ÓBUDA UNIVERSITY

Keleti Károly Faculty of Business and Management
Institute of Business Development and Info communication

DEGREE PROJECT
THESIS

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2023 Student's registration number: **T009268/FI12904/G**

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Student's surname, forename (s): Mehreen Aneel
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Branch of study: Business Development
Specialization:

Thesis title: Future of Self-driving cars and its impact on the economy
Task description:
1. Give a comprehensive overview of the literature!
2. Plan and carry out your own research!
3. Evaluate the results of the research!
4. Give some recommendations on the basis of the research results!

Institutional consultant's name: András László Keszthelyi

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Director of Institute

The Thesis is suitable for submission:

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Institutional consultant

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External consultant

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STUDENT'S DECLARATION

I the undersigned student named Aneel Mehreen (Neptun code: [redacted]) hereby declare that the degree project is the result of my own work; I referred to the special literature and the means used in an identifiable manner. The results included in the degree project completed are allowed to be used by the university and the institution announcing the task for their own purposes free of charge, subject to any restrictions on classification as confidential.

Budapest, 11 day 12 month 2023 year

.....

student's signature

CONTENTS

LIST OF FIGURES

LIST OF TABLES

Title: Future of self-driving cars and its impact on the economy

(Base on the Study of four countries UK, Hungary, Malaysia & Pakistan included Safety issues and human awareness of self-driving Cars)

INTRODUCTION

The study of Self-driving cars is very popular topic in these days for the innovation in the car industry. Self-driving car means driverless cars or drive the car without human effort on the road. The perception of self-driving cars has been in progress for many years, but latest development in technology, specifically in artificial intelligence, sensor systems, Industry 4.0 and connectivity, have brought the concept in physical existence. According to the statistical data 94% accidents happened due to the human error during the driving. In 2022 Kisling, Nestico & Redick LLC, It has been reported by manufacturer, nearly 400 crashes of car with moderately automated driver-assist systems are recorded to the National Highway Traffic Safety Administration (NHTSA).

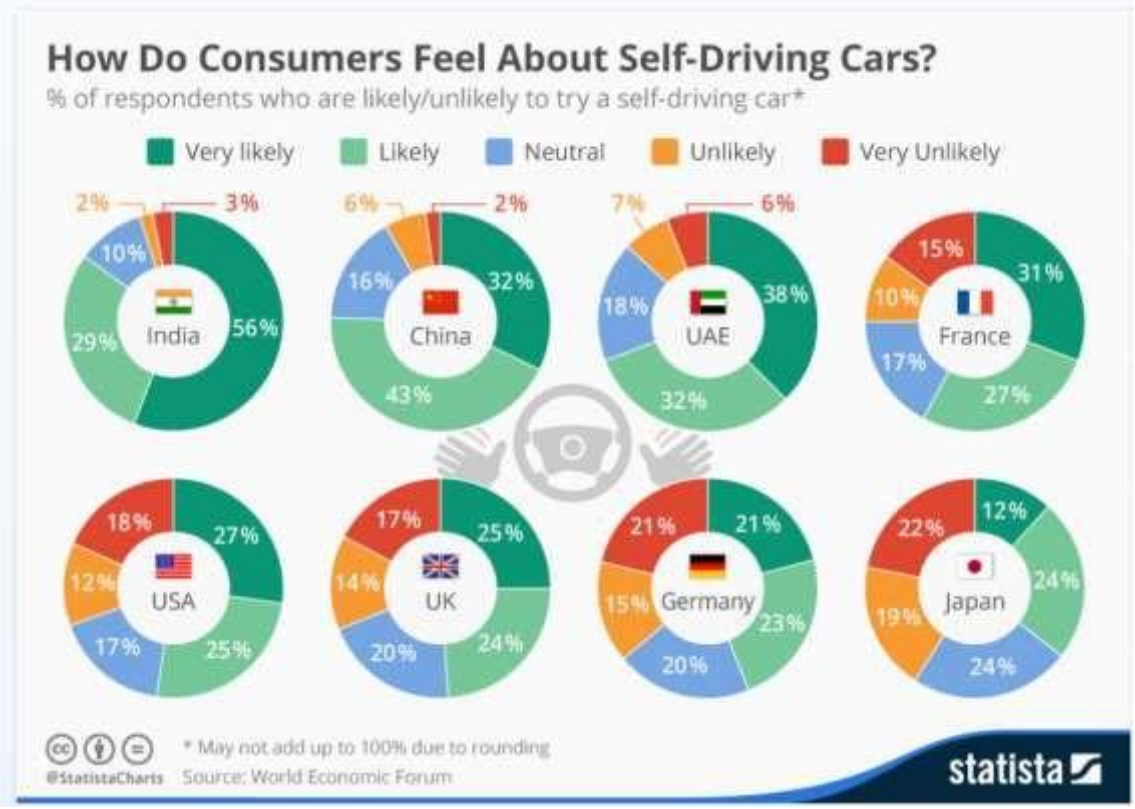
273 accidents have been done by Tesla involved in with self-driving capability also 70% of which used autopilot beta at the time. The development in autonomous cars is going on process while working on innovation and invention in advance technology of safety, protection, audio and video visualization devices. Further, Self-driving cars is an interesting research oriented topic of the recent times as population is increasing, therefore complexity of mobility is also increasing so it is important to understand the fact of mobility in the developed countries and developing countries.

There are some potential advantages of self-driving cars such as easy and comfortable travel, environment protection, less traffic flow and parking issue due to increase in is increasing and accidents are also happening due to human error. Sometime people are drunk in some countries, most of the countries followed zero tolerance against alcohol such as Hungary, Malaysia and Pakistan. Few of countries allowed to drink a glass of beer during the driving. Sometime people are tired and upset while driving. Countries, US, Germany, Japan, and China are mainly investing in the self-driving cars. This study also helps to assess level of preparedness where we are standing in this journey of self-driving cars mainly in UK, Hungary, Malaysia and Pakistan developed and developing countries respectively.

I have seen some incidents on the roads and Metro working of advancing technology in automotive industry interlinked traffic signal system and door opening and closing system of vehicles. Sometimes mother, child and old people have to move quickly while the situation is not favorable because old age people walk slowly and take more time to

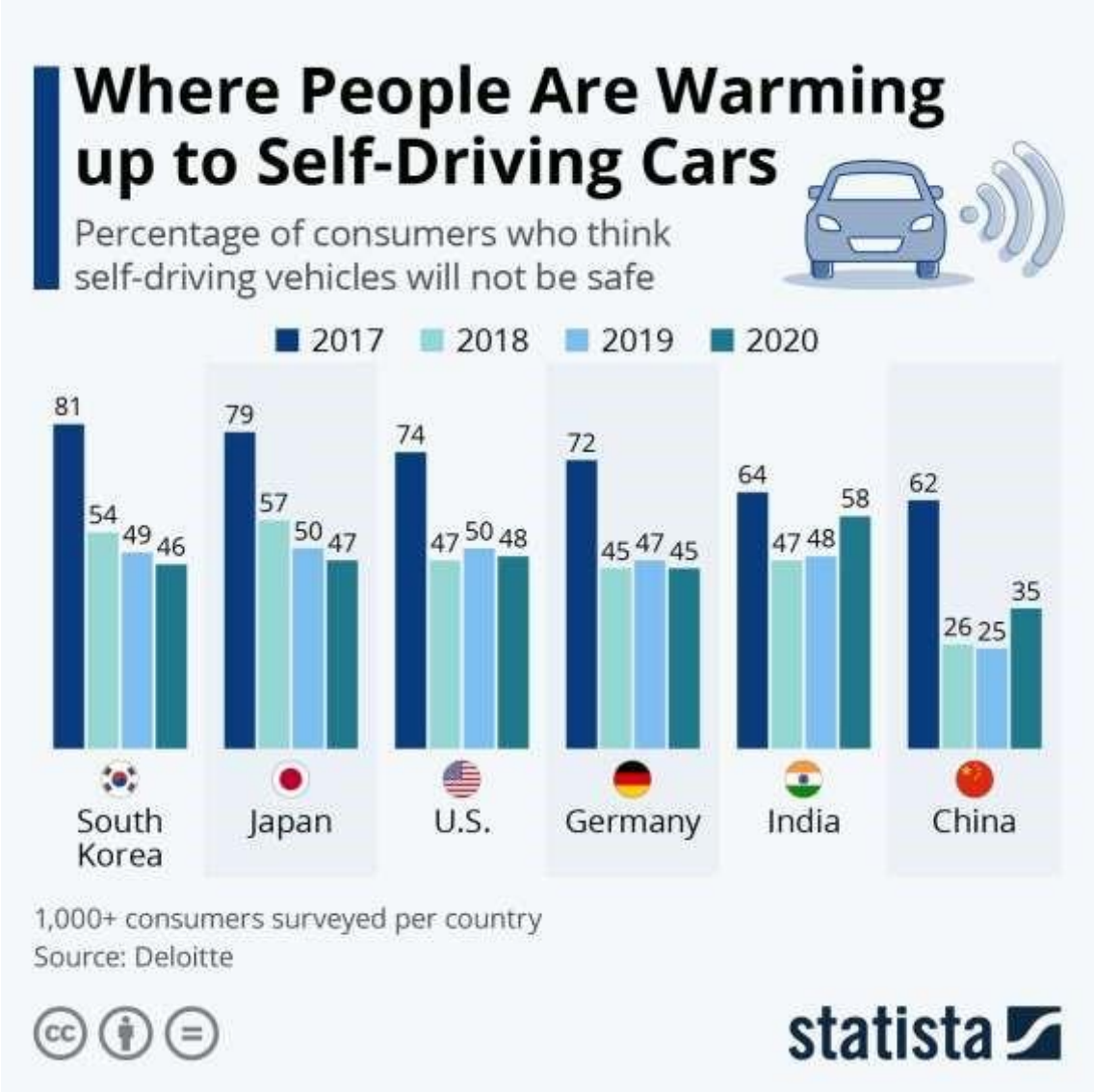
get in but technology has set some specific time duration and limited understanding of the situation. Moving a wheel chair in the train is also important event. Disable people has to make effort to move and use this advance technology of mobility cars. On the other hand, developing countries are very far behind due to technological advancement, social, economically, and politically challenges of self-driving cars, like Pakistan and Malaysia. Political situation is not favorable in Pakistan as parties are fighting with each other. Development projects do not complete and remain unattended by the other parties. According to the world bank in 2021, recorded -1.67 political instability in Pakistan. In 2022, flood effected the industry in Karachi as it is also big city of Pakistan. There are lack of infra-structure and legal framework. The geographical environment is also different between plate and mountain majority countries. Traffic system are very poor as compared to the developed countries. Although in previous years in Pakistan made effort to invested on the traffic signals networking, cameras and control unit to avoid the accidents and traffic issues.

In this study, I will discuss in brief about US, Europe, Japan and China situations related with the self – driving cars along with the brief description about the companies (Waymo, Tesla and Volvo which are already working on the self-driving cars in the literature review. People are more willing to adopt self-driving cars as compared to the developing countries. Graham Hope 2022, reported a study shows that driverless cars will be gender specific and females are more open and better in the self-driving cars, a team from England's Newcastle university carried out research that women showed reaction more quickly than men to take over the steering control. World Economic forum and Deloitte 2020 reported Chinese people trust more on the autonomous driving cars. Overall, report showed that people are knowing and trusting more on the self-driving cars as compared to the previous years. In US and Europe people are scared to accept this technology due to accidents situation occurred in these countries. However, People of developed countries have prior knowledge of self-driving cars as associated to the developing countries.



