomous Vehicles

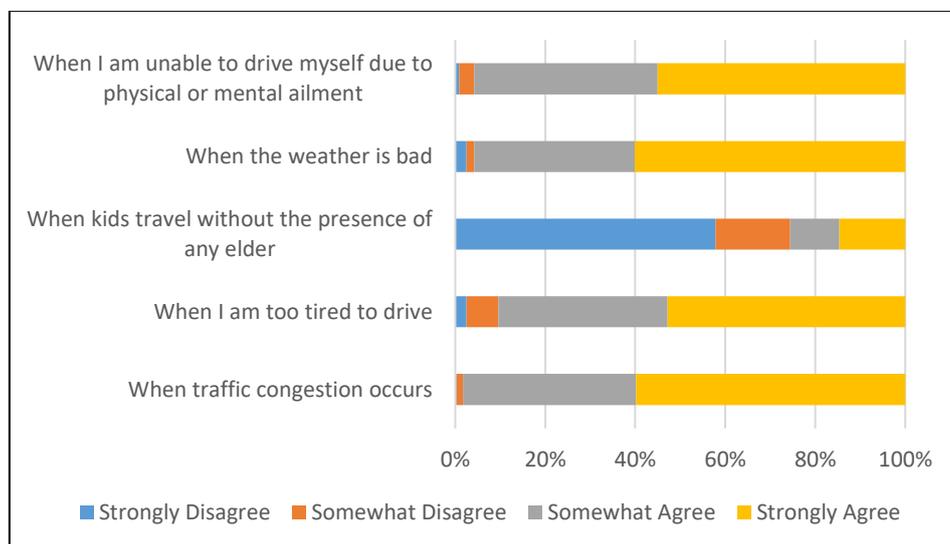


Fig. 5: Scenarios that require the use of Autonomous Vehicles

4. Conclusion and Future Work

This study provides an insight into the perception of people in Pakistan regarding autonomous vehicles. Although, autonomous vehicles are yet to be introduced in Pakistan, most of the respondents are aware of the technology, and predominantly trust the advantages associated with AVs. However, they have serious apprehensions, especially related to driverless trucks moving in the same traffic stream. Further, they are reluctant to allow AVs to pick up or drop off kids without the presence of any elder in the vehicle.

Before introducing AVs into Pakistani market, which may take more than 10 years, a comprehensive study should be undertaken to

evaluate the present infrastructure and devise a phased plan to improve it so that AVs may be integrated into traffic, and their advantages may be fully utilized.

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