World Economic Forum 2015 (Figure 1)

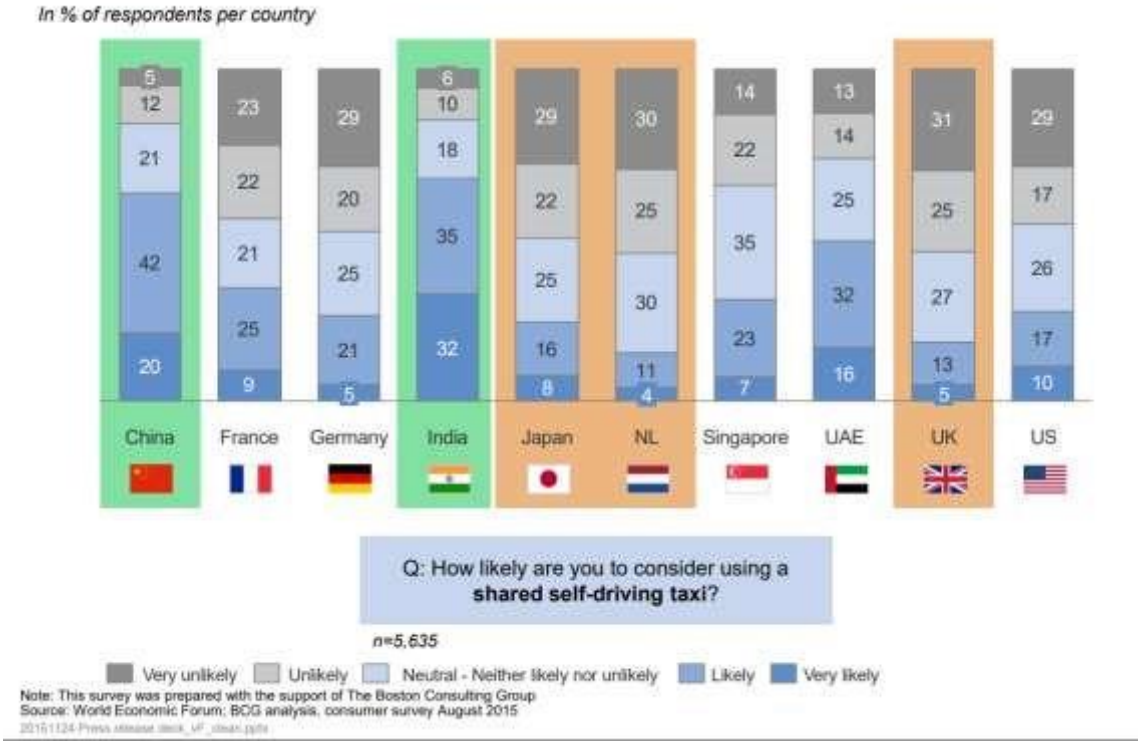
The scope of my research is mainly focused on the people's behavior and safety issues of the self-driving cars, specifically in UK, Hungary, Malaysia and Pakistan. The lope hole is more perfection and appropriate steps are required to get the specific result in technical instruments such as sensing and hearing noise, cyber security, social dilemma, Job constraint, weather situation such as fog, dust, temperature and storm impact, economical grounds mean infra structure and networking then favorable circumstances in legal and political system in these countries.



https://www.statista.com/chart/16654/self-driving-cars/ 2020 Figure. 2

Millions of lives could be saved because of the growing use of computer technology in transportation, which will also increase safety and dependability and lower the cost of both individual and corporate shipping. Sharing ride will cost less and benefit to the company but there is a safety threat for the women and children specially. Due to low fare and income Asian countries such as Pakistan and Malaysia prefer ride sharing as mentioned below India and China have higher ranked for the ride sharing. It is unjustified to some certain extent to be afraid of putting our trust in the "hands" of automated transportation.

In China and India has great willingness to use a shared self-driving taxi



World Economic forum 2015 pg 11 Figure 3

Technology in self-driving cars exhibits an unreasonable dread of being subjugated by technology. Compared to manual human operations, automated systems can be regulated to higher safety standards and are statistically more stable. Autonomous transportation will become more prevalent over time and reduce accidents brought on by human error as technology advances.

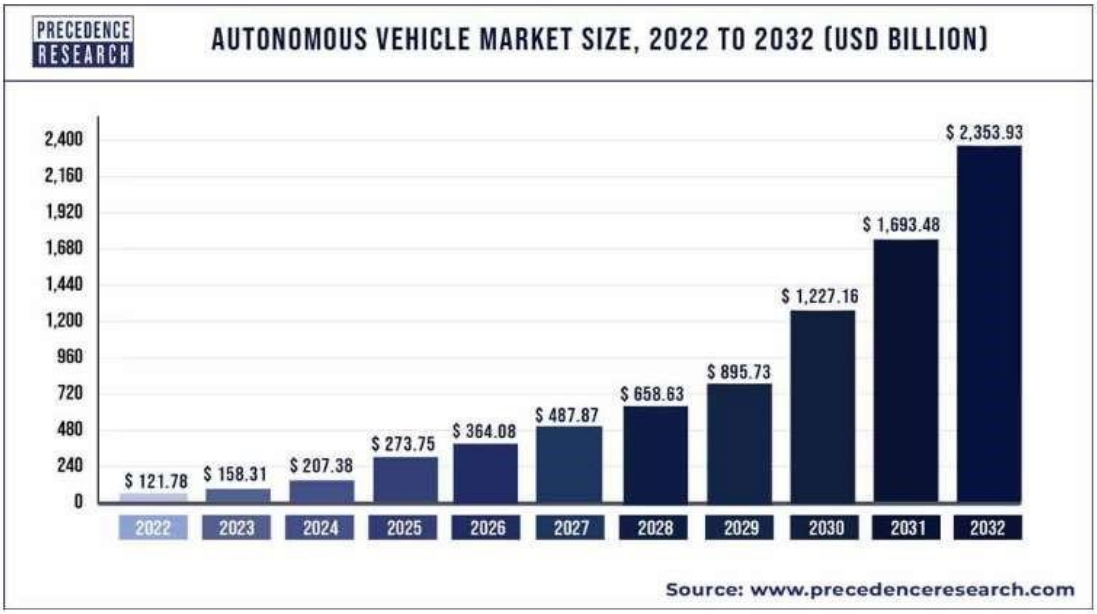
Despite these challenges, self-driving cars demonstrate a noteworthy phase toward the upcoming of transportation, with key benefits for safety, convenience, and the environment. The development and disposition of self-driving cars continue to be a subject of far-reaching research, investment, and public discourse. In this paper, I will focus on the impact of computer controlled driving on the people lives such as compatibility to the new tech mean people will know new innovation, new habit will learn like relaxing, sleeping, reading and working style. So, the development of self-driving cars will decrease the number of vehicular accident and increase the chances of theoretical and practical knowledge among the people for the trust and reliability on the autonomous cars.

This paper is structured as follows: Brief introduction of importance of self-driving cars and consumer perception. section 1. Literature review provide history of development phases of self-driving cars along with the old car evolution. It also talks about four countries categorized developed and developing countries, division is based on GDP per capita Section 2. My own way of research in self-driving cars, my objective, aim and description of the problems in the progressing the self-driving cars. Section 3 Evaluate the results of the research paper Section 4. Future recommendations, this is how, this study analyzes in brief technological, safety and security, legal, demographic and environment effect of self-driving cars in developed and developing countries.

1.LITERATURE REVIEW

1.1 Introduction

The magnitude of the international industry for autonomous cars was projected at USD 121.78 billion in 2022 and is predictable to reach USD 2,353.93 billion by 2032, progressing at a projected CAGR of 35% from 2023 to 2032. The demand of Level 1 and 2 are increasing in the market which are the major caused to increase in the investment in level 4 and 5 of the self –driving cars. OEM plans to launch level3 semi-autonomous cars models and conduct testing of level 4 cars. This will take leap of growth in the car industry in the coming years. **(Mathlida Carlier, 28 Aug, 2023 Revenue - automobile manufacturing industry worldwide 2019-2022)**. Currently, 20.3 million units are working in automotive industry. By 2030, 62.4 million units will be expected to function in the car industry at compound annual growth rate(CAGR) 13.3% in near future as per recent forecast period. Moreover, there are chances of shared mobility and growing partnership in the self- driving cars.

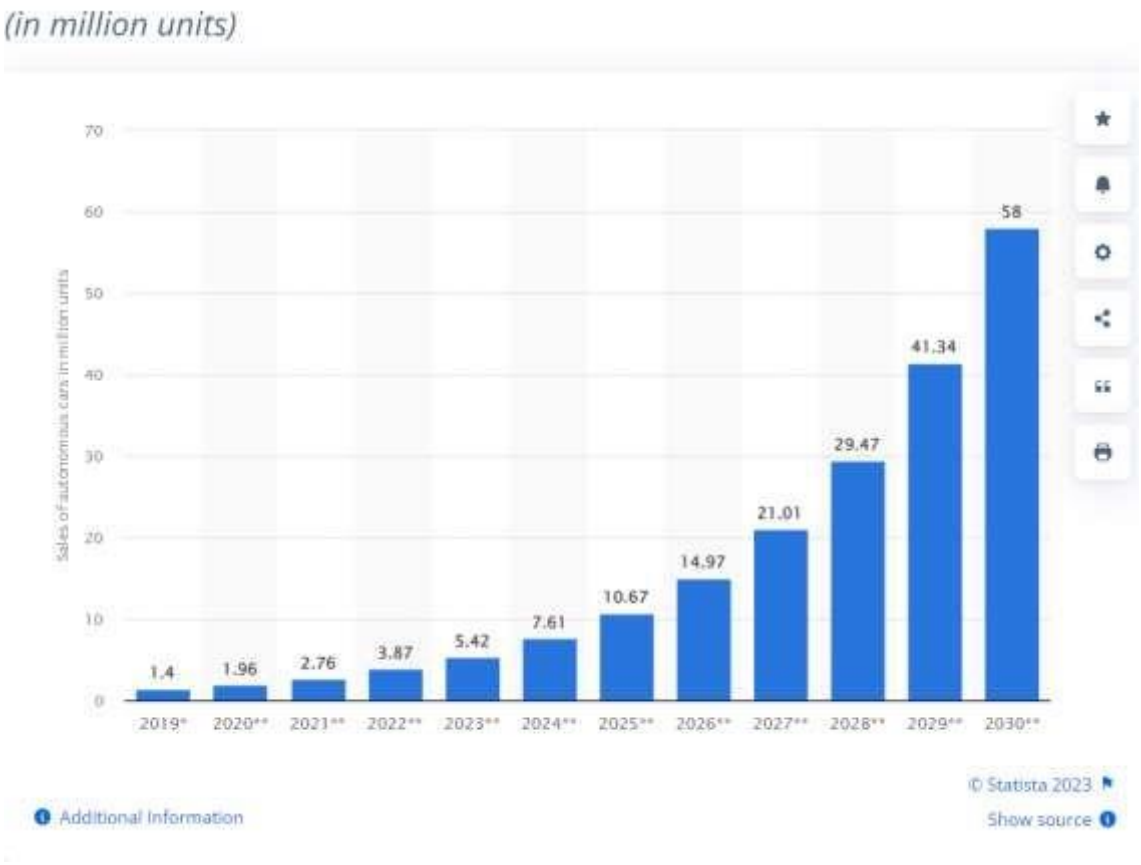


https://www.precedenceresearch.com/autonomous-vehicle-market, March 2023 Figure 4

Shift from Buying a Car to Using Mobility as a Service in MaaS

The need for an integrated mobility service platform that integrates many modes of transportation, including bikes, private vehicles, and public transit, into a compact service package has grown in recent years due to the evolving nature of everyday passenger commutes. The number of people living in urban areas is predicted by the UN to increase from 55% in 2018 to 68% in 2050. As a result of this fast growing urban population, there will be a greater need for sustainable transportation options that are convenient, economical, and take less time to use. Forthcoming mobility services are expected to benefit from MaaS's ability to less expense, support effective shift from one point to another, and release traffic blocking.

Projected sales of autonomous vehicles worldwide from 2019 to 2030



https://www.statista.com/statistics/1230733/projected-sales-autonomous-vehiclesworldwide/ 2022 Figure 5

The mainstream of MaaS facilities will be provided by self-driving taxis, or robo-taxis, which are self-directed vehicles functioning at Level 4 or Level 5 that are used for on-demand mobility services like ride-sharing and ride-haling. Additionally, a confounding amount of investigation and expansion is being done by independent driving technology providers like Waymo, Uber, and Zoox, among others, to create Level 4 or Level 5 robo-taxis. Uber, for example, donates between $125 million and $200 million every quarter to projects involving independent vehicles. In order to harvest cutting-edge driverless vehicles, autonomous technology providers are also working with tier 1 component suppliers and automotive OEMs.

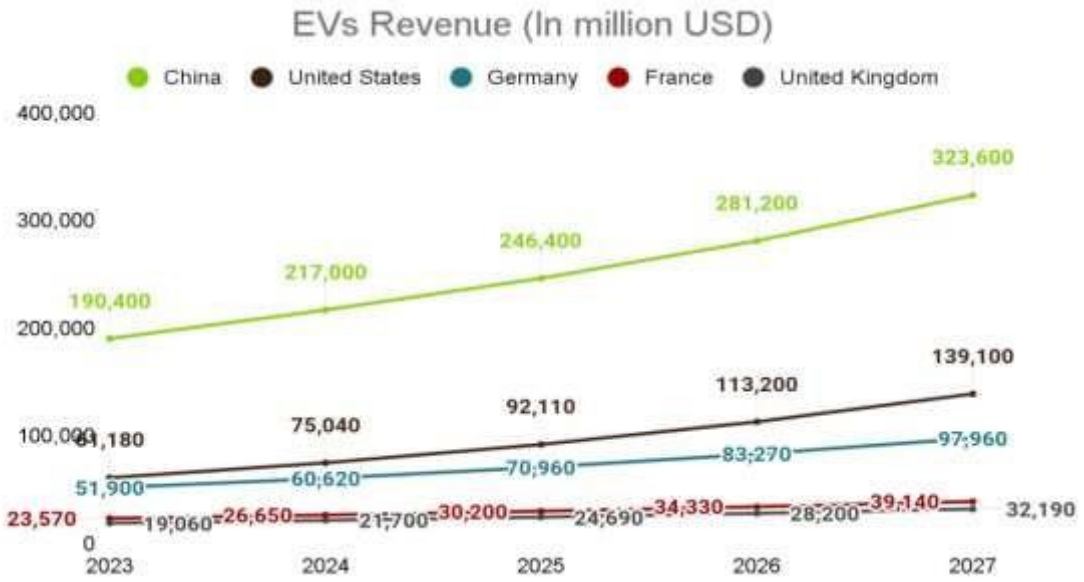


Figure 6

For instance, in August 2018, Uber and Toyota together, Toyota capitalizing $500 million in Uber as part of the collaboration contract. The two productions would work together on the progress of self-driving cars. Commencement in 2021, the combined self-driving technologies will be used on Uber ride-hailing networks and paired with Toyota Sienna minivans. It is projected that each of these variables will greatly expand the market's growth prospects.

Huge Potentials in Emergent Economies for Extravagance Vehicles (Level 1 and Level 2)

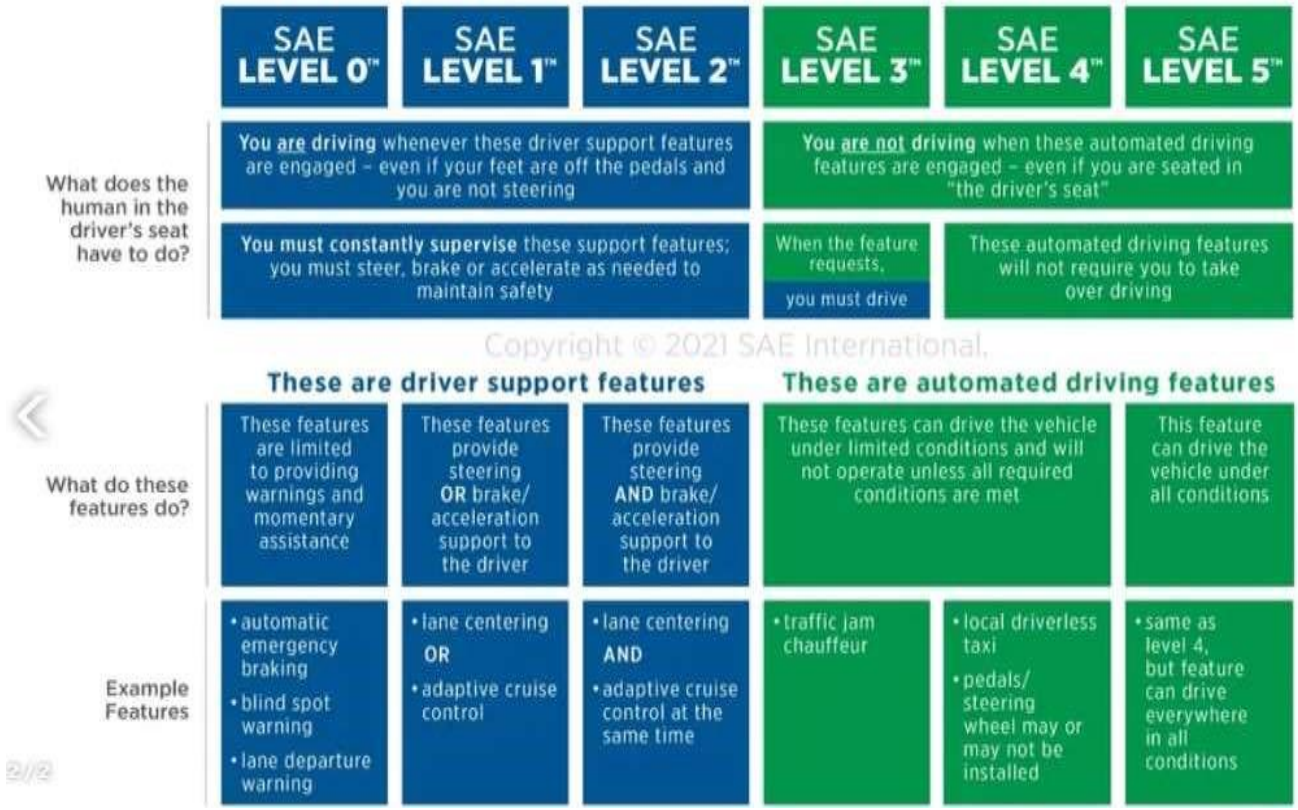
Level 1 and level 2 autonomous vehicles are being developed by automotive OEMs including Volvo, BMW, Audi, Mercedes-Benz, and others in response to the growing demand for luxury cars. In recent times, emerging economies like China, India, Vietnam, Malaysia, and Indonesia have experienced unparalleled expansion in the automotive sector. These countries are also turning into significant hubs for production for key global automotive players. To effectively leverage the growing desires of consumers for automobiles, top international automakers are expanding their businesses into new and developing regions through product launches, acquisitions, and partnerships.

In India, BMW plans to release the X7 and X4 in 2019. Adaptive cruise control, lane departure warning, blind spot recognition, and speed limit information are just a few of

the ADAS features available on the BMW X7. The company's position in developing nations will be further strengthened by this kind of expansion, which will also increase its market share.

Additionally, in order to close the gap between supply and demand for cars, top automakers are extending their manufacturing footprints geographically in developing nations. For example, an agreement to extend the Chinese joint venture "BMW Brilliance Automotive" was struck in July 2018 between BMW and its Chinese partner "Brilliance Automotive Group Holdings." The company will be able to increase output to 520,000 automobiles in 2019 thanks to this development.

Some of the IMPORTANT players in the Self-Driving cars in the market include: 1.BMW AG 2. Audi AG 3. Ford Motor Company 4. Daimler AG 5. Google LLC 6.General Motors Company 7.Nissan Motor Company 8. Honda Motor Co., Ltd. 9. Toyota Motor Corporation 10. Tesla 11.Volvo Car Corporation 12. Uber Technologies, Inc.13.



Volkswagen AG

Figure 7 SAE International 2021

September 11, 2023. Japan has formally given the permission to Level 4 autonomous vehicles for consumer use. The place of Eiheiji in Fukui newly presented nearside service after Japan's government amended the Road Traffic Act in March of this year to permit level 4 autonomous driving.

SAE International 2021

The SAE (Society of Automotive Engineers) has thus defined 6 different levels of autonomous driving: **(SAE Level of Automation 2021)**

Level 0: no driving robotics

Level 1: driver support

Level 2: fractional driving computerization

Level 3: restricted driving robotics

Level 4: extraordinary driving robotics

Level 5: full driving robotics

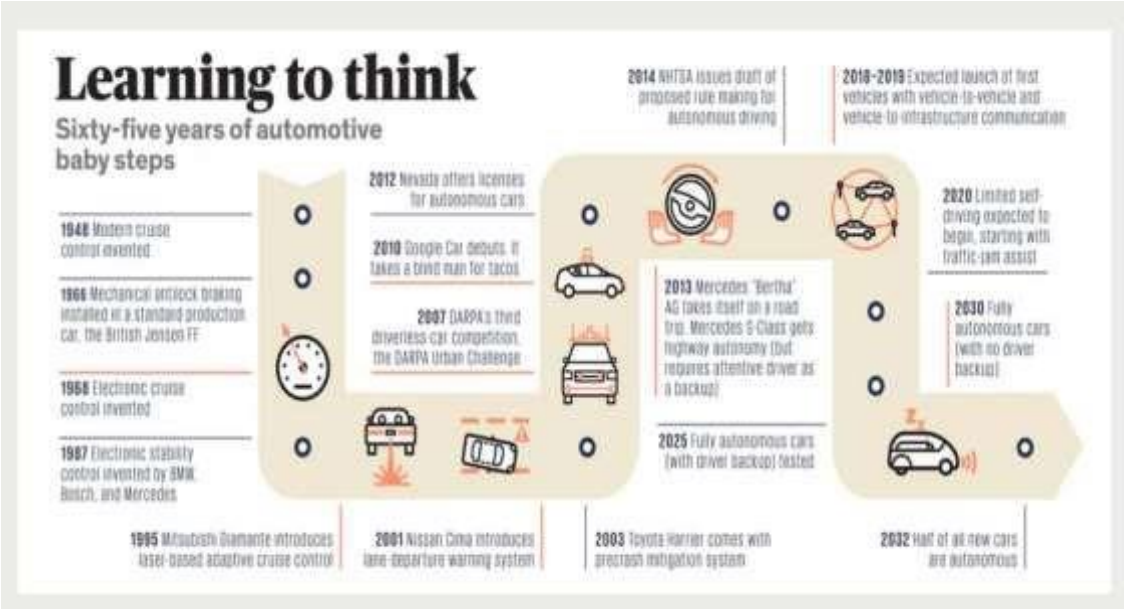


Figure 8 **Sixty-five years of Automotive baby steps, Source: Philip Ross, 2014, p. 62 da Vinci's Self-Propelled Cart (ca. 1500)**

Struggle for self-driving cars assisted the development and research in the area of autonomous vehicles towards impending solutions for the future movement**. (Blane, 2014)** inspect the texts that explores glaucoma and crash risk, driving presentation, mental demand, driving self-regulation, and driving termination in older drivers. This review has identified that the literature related to glaucoma and driving act, crash risk, intellectual demand, and driving practices in older adults is unpredictable. As a result, there is an urgent need to study the possible security threats and different solutions that can ensure the safety of drivers and also the security of industry. **(Abu Talib et. al., 2018),** This study is also focus on VANET(vehicular ad hoc network) and (MANET Mobile ad hoc network). This technology brings the concept of smart cities for the self-driving cars but beside it VANET is under security risk due to short and long wireless internal system in car in order to realize intelligent vehicular transport networks and self-driving cars, connected autonomous vehicles (CAVs) are required to be able to estimate their position to the nearest centimeter. **(Adegoke et. al., 2019)** seek to investigate recent technological advances relating to positioning techniques between an ego vehicle and a vehicular network infrastructure**. (Badue et. al., 2019)** survey research on self-driving cars published in the literature focusing on autonomous cars developed since the DARPA challenges, which are equipped with an autonomy system that can be categorized as SAE level 3 or higher. **(Badue et. al., 2019)** present the typical architecture of the autonomy system of self-driving cars. Autonomous vehicles need data and updating continuously, so in the case, IoT and Artificial intelligence help to share the information device to the device. **(Raviteja et. al., 2020)** address what the technologies and strategies are used in autonomous vehicles by literature reviews and the gap between them. The high-tech contains of traditional and bodily methods, deep learning networks, and reinforcement learning. **(Paravarzar et. al., 2020)** study motion prediction on self-driving cars: a review. Experts and ploys of the methods and gap of the research presented. Autonomous, or self-driving, cars are emerging as the solution to several problems primarily caused by humans on roads, such as accidents and traffic congestion. The relevant research literature in recent years has been systematically reviewed and classified in order to investigate the state-of-the-art in the software V&V of autonomous cars **(Rajabli et. al., 2021).** With

fleets of self-driving cars on the horizon and the rise of multi-robot systems in industrial applications, **(Lajoie et. al., 2021)** believe that Collaborative SLAM will soon become a cornerstone of future robotic applications.

1.2 HISTORY OF SELF-DRIVING CARS

Daniel Kaszas et al. 2023 define: An independent car is an automobile accomplished of detecting its atmosphere and functioning without human participation. A human traveler is not obligatory to take control of the vehicle at any time, nor is human passenger required to be current in the car all the time.

Euro NCAP defined independent as the system acts autonomously of the driver to avoid or alleviate the accident, which implies autonomous system not the driver.

Independent vehicles, sometimes known as self-driving automobiles, robotics cars, computer control cars and driverless cars have developed gradually over a number of decades. At this point, abridged delineation substantial revolving facts in the conception and improvement of self-driving cars:

Primary Impressions and Tests, 1920s–1980s

Self-driving car models and initial experiments of the period back to the 1920s, thus the idea has been all over the place for periods. The progress of self-driving cars was inspired by artificial intelligence (AI) research in the 1950s and 1960s.

DARPA Grand Challenges, 1980s–2000

In 1982, The DARPA Grand Challenges, which were commenced by the U.S. Defense Advanced Research Projects Agency (DARPA) in the 2000s, prominently enlarged concern in and monetary deal in self-governing automobile expertise. In 2004, self-driving cars contested in the primary DARPA Grand Task, which prolonged a 142-mile desert circuit. Regardless, of the fact that no automobile completed the track, the event indicated an important beginning.

Progressions and Money-making Interest in the 2010s

Foremost tech organizations started creating funds in the learning and expansion of self-driving cars, including Google (now Waymo). Google proclaimed the formation of a self-driving vehicle in 2010 and began testing the technology on public roads in California.

Advanced driving assistance systems (ADAS) with functions like adaptive cruise control and lane-keeping assist have been developed by automakers like BMW, Audi, and Tesla. Uber and Lyft began testing with self-driving taxi services. In 2018, Waymo (an Alphabet company) became one of the first businesses to provide commercial autonomous trips when it introduced a ride-hailing service with autonomous vehicles in Arizona.

2020s: Expansion and Deployment

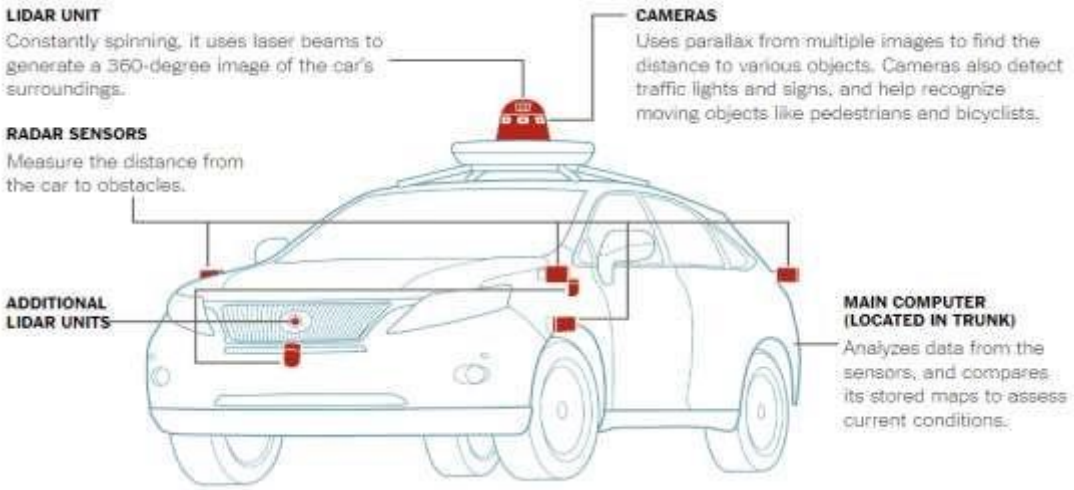
Autonomous ride-hailing services are now available in more places because to businesses like Waymo, Cruise (owned by GM), and others. Automakers keep releasing cutting-edge ADAS technologies, bringing us closer to higher degrees of autonomy (such Level 3 and Level 4). With pilot projects in several nations, the testing and use of autonomous vehicles has expanded globally. Autonomous vehicle safety standards and regulatory frameworks are constantly changing. Autonomous vehicle development is entwined with the switch to electric and connected vehicles. (By William B et all, The DARPA model transformative technology,2019)

1.3 Overview of technology in self-driving cars

The main characteristics of self-driving cars are:

1. Artificial Intelligence
2. Radar Sensor
3. Lidar
4. Mapping and localization
5. Control system and Environment perception
6. Radar Communication

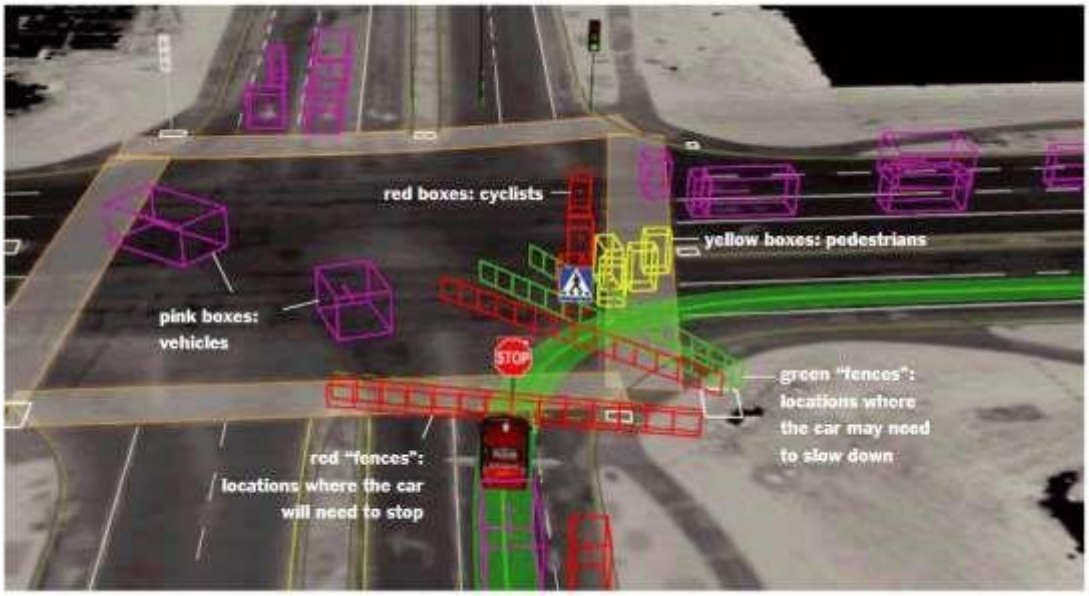
Components of Self-Driving Cars



By Guilbert Gates | Source Google | Car is a Lexus model modified by Google| June 2017 **Figure 9.**

Self-driving cars are equipped with a variety of sensors, including radar, LIDAR, cameras, and ultrasonic sensors. These sensors constantly gather data about the car's surroundings, allowing it to detect obstacles, other vehicles, pedestrians, and road conditions.

The core of self-driving technology is artificial intelligence (AI). AI algorithms process the data collected by the sensors, enabling the car to make real-time decisions, recognize objects, and navigate the road safely. **(Gambi et. al., 2019)** syndicate practical content generation, a system commonly working in current video games, and search-based testing, a testing technique established to be effective in many domains, in order to robotically create thought-provoking virtual situations for testing self-driving car soft-ware. To better test self-driving car soft- ware. **(Gambi et. al., 2019)** propose to specifically test car crash scenarios, which are critical par excellence. Since creating detailed maps is a manual process, they are expensive, and testers should avoid wasting such valuable resources, for example, by generating irrelevant test cases. To address those issues, **(Nguyen et. al., 2021)** propose SALVO a fully automated approach to identify quantifiably diverse and critical driving scenarios that can be instantiated on existing high-definition maps and implement them in an industrial driving simulator as executable test cases.



By Guilbert Gates | Source Google |June 2017 Figure 10

(Deep learning Machines by Lex Friedman 2020). According to Lex Friedman, It is like chess piece that can machine think? Sensors are consisting of two dimensions:

Internal and external.

Internal: 1. Visible Light Camera 2. Infrared Camera 3. Audio

External: 1. Radar 2. Visible Light Camera 3. Lidar 4. Infrared Camera 5. Stereo vision 6. GPS\IMU 7. Can 8. Audio

Self-driving car has to think in this way, where am I? (Localization & Mapping). Where is everyone else? (Scene understanding). How do I get from A to B? (Movement planning). What the driver up to? (Driver's state). Self-driving cars rely on high-definition maps for accurate navigation. They use these maps in combination with real-time sensor data to precisely determine their location on the road. The car's control systems manage acceleration, braking, and steering. These systems ensure that the vehicle responds to the AI's commands and operates safely.

(Akinnawo Olanrewaju Akintunde, et al. 2019), This paper suggest that Self-driving cars can talk with each other and with traffic substructure to enhance safety and traffic flow. Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication systems are key modules of this connectivity.

Self-driving cars are often classified into levels of autonomy, ranging from Level 0 (no automation) to Level 5 (full automation). Most commercial self-driving systems today are at Level 2 or 3, meaning they still require some level of human oversight.

SYSTEM IN AN AUTONOMOUS CAR

Illustration by Guilbert Gates The New York Times 2017 Figure 11

Although, there will be advance stages in the self-driving cars in the near future along with high technology in radar, sensor and AI but still needs to more work required Machine among human beings, social and environment circumstances, Tech to Tech interaction, Networking infra structure, regulatory affairs and investment opportunities because it will create new era for mankind and technology. How does people think about it and put impact on our lives? **(Sam Hind 2023).**

It opens lot of doors for welfare of the society as well as economy. Progression of the self-driving car is showing increase in production and evolution of the technology in the self-driving cars day by day. Self-driving cars, are an exciting and quickly evolving technology that promises to transform transportation by making vehicles capable of operating without the need for human intervention. An outline of the technologies enabling self-driving cars is provided below:

1. (**Boosarapu Asmika et al, 2021),** Numerous sensors are included in self-driving automobiles to provide them access to real-time environmental data. Among these sensors are:

(Gor Hakobyan; Bin Yang, 2019.) Light Detection and Ranging, or LiDAR: LiDAR sensors map the environment in three dimensions using laser beams. They have extremely accurate object, car, and pedestrian detection. Radio waves are used by radar sensors to identify objects and offer details about their location, velocity, and direction. In order to assist with duties like object identification, traffic sign recognition, and lane detection, high-resolution cameras record pictures and videos of the surroundings around the car. Ultrasonic sensors are utilized for low-speed and parking-related short-range object recognition.

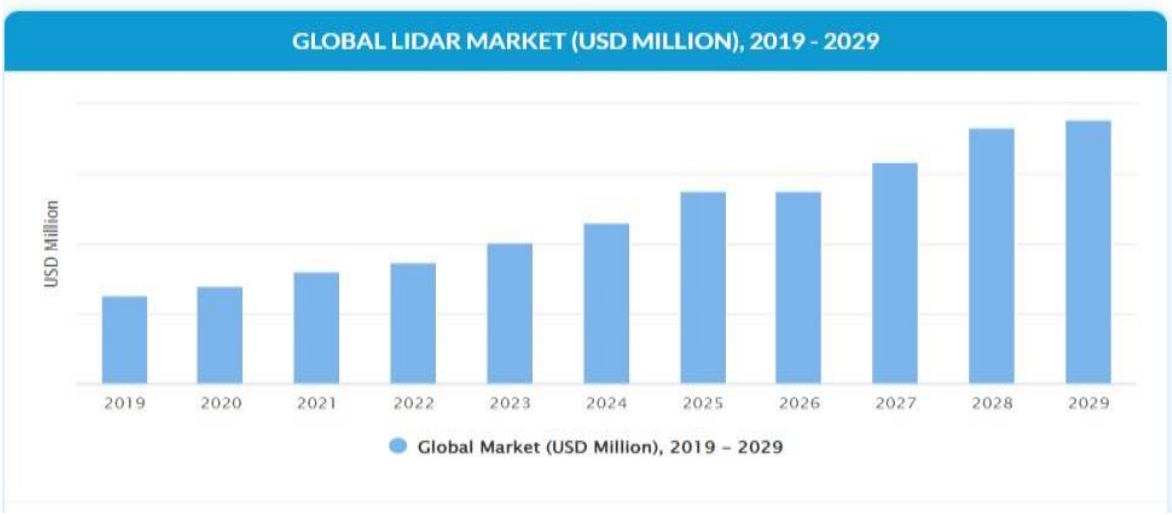


Figure 12

The global LiDAR market was estimated to be worth USD 2,001.30 million in 2022. This market is anticipated to grow at a Compounded Annual Growth Rate (CAGR) of 9.6%, reaching a size of USD 3,801.76 million by 2029.

2. **(Sarcinelli et. al., 2019)** improve the pedestrian handling systems by incorporating an object tracker with the aim of predicting the pedestrian's behavior. The combination of data from the Global Positioning System (GPS) with the Inertial Measurement Unit

(IMU) facilitates localization and navigation. **(Claudine Badue et. al., 2019)** present the typical architecture of the autonomy system of self-driving cars. **(Cavalcante et. al., 2021)** present a visual global localization system based on Deep Neural Networks (DNNs) for self-driving cars, named DeepVgl (Deep Visual Global Localization).

Computer Vision to identify and track objects, recognize traffic signs and signals, and determine the position of the vehicle in relation to its surroundings, sophisticated computer vision algorithms process input from cameras and other sensors.

3.AI and Machine Learning to make decisions and navigate their surroundings so that self-driving cars rely on AI and Machine Learning. These algorithms are able to adjust to shifting traffic patterns and road conditions. **(May El Barachi et al, 2020)** stated that Control systems use sensor data to make judgments regarding steering through crowd sensing solution in real time, braking, and accelerating in order to safely maneuver the vehicle. These technologies make sure the vehicle stays on the intended course and complies with traffic laws.

4.**(Patrick Lapointe et al, 2020)** Mapping and Localization comprehend the road network and their exact location. self-driving automobiles use high-definition maps to precisely determine the position of the vehicle, localization algorithms compare the real time sensor data with previously created maps. Cars can gather and exchange information about traffic conditions, potential hazards on the road, and other objects by communicating and connecting with infrastructure and with each other (V2V and V2I). The management of traffic laws and safety rules can be improved by this connectivity technology and networking of infra structure**. (M. Naeem Tahir, Pekka Leviakangas & Marcos Katz 2022)**

5.Safety and Redundancy to guarantee safety, many layers of redundancy are incorporated into the design of self-driving cars. For instance, they have safety procedures and backup systems in place to deal with unforeseen circumstances like sensor failures or bad weather through controlled braking and steering system.

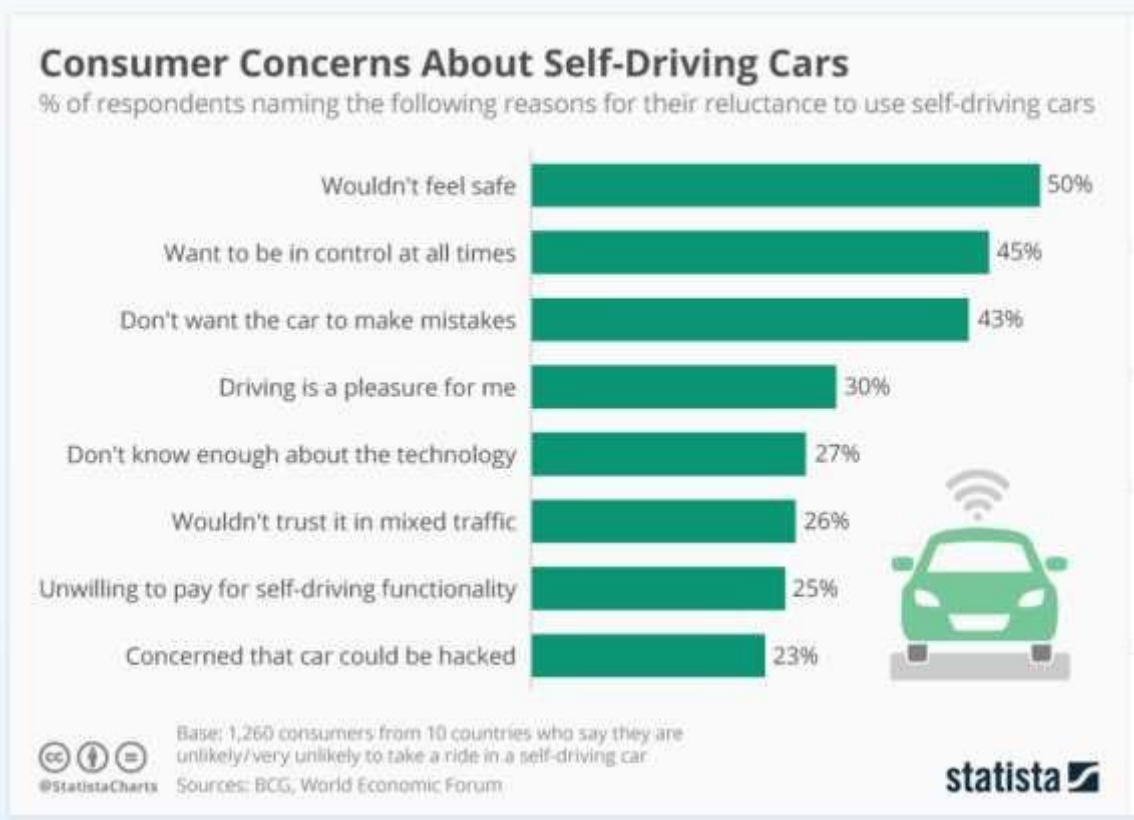
6**.(Nynke E. Vellinga, 2017)**, Strict guidelines and rigorous testing are in place to make sure self-driving cars adhere to safety requirements how to deal without drivers, insurance liability, producer and government role. Autonomous vehicle development companies frequently carry out extensive testing through the virtual different events in controlled

areas and on public roads. Computerization Levels from Level 0 (no automation) to Level 5 (whole robotics), the Society of Automotive Engineers (SAE) has well-known six automation levels. The majority of self-driving cars on the road today are Level 3 or 4, which means they can do many driving tasks on their own but may still need human assistance in some circumstances.

The authors and experts emphasize the technology's relationship to human interaction for all the reasons listed in the IEEE Interview **(Knight, 2013; Yang & Coughlin, 2014);** the technology's general a priori acceptability in recent and smaller studies **(Payre, et al., 2014),** the companies' approach to the introduction of technology; and recent studies involving future users that conclude that trust and acceptance increases with high anthropomorphism in technology **(Waytz, et al., 2014).**The three biggest barriers to the widespread adoption of driverless cars are legal safety and liability, policymakers, and customer acceptance, according to a survey conducted in 2014 by the IEEE, the largest professional association for technological advancement in the world, with more than 200 experts on the subject. Cost, infrastructure, and technology are viewed as less of an issue. Through a survey of the literature, the following section demonstrates how research has primarily concentrated on technological advancement, with a more recent emphasis on legal responsibility and policymakers. In contrast, customer acceptability has received less attention. To develop deep and relevant consumer insights that can be used to produce the solutions that customers want, it is imperative to begin understanding and integrating customers **(Bartl, et al., 2012; Von Hippel, 2005).** A literature analysis centered on a methodical keyword search across the most widely used literature databases is used in the ensuing section to illustrate the research gap on the subject. **(Cyriel Diels et. al., 2015)** discuss the impact of the user interface design in particular, focusing on display size, position, and content and the relationship with the degree of sensory conflict and ability to anticipate the future motion trajectory of the vehicle, two key determinants of motion sickness in general. Following a conversation on the reasons of gesture disease in the context of self-driving cars. It presents guidelines to steer the design and development of automated vehicle technologies.

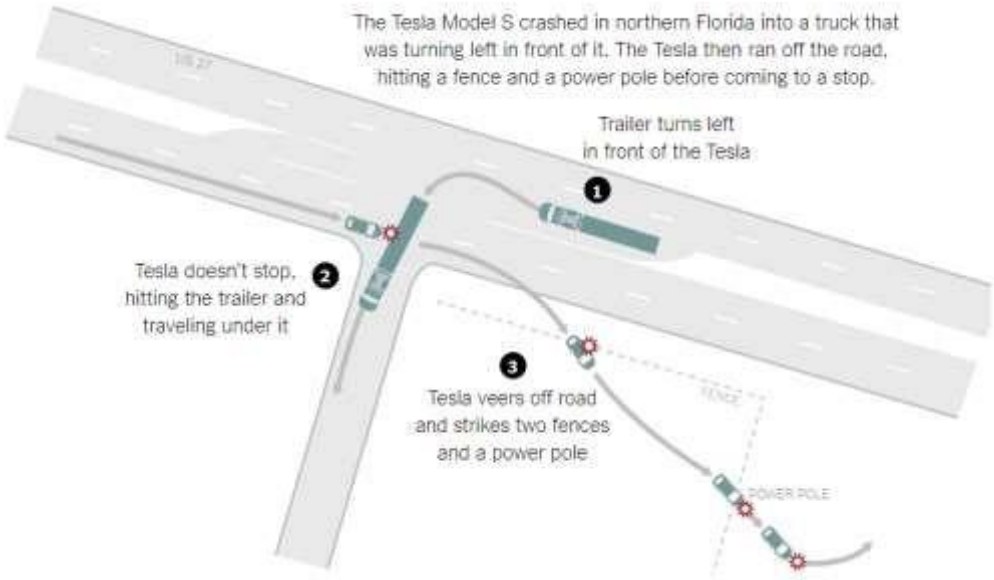
1.4 Safety Challenges of Self-Driving Cars on Global Basis

Although self-driving cars have a lot of potential to increase traffic safety, there are a number of safety issues that need to be resolved before they are widely used on our roads.



World Economic forum 2015 Figure 13

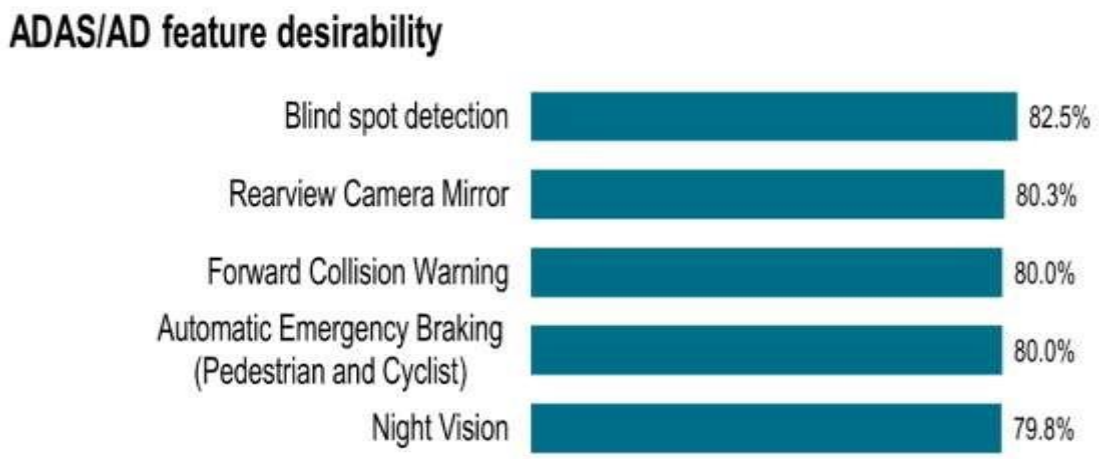
As 80 companies are testing self-driving cars in 36 states with the 1400 vehicles in 2021.



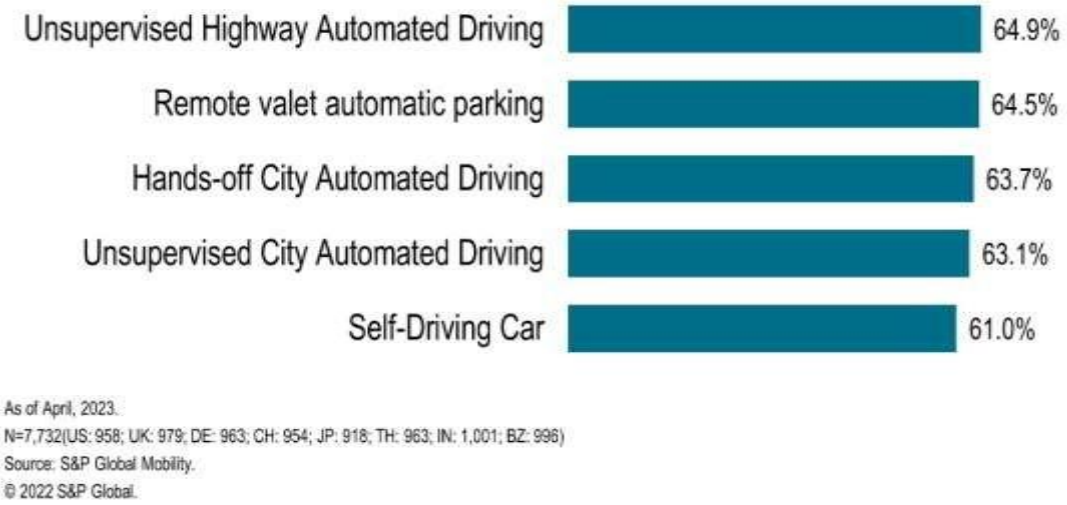
By Anjali Singhvi | Florida traffic crash report figure 14

Though issue of safety and security is complex, but it is a possibility that 34% accidents can be reduced with the help of self-driving cars. KNR Car Accident. There are a few of the present safety issues with self-driving cars:

(Jeremy Straub et. al., 2017) present an intrusion detection system, based on system-of -systems principles for the self-driving car system-of-systems. As self-driving cars have grown in sophistication and ability, they have been deployed on the road in both localized tests and as regular private vehicles. **(Barry A. Brown et. al., 2017)** draw upon publicly available videos of autonomous and assisted driving (specifically the Tesla automated and Google self-driving car) to discover how their car owner and the drivers of other cars interrelate with, and make sense of, the actions of these cars. Getting infotainment contents from Data Centers (DCs) can be perturbed by the high end-to-end delay. To address this issue **(Anselme Ndikumana et. al., 2019)** propose caching for infotainment contents in close proximity to the self-driving cars and in self-driving cars. **(Anselme Ndikumana et. al., 2021)** propose a computation model for the cached contents, where cached contents can be served in different formats/qualities based on demands **(Stamatis Karnouskos, 2020)** address the key question: In the scope of unavoidable accidents, what is the effect of different ethical frameworks governing self-driving car decision-making, on their acceptance? It hypothesizes their link to self-driving car acceptance.



Consumers desire automated safety over self-driving tech



As of April, 2023.
N=7,732(US: 958; UK: 979; DE: 963; CH: 954; JP: 918; TH: 963; IN: 1,001; BZ: 996)
Source: S&P Global Mobility.

https://www.spglobal.com/mobility/en/research-analysis/consumers-desire-automatedsafety-over-selfdriving-tech.html 2023 figure15

1. Artificial Intelligence is also important problem in the fully functioning of self-driving cars. AI is a basic tool of deep learning which is helping to explore in automotive industry. It's modern components in the assembling of the Self driving cars and inter-related system of networking all consist of AI. **(Quang et. al., 2020)** present the Simultaneous Localization and Mapping, and implement a path planning for the movement of Omni-directional self-driving robots based on the navigation stack. The achieved results show the efficiency, research direction of using Robot Operating System for controlling and monitoring autonomous robots, self-driving cars as well as developing intelligent robot systems. Self-driving vehicles promise to bring one of the greatest technological and social revolutions of the next decade for their potential to drastically change human mobility and goods transportation, in particular regarding efficiency and safety. **(Massa et. al., 2020)** present a localization architecture for a racing car that does not rely on Global Navigation Satellite Systems (GNSS). In this contribution of **(Gupta et. al., 2021)** to bridge the gap between deep learning and self-driving cars through a comprehensive survey. **(Gupta et. al., 2021)** begin with an introduction to self-driving cars, deep learning, and computer vision followed by an overview of artificial general intelligence. A 360{\deg} perception of scene geometry is essential for automated driving, notably for parking and urban driving scenarios. As a result, **(Kumar et. al., 2021)** present novel camera-geometry

adaptive multiscale convolutions which utilize the camera parameters as a conditional input, enabling the model to generalize to previously unseen fisheye cameras. Scene classification is one of the key technologies of self-driving cars, which can provide the basis for decision-making in self-driving cars. Some problems should be further studied in the scene classification methods, such as how to deal with the similarities among different categories and the differences among the same category. **(Ni et. al., 2022)** study an improved deep network-based scene classification method for self-driving cars. To deal with these problems, an improved deep network-based scene classification method is proposed. Due to the rapid and significant interest in self-driving cars, several localization techniques have been proposed with different directions and approaches. **(Chalvatzaras et. al., 2023)** analyze the advanced map-based localization techniques in an attempt to examine their potentials and limitations.

Mckinsey reported in 2021 that chip shortage has been observed in the automotive industry due to covid-19 and war of Russia and Ukraine. In the covid-19, supplies of information technology has been increased in server, communications and PC's so development shifted. Russian provide Palladium metal 25-30% for semiconductors and Ukraine deliver refined neon gas 25-35% for the automotive industry. There is bullwhip effect in the automotive industry because industry is demanding 10-20 more surplus semi-conductors when chip became short. It causes to remove some vehicles production from the market.

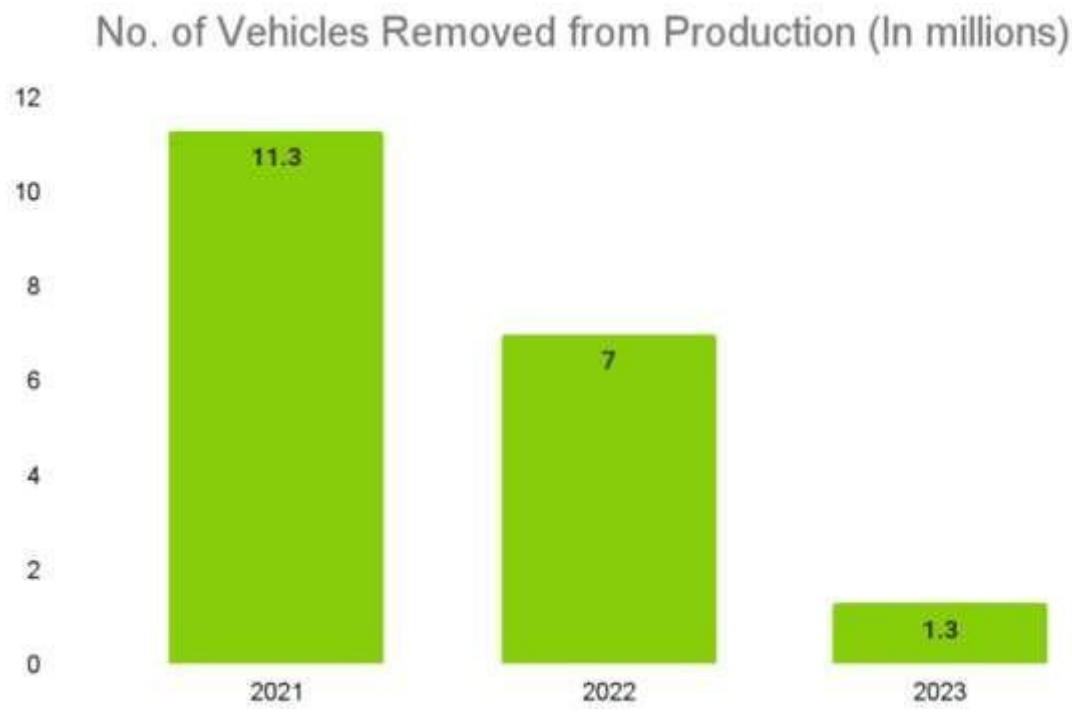


Figure 16. Source Statista 2021https://oakbusinessconsultant.com/automotive-industryoverview-analysis-and-trends/

2. Sensor restrictions is important issue of the recent time. LiDAR, radar, and cameras are just a few of the sensors that self-driving cars use to sense their surroundings. In bad weather, including persistent rain, snow, or fog, these sensors may not be as effective in precisely detecting and reacting to impediments. **(Hakobyan et. al., 2019)** gives an overview of the challenges that arise for automotive radar from its development as a sensor for ADAS to a core component of self-driving cars. The overview presented shows that new paradigms arise as automotive radar transitions into a more powerful vehicular sensor, which provides a fertile research ground for further investigation **(Hakobyan et. al., 2019).** Due to fast advances in the self-driving car technology, such articles become obsolete very fast. **(Fan et. al., 2019)** give a brief but comprehensive overview on key ingredients of autonomous cars (ACs), including driving automation levels, AC sensors, AC software, open source datasets, industry leaders, AC applications and existing challenges. In a period of fewer than 10 years, the quest for self-driving vehicles, also referred to as autonomous vehicles (AVs) or driverless cars, has become one of the biggest technology races in

the world, with tens of billions of dollars poured into companies and start-ups. **(Milford et. al., 2020)** provide an overview of the key technical challenges and solutions for both on and off-road AVs, with a focus on one of the key unsolved challenges-interaction with vulnerable road users (VRUs).

3. **(Guillaume Bresson et. al., 2017)** propose a survey of the Simultaneous Localization and Mapping (SLAM) field when considering the recent evolution of autonomous driving. The object detection and recognition is second vital obstacle. Pedestrians, cyclists, and other vehicles are among the many items that autonomous cars need to be able to identify and recognize with accuracy. **(Viktor T Pyagay et al, 2020**) It is still difficult to make sure these systems can recognize items and respond to them in complicated and unpredictably changing environments.

4. **(Shun kondo et. Al.,2018),** In this study batch plant practical perform to analyze product cycle, it appeared that contaminated fault and risks are also there. Cybersecurity and hacking vulnerability is third key obstacle in reliance on software and data transmission. self-driving cars are susceptible to cybersecurity risks. Unauthorized use or access to a car's control systems might result in mishaps.

   (Y. Hashimoto et al, 2013), Handover and transition of control is also difficult process to transfer control from the driver to the car (or vice versa) when autonomous vehicles perform at levels that call for human intervention. Another important safety concern is making sure drivers can stay alert, data processing and promptly take over in an emergency as well as keeping in mind time factor.

5. **(Boosarapu Asmika et al, 2021)** Ethical Decision-Making is complex situations in self-driving cars. Decision must be in real time and distance from the surrounding objects along with the moral values of the society. For example, in an emergency, they could have to put the safety of other drivers, pedestrians, or passengers inside their vehicle first, deciding how these choices ought to be made.

6. (Haiyan Wang et al, 2022), Redundancy and System Failures are critical to make sure self-driving car systems have enough components and layers. It is not safes some certain extent to handle system because it causes failures and parts are interlinked in the system. It is a complicated system and one part can effect on the other part function. In the case

of a malfunction, this comprises backup systems for sensors and controllers to avoid mishaps.

7. (Nynke E.Vellingo, 2017), Legal Frameworks element is also misleading, somehow to give guarantee that self-driving cars fulfill the safety requirements. It is not sure that self-driving cars are successfully incorporated into current traffic systems as clear and uniform rules are required. The legal environment for self-driving cars is still in process.

8. (Daria Belkouri et al., 2022), Validation and Testing is very important issue to prove its dependability and safety in autonomous cars. It must go through a solid and profound testing process and steps that takes place in both controlled settings and on public roads. Creating standardized testing protocols and techniques is a never-ending task.

9.**(Daniel Piatkowski, 2023)**, Public Acceptance and Trust is a big hurdle in the success of self-driving technology. It depends on the general public's acceptance and trust in it. Public trust in self-driving car technology may be damaged by well-publicized incidents involving these vehicles.

10.**(Futao Zhang et al,2023),** In Perplexed Traffic Conditions, factors of slope, cooperative adaptive cruise control vehicle, vehicle penetration and lane changing are also vital reasons in autonomous vehicles. In the populated area, it will have to share the road with human-driven and autonomous vehicles. It can be difficult to interact with erratic human drivers.

11.(**Qian Zhang, 2020),** Surprising Human Behavior is also one state of human behavior on the road. People might act in surprisingly in different ways as cyclists, pedestrians, and cars while interacting with self-driving cars. Such conduct must be able to be understood by self-driving automobiles so that they can react to it safely.

Industry, regulators, and researchers must work together to set strong safety standards, validate technology, and guarantee the safe integration of self-driving cars into the current transportation infrastructure in order to address these safety challenges. In order to improve the safety and dependability of self-driving cars on the road, ongoing research and development are essential. Cities, roads and crowdies place needs to adjusted according to the Self driving cars. It is also difficult to run self-driving cars on mountains side and complex road turns. Nearly, every country has mountains and tracks which are

complex. Idea of smart cities and transportation system must be introducing for the self-driving cars.

People preference is also important factor in the self-driving cars whether they want to own self-driving cars or they prefer ride sharing facility. Owned self-driving car is a huge investment by the consumer which is depend on its purchasing power and income. Owned car make complex system of self-driving cars along with mapping and localization. It causes congestion and heavy traffic. For ride sharing in self-driving cars and other utilization of the trucks and train for mobility, customer preference must be observed.

1.5 Scenario of Self-driving cars in UK & Hungary (Developed Countries)

The aim of the existing study is to investigate the current state, identifying the challenges of different factors (Economic, social, Political, Environmental and technological) and opportunities, also examining the policy framework and regulatory issues for the self-driving cars.

1.5.1. UK'S Significance in autonomous vehicle

(SMMT. Co. UK 2023), says that the automotive sector plays a crucial role in the economy of the United Kingdom and is essential to achieving the goals of net zero, leveling up, developing global Britain, and the growth plan. The UK economy benefits from £67 billion in turnover and £14 billion in value added from the automotive industry, which also invests about £3 billion annually in research and development. With over 182,000 manufacturing jobs and around 780,000 in the automotive sector overall, we make up 10% of all UK exports, with over 130 countries importing cars made in the UK, resulting in £77 billion in commerce. With the assistance of 2,500 component suppliers and some of the most talented engineers in the world, more than 25 manufacturers produce more than 70 different car models in the UK. In 2022, the UK produced over 775,014 automobiles, 101,600 commercial vehicles, and 1.5 million engines. Approximately, 80% of all cars made in the United Kingdom are exported to 130 different countries.

1.5.2. Challenges of self-driving cars in UK

1. Technological issue including sensor and perception system, cyber security and environment of urban area.

2. Regulatory and legal problems need to clear and solid picture of law in the case of accident and malfunctioning of the software must be achieve for smooth function of self-driving cars on the road.

3. Public perception and trust reliability on the self-driving cars due to new and advance technology handling in this scenario fear and un-describable emotions reaction.

4. Economical problem such as modern infra-structure employment, Investment, income and cost affordability.

1.5.3. Responsibility of Liability

(Alistair Smout & Nick Cary Nov.2023), latest update is that Britain says that owner of the car is not liable but the Producer of the car for the crashes, according to the new legal frame work. King Charles said that government would bring new bill related with autonomous vehicle before the parliament session to approve because new manufacturer and technology system are rising and introducing to the public. UK Government are focusing on key elements for joining fast pace of global automotive industry. 1. Investing in research, Science and Technology 2. Trying to upgrade infrastructure 3. Assist Automotive manufacturer to grow 4. Delivering affordable energy and clean growth. 5 Trying to initiated world leading sector 6. Focusing on companies and organizations cooperation. Government and private companies are work together for this great purpose.

In the 2023, 7TH November, King's speech about the self-driving cars: He said that technology or self-driving cars which take care both the driver and itself, this is the future of the self-driving cars. **(Look, no hands: Scotland to Launch autonomous buses Simon Calder 2023)**, The man who pay his way: Give me fly-drive without need to steer." Currently, self-driving cars are limited to the buses shuttle in Scotland and the Heathrow which connects Terminal 5. In April 2023, Scotland launched autonomous buses across firth of forth between Edinburg Park Transport interchange and Ferry toll park and Ride outside Inverkeithing. The project is called CAVForth. It will departure every 20 minutes. Buses' speed 50mph. So, public and government are cooperating together for the self-driving cars. Government has given permission to shift on the technology of Blue Cruise self-driving. **(Cohen et. al., 2018)** describe on the first systematic UK process of engagement with stakeholders. **(Jack Stilgoe, 2021)** take a qualitative social science approach to the question 'how safe is safe enough?

1.5.4. Economic Challenges in Hungary

OECD reported, In the latter part of 2022, Hungary's economy experienced a recession due to the combined effects of increased energy costs and monetary tightening. Along with a slowdown in export and consumption growth, investment declined. The real GDP shrank by 0.4% on a quarterly basis in 2022–Q4, and monthly data suggests that 2023–Q1 will see even more declines.

Forecasts indicate that annual GDP growth will decrease from 4.6% in 2022 to 0.5% in 2023, before increasing to 2.8% in 2024 due to decreased energy commodity prices and anticipated deflation. It is anticipated that consumption would decrease in 2023 before increasing again in 2024 as a result of changes in real income. The projection horizon indicates that investment would remain subdued due to low demand, restrictive financing circumstances, and fiscal reduction efforts.

According to projections, exports would decrease in 2023 but increase in 2024 in response to external demand and with the help of existing FDI projects. However, throughout the projection period, lower domestic demand is expected to restrain imports, guaranteeing that net exports will contribute positively to GDP growth. Due to severe droughts, the agricultural sector significantly impacted GDP growth in 2022 by 1.1%; however, this year, as crop yields rebound, the GDP is expected to increase, primarily through inventory accumulation.

During the current economic downturn, labor demand remained strong, and the unemployment rate only slightly increased to 4.1% in 2023 Q1. It is anticipated to increase to an average of 4.2% in 2023 before declining to 4.0% in 2024. It is anticipated that there will always be a shortage of competent labor, made worse by population aging. In keeping with the tight labor market and high inflation, nominal wage growth is anticipated to continue to be strong. A 16% increase in the minimum wage is also expected to spur pay growth in 2023. Due to excessive inflation, real wages are currently dropping, but they should start to grow again in the fall of 2023.

(Andrea Szalavetz. 2022), The economy's vulnerability to a potential jump in energy costs and a sharp increase in the country risk premium, which might potentially constrain fiscal policy, are the main sources of downside risks to the growth outlook. A possible easing of fiscal policy, rapid wage growth in a tight labor market, and the de-anchoring of inflation expectations are the factors that provide upside risks to inflation.

Hungary has a wide range of weather, with summers being very hot and winters being covered with snow. It is imperative to guarantee the dependability of sensors in these circumstances. Hungary's current laws must be modified to allow for autonomous vehicles. Autonomous vehicles must adjust to Hungary's unique traffic patterns, signage, and infrastructure, which may be different from those in other nations. It could be necessary to make investments in smart technologies like communication networks and intelligent traffic management systems in order to integrate self-driving automobiles with Hungary's current infrastructure. The public's acceptance of self-driving automobiles may be influenced by cultural attitudes and beliefs of technology, automation, and personal mobility. To tackle the possible misunderstanding of self-driving technology by the broader public, educational campaigns are needed to establish awareness and trust.

1.5.5. Current state of self-driving cars in Hungary

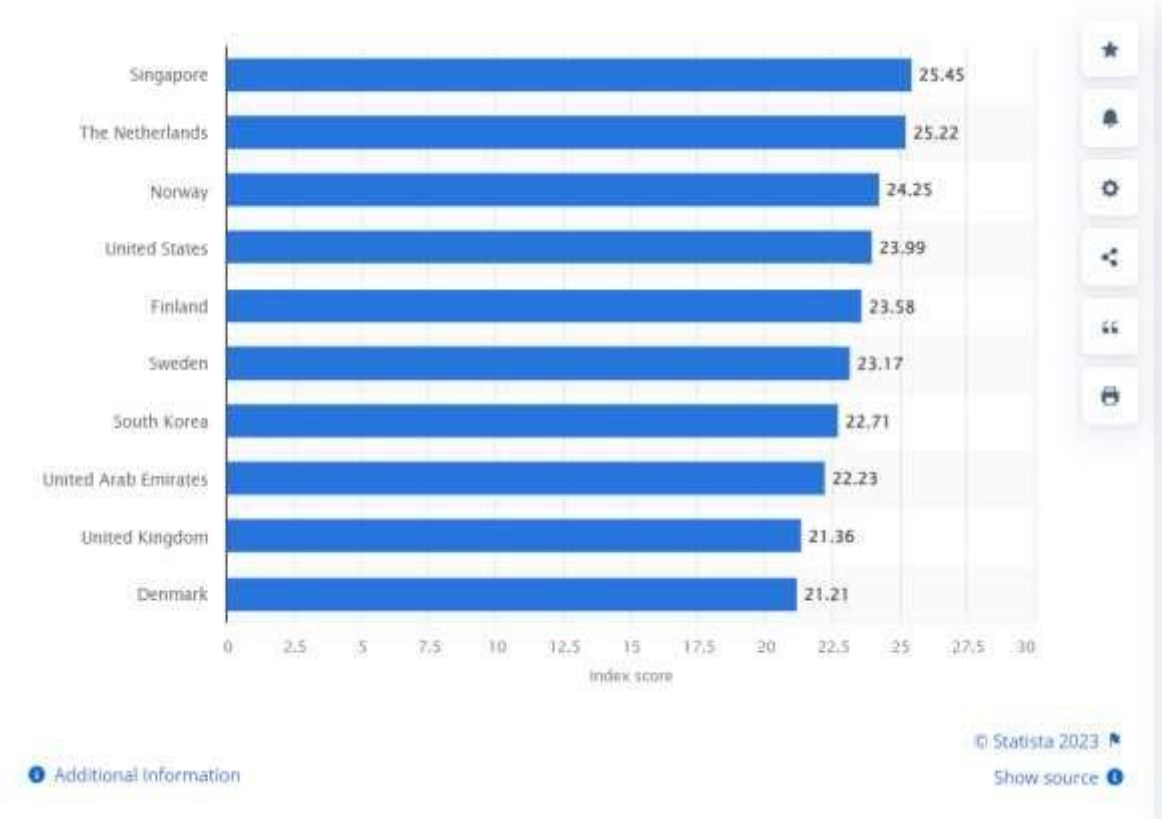
In Hungary, more than half of the workforce engaged in the production of transportation equipment was regarded as digital in 2021. Simultaneously, forty percent of the industry's advancements and investments were digital. With over 7.2 thousand registered units in Hungary in 2022, the Suzuki S-Cross emerged as the most popular automobile model in the country. The Suzuki Vitara, with more over 5.5 thousand new registrations in 2022, came in second. This data illustrates the quantity. In Hungary, there are many kinds of PEV charging stations that will be available from 2013 to 2021. Hungary has experienced an increase in the infrastructure that is available for PEV charging during the time period covered here. Hungary had 2,130 PEV chargers as of 2021.

Hungary is seeing an increasing number of electric vehicle registrations each year. Their popularity is still growing, though. The Hungarian government has taken a number of actions to encourage e-mobility, including announcing tenders to help the purchase of electric vehicles, therefore it is anticipated that the inventory of electric vehicles will continue to increase. There were more than 4.6 thousand plug-in hybrid electric vehicles (PHEV) in the nation as of 2021. In Hungary, there were more than 6,000 battery electric cars (BEVs) that same year.

Hungary's automobile sector is expanding steadily and offers a number of opportunities for foreign investment. More German and British businesses, including ThyssenKrupp, Jaguar Land Rover, and Continental, announced the opening of new research and

development centers in Hungary last year. In the newly released Autonomous Vehicles Readiness Index (AVRI) by KPMG, Singapore and Hungary have been rated as having the best government agencies dedicated to autonomous vehicles. Hungary ranked 25th overall out of the 30 countries that were looked at.

Selected countries' preparedness for autonomous vehicles as of 2020 (based on index score)



Statista Research Department, 2023, https://www.statista.com/statistics/801361/countriespreparedness-for-autonomous-vehicles figure 17

The Autonomous Vehicles Readiness Index assesses the degree of preparedness for autonomous vehicles based on 28 distinct metrics. It covers 30 countries and jurisdictions and assesses "policy and legislation," "technology and innovation," "infrastructure," and "consumer acceptance of driverless cars." Seventeen of the twenty-five nations included in the 2019 index now have higher scores. In the areas of "policy and legislation" and "consumer acceptance," Singapore surpassed the Netherlands for the first time and won first position. The United States and Israel are leading the area of "technology," while the Netherlands maintained its top place on the "infrastructure" pillar. In addition to the car

manufacturers and suppliers that are based in Hungary, like Bosch, Continental, KnorrBremse, or ThyssenKrupp, a large number of independent Hungarian organizations and businesses are actively involved in the autonomous driving space. Since 2015, Hungary has been able to support top-notch research and development operations and offer globally recognized education and research thanks to the founding of the Research Center for Autonomous Road Vehicles (RECAR). The government made the decision to establish the vehicle test track in Zalaegerszeg in 2016 with the goal of enhancing domestic automotive R&D capabilities.

The 265-hectare Zala Zone test track's first phase was finished in 2019 and is appropriate for testing driverless and conventional vehicles. MTI claims that Hungary is also working on the development of self-driving cars with Slovenia and Austria. According to the minister, the nations wanted to see how an automobile of the kind handles border crossings. Hungary continues to expand its research and development sector and is a leader in the use of 4G and 5G networks.

Founded in Hungary in 1991, Continental has grown steadily to become a strategically significant component of the multinational conglomerate. All five of the group's divisions are represented in Hungary, with a total of 7 industrial facilities spread over 7 locations. Production is carried out by the Makó, Nyíregyháza, Szeged, and Veszprém units; since 2003, the German behemoth has also utilized Veszprém's R&D facilities.

For many years, the advanced driver assistance systems (ADAS) industry sector of Continental has been using the outcomes of machine learning and neural networks. Intelligent cars need to anticipate the actions and reactions of other drivers in their immediate vicinity. In complex driving scenarios, one object or sensor cannot serve as the basis for all decisions. Deep machine learning techniques help solve such complicated problems at different levels, such as environmental sensors, driving strategy, and actual vehicle control. The opening of the Budapest Deep Learning Competence Center is a significant step forward for Continental on its journey to fully autonomous vehicles. A partially or fully self-driving system requires the independent design of each component, which must then be naturally merged. The Budapest-based ADAS center not only creates deep machine learning techniques but also conducts research in specialized areas like application and integration, which significantly shortens the time between the stages of preparation for development and product planning.

1.5.6. Consumer Challenges

Experts can gain real-world experience by incorporating the new solutions easily into specially designed test cars. The research's most intriguing pillar is consumer acceptance, since the developing sector as a whole would not have a market if consumers reject self-driving cars. It is not unexpected that the top-ranking nations in this area are South Korea, Sweden, the United States, and Finland in terms of digital skills and adoption of information and communication technology. KPMG evaluated the nations using a range of factors, including the percentage of the national population residing in test areas, the usage of technology by civil society, the assessment of digital literacy among the participating population, and individual preparedness. Regretfully, Hungary scored poorly on the majority of the characteristics in this area. In the second half of 2022, Hungary's GDP shrank and inflation skyrocketed due to increased exposure to increasing commodity prices, a decline in foreign demand, and more stringent financing requirements.

(Flora Medve, 2023) In 2021, around thirty percent of Hungarians knew the pros and cons of driving an electric vehicle. Twenty-two percent more respondents said they would be content to utilize a self-driving automobile in the future. The overwhelming majority of Hungarians concurred that driving an electric automobile helps to lower urban air pollution. But only one in four respondents thought that using electric cars over the long run was more economical than using conventional cars**. (P. Balogh et al, 2015),** Because they are a good and renewable substitute for fossil fuels and help reduce carbon dioxide emissions, biofuels are widely used in Hungary's transportation industry. Biodiesel is the most widely utilized biofuel in the Hungarian transportation sector; in 2019, 145,100 metric tons of oil equivalent were consumed.

(Andrea sestino et all, 2022) stated that people are not sure about it the utilization of the self-driving cars completely. Manufacturer are showing intense interest to show new technology in the transportation area while discussing lot of benefits easy traveling, traffic congestion, positive impact on environment and safety but people perception of self-driving cars is different due to handling and behaving before the new technology. (**Patrik Viktor & Monika Garai, 2023)** Different generation have distinction perception, attitude, belief regarding the self-driving cars. People of modern age, young students and professional who are working in this area, more interested in the self-driving technology

but old people have fear related with self-driving cars. They say technology is not fully reliable and its complicated. **(Jana Plananska et al,2023)** stated that age, education, gender, culture, social and economic factors are impacted on the consumer behavior and acceptance of self-driving cars. They presented the consumer behavior model of three countries Denmark, Italy and Belgium. It is also stated that hybrid, Electric and self-driving cars adoption by people depend on the characteristics of the specific country. To bring advance change in the transportation system, countries has to be gather on one point for upgrading the system in developed countries and developing countries. **(Wolfgang Guruel et all**, **2016),** it stated that legal framework and government policies put also higher impact on the people adoption because people are worried about their safety and technology complications. People are also considering the Uber taxi, sharing ride and owned cars how does it function will impact people perception about the self-driving cars**. (Patricia Delhomme et al, 2021),** it states about the driver who drive the truck in stress, pressure and sleeping issue because in the supply chain business, goods moved around Europe through the road via trucks. It is very hectic job loaded heavy container cross borders and cover long distance.

1.6 Self-driving car's Comparison of factors in UK, China, US & Germany (Developed Countries)

UK	China	US	Germany
1. Technological Advancements			
The United Kingdom has been a leader in the development of autonomous vehicles, with numerous businesses and academic organizations making significant strides in the field.	With firms like Baidu, Alibaba, and Tencent actively engaged in self-driving project development, China has made significant expenditures in the research and development of	With big businesses like Waymo, Tesla, and Uber performing considerable testing and deployment, the US is a global leader in self-driving technology.	Germany has played a significant role in the development of autonomous vehicles thanks to its robust automotive sector. Enterprises like as Daimler, Volkswagen, and BMW are engaged
Innovation is greatly aided by collaboration between academia and industry.	China's emphasis on new technologies is consistent with its overarching objectives of being a technology leader.	Research on driverless vehicles is concentrated in Silicon Valley, which draws expertise and funding.	The goal is to incorporate self-driving capabilities into luxury cars while maintaining the highest
2. Regulatory Framework			

The United Kingdom has demonstrated initiative in modifying its regulatory structure to integrate self-driving cars. Testing on public roads is permitted, and a flexible approach is taken to foster innovation.	China has been developing laws governing self-driving cars, emphasizing their testing and implementation in particular areas. In order to address safety concerns, regulations are changing.	State-level laws in the US are patchy, with certain jurisdictions having more guidelines for testing and implementation than others. Guidelines are provided by the National Highway	A legislative framework for the testing and use of autonomous vehicles has been established in Germany. The nation places a strong emphasis on safety standards and is actively seeking to Traffic Safety.
3. Public Acceptance			
Although there has been an increase in public acceptance in the UK, safety and ethical issues are still worries. Campaigns for awareness and education are tackling these problems.	An overall passion for technology influences public acceptance in China. But there are also worries about employment displacement, data privacy, and safety.	In the US, opinions are not all the same. Self-driving cars have generated a lot of curiosity and enthusiasm, but some high-profile events have damaged public	When it comes to new technologies, especially self-driving cars, German consumers are often cautious. Acceptance depends on resolving ethical issues and
4. Economic Consideration			
The automobile industry, technology sector, and allied industries could benefit economically from the development of self-driving technology, according to the UK.	China sees the development of autonomous vehicles as a component of a larger plan for both economic expansion and technology leadership. The nation is making significant investments in infrastructure and allied businesses.	Autonomous vehicles are viewed in the US as a major force behind economic expansion and innovation. The technology could have an effect on a number of industries, including services and transportation.	Germany is well positioned to gain economically from self-driving technology thanks to its robust automotive sector. The goal is to continue to be competitive while producing high-end, cutting-edge cars.

(My own Table comparison 1) on the basis of literature review

1.7 Scenario of Self-Driving Cars in Malaysia and Pakistan

1.7.1 Importance of self-driving cars in developing countries

Self-driving cars help to reduce traffic jam and accidents on road. It will create new emerging technological era for developing countries. It will increase global competitiveness for Malaysia. Self-driving cars are important because they can help with special transportation problems in Pakistan and Malaysia. They can also promote economic growth, increase safety, and improve technology. While the advantages are substantial, in order to fully utilize self-driving technology in these emerging nations,

obstacles pertaining to infrastructure, legal frameworks, and public acceptance must be overcome.

1.7.2. Current state of developing countries Malaysia, Pakistan

Asian Automotive analysis reported in 2023, In the first half of 2023, automobile sales in Asia—a total of 12 nations in South Asia, ASEAN, and East Asia, excluding China and Japan—rose 4.5% year over year to 5,378,704 units. Comparing the same period last year to this one, sales increased in six of the twelve countries. Along with better car availability, the expansion is mostly driven by the economic recovery. However, since the second half of 2022, increased interest rates, high costs, and more stringent loan screening have slowed the market's growth. Furthermore, the rise was 7.9% in comparison to the first half of 2019, before to the coronavirus pandemic. India exceeded the 2019 level by more than 20%, whereas seven of the twelve nations this survey examined declined.

In the ten countries under consideration, auto manufacturing rose by 13.3% to 7.48 million vehicles over the same period last year. All other nations increased production, despite notable declines in Pakistan and Myanmar. When comparing the five countries under consideration's vehicle exports, India saw a minor decline of 1.3% from the same time previous year; the other four saw double-digit growth.

Asia: Sales, Production and Export Volume of Automobiles by Region and Country (2019-2022, YTD June 2019 / 2022 / 2023)

■Sales (Units)

Region / Country		2019	2020	2021	2022	YUD Jun. 2019	YUD Jun. 2022	YUD Jun. 2023	(Year-on-year)
South Asia	India	3,816,858	293,823	3,759,537	4,725,469	2,049,238	2,305,474	2,510,597	(8.9%)
	Pakistan	192,767	127,939	242,881	232,790	123,196	146,727	44,651	(▼69.6%)
ASEAN	Thailand	1,007,552	792,146	759,119	849,388	523,770	427,296	406,131	(▼5.0%)
	Indonesia	1,030,126	532,027	887,202	1,048,040	482,097	475,030	505,985	(6.5%)
	Malaysia	604,281	529,514	508,911	720,658	296,317	331,386	366,037	(10.5%)
	Philippines	416,628	248,184	293,336	*364,371*	*174,135*	*154,874*	*206,979*	(33.6%)
	Vietnam	421,290	407,487	410,391	509,141	190,174	252,931	176,976	(▼30.0%)
	ASEAN total	3,479,877	2,509,358	2,858,959	3,491,598	1,666,493	1,641,517	1,662,108	(1.3%)
	Singapore	90,429	56,423	58,953	42,550	47,617	21,710	17,583	(▼19.0%)
	Myanmar	21,916	17,707	9,350	7,068	8,893	5,848	1,380	(▼76.4%)
	Laos	21,558	14,445	14,948	21,887	11,620	11,235	11,222	(▼0.1%)
East Asia	South Korea	1,788,518	1,889,929	1,730,688	1,689,484	869,949	810,294	896,310	(10.6%)
	Taiwan	439,835	457,453	449,855	429,738	206,923	203,160	234,853	(15.6%)
Total sales		9,851,758	5,367,077	9,125,171	10,640,584	4,983,929	5,145,965	5,378,704	(4.5%)

■ Production (Units)

Region /Country		2019	2020	2021	2022	YUD Jun. 2019	YUD Jun. 2022	YUD Jun. 2023	(Year-on-year)
South Asia	India	4,524,366	3,393,495	4,399,112	5,456,857	2,465,478	2,668,647	2,896,658	(8.5%)
	Pakistan	186,751	117,375	241,763	236,659	113,908	145,871	46,302	(▼68.3%)
ASEAN	Thailand	2,013,710	1,427,074	1,685,705	1,882,385	1,065,945	870,111	921,512	(5.9%)
	Indonesia	1,289,847	690,150	1,121,967	1,470,146	592,396	662,920	696,845	(5.1%)
	Malaysia	571,632	485,186	481,651	701,172	285,028	317,933	362,535	(14.0%)
	Philippines	95,094	67,297	83,846	92,223	40,626	40,334	56,973	(41.3%)
	Vietnam	363,800	249,000	299,800	439,600	n.a.	n.a.	168,700	(-)
	ASEAN total	4,334,083	2,918,707	3,672,969	4,585,526	1,983,995	1,891,298	2,206,565	(16.7%)
	Myanmar	15,496	10,753	1,956	3,175	7,620	2,963	229	(▼92.3%)
East Asia	South Korea	3,950,614	3,506,774	3,462,499	3,756,491	2,028,332	1,779,039	2,197,696	(23.5%)
	Taiwan	251,304	245,615	265,320	261,263	120,677	121,584	139,447	(14.7%)
Total production		13,262,614	10,192,719	12,043,619	14,299,971	6,720,010	6,609,402	7,486,897	(13.3%)

Table 2.

(By Choudhry Nauman, 2022), The idea of self-driving cars is not new for the people of Pakistan. People know about it as technology is growing. Elite class in Pakistan have very expensive and advance cars. People of Pakistan love to use modern technology whether its mobile, home appliances and modern machinery, latest software. In the shift of self-driving cars from the automatic transmission car, its huge transformation of different co-factors. The important point is to bring investors for the manufacturing of self-driving cars. Though, Toyota expects to launch advanced autonomous cars in global market 2025. So, it may be possible that Toyota will bring this technology in future to Pakistan but it will take time to consider it.

1.7.3. Challenges of self-driving cars in Pakistan

(Business Record Research Lahore speed 2018). Rapid urbanization is required in developing countries which is very challenging task. Developing countries are very far behind from advance technology. Lahore is a very diversified and big city of Pakistan. Population of Lahore is 11.1 million with growth rate 4.2 % increasing day by day. It will be projected double in 2035. People are moving from other cities of the Punjab to get better education, employments and services. In Pakistan there is no official statistic measure for the assessing the district level data. Punjab GDP Contribution is 5% in overall GDP of the country while Lahore GDP is progressing with the rate of 6.1% in Punjab. The quality of the growth is not good in Lahore as energy share is decline from 15% to 8%. The real growth is in Housing, transportation, Communication, finance, insurance and storage**. (Aaron O Neil Oct. 2023),** Agriculture 22.25%, Services 51.55% Industry 19.82% contributed in the GDP of Pakistan in 2022. Unemployment rate is also

increasing which is 6.42%. Inflation rate is like wave, its going up and slightly down since 1987 to till 2028, it projected high in 2025 and may be goes down in 2028 as per forecast. In 2018,12,870 Jeeps and light commercial vehicle sold in Pakistan but later it declines up to 7654 in 2019. **(Muhammad Huzaifa Butt, Jai Govind Singh** These are the factor which are influencing the self-driving cars in Pakistan. Rate is low for the adoption of the electric vehicle and self-driving cars.

Dawn News reported in 2017, Lahore issues related with the Traffic congestion in which Traffic engineering and planning agency has been questioned about the roads alignment of jail road and Muslim town as they are very rush and crowd roads during the peak hours. Government fixed 800 CCTV cameras to inspect the Traffic on the roads in Lahore. Punjab safe city authority has been established by the government to minimize risk of the accidents on the road and ensure people follow the traffic rule. In the result, there were lot of challan made and sent online or via courier to the addressee. Chief Minister Shahbaz Sharif discussed the situation of London traffic to analyze and applied those techniques into the Lahore traffic. Transport for London is made smooth traffic flow in London with the help of traffic models, research and advance Technology. Horn noise, people behavior, stress and depression are creating chaos on the roads.

Lahore often witnesses the worst traffic jams on its busiest roads during peak

Sarvat Hossein, Dawn, 2017 figure 18

1.7.4. Self-driving & Electric cars Phases in Pakistan

Business recorder, Syed Ahmed Raza Reported in 2021, stated Changan Motors is working tirelessly to introduce Pakistan to the cars of the future. Pakistani social media was immediately ablaze with speculation about the possibilities when Changan Pakistan's Facebook page put the notion out there. The prospect of seeing such cutting-edge cars offered in Pakistan has people buzzing with anticipation. Danial Malik, Master Changan Motors' Chief Executive Officer (CEO), stated: "The future is here; it's just not spread equally yet. Changan Pakistan aims to transform that by introducing autonomous mobility and bringing the future to Pakistan. We don't see any reason why we can't offer modern mobility technologies to Pakistan, as Changan Auto leads the way in China. Our goal is to introduce the most advanced autonomous technology available worldwide to Pakistan in order to spark a safer future.

The CEO also disclosed that, in line with Master Changan's philosophy of "Future Forward, Forever," the automaker is testing exclusive AI-based autonomous driving technology. They're also attempting to modify this technology for Pakistani roadways.

Changan UNI-T is being tested technologically by Changan Pakistan. It is the first car from the manufacturer in a new "UNI" product line that features a number of cutting-edge innovations. With its AI-chip-based intelligent vehicle system, the futuristic UNI-T offers the finest possible human-machine interaction. The technology allows the driver to communicate via:

1. dual-screen touch interface 2. intelligent voice activation 3. a facial recognition system

If you think the plot sounds sci-fi, wait till you learn what motivated the artwork. The UNI-T's design is reminiscent of a spaceship. The UNI-T's front serves as the fundamental design element around which the vehicle's overall shape develops. This design is both gorgeous and practical.

1. Trapezoid-cut integrated diamond grill enhanced by the strongly defined LED lights.

2. Split headlamps and flushed door handles perfectly blend into the motion and tension of the body curve

3. Bold V-shape tail wing that guides the airflow

Because Changan UNI-T has Level 3 autonomous driving capacity, the driver won't have to always keep their eyes on the road during the initial iteration. The driving experience will advance to the hands-free and feet-free stages in subsequent iterations. Fully autonomous driverless self-parking technology is fitted in the car.

Business record, Syed Ahmed Raza 2021. figure 19

Brian Wong 2022 reported that In the Asian market, electric vehicles, or EVs, are starting to proliferate. There seemed to be a new electric vehicle released every weekend, either in Malaysia or in China. The vehicle industry is currently experiencing a dramatic transformation toward an electrified lineup camaraderie. According to Paultan.org, as of January 2022, only 274 electric vehicles (EVs) had been sold in Malaysia, despite the government providing tax breaks and exemptions.

The self-driving capability is one modern innovation from EVs that is present in every one of their vehicles. For those who are unaware, Self-Driving or Autopilot refers to software that is installed to help the driver autonomously get from Point A to B based on the location provided. It is comparable to the systems seen in large airplanes. Tesla was the first to provide this feature to its cars, and other manufacturers such as Mercedes, Kia,

and Volvo started to adopt it in turn. Electric vehicles and self-driving cars will soon be commonplace. But is Malaysia truly ready to accept EVs at this point.

Figure 20

1.7.5. Current state of self-driving cars in Malaysia

When the Malaysia/Singapore border opened earlier in March of this year, a couple from Singapore recorded their entire road trip in a Tesla on Autopilot, starting in Singapore and ending in Penang. The fact that the driver's hands were not on the steering wheel as shown in the picture is what makes this entire incident unacceptable. Around the world, this was not the first solitary case. People exploiting the function of electric self-driving cars, either for convenience or for sinister reasons, has caused a stir. The couple was still the subject of a police inquiry despite the lack of rules governing electric self-driving cars, according to Bukit Aman Chief Assistant Director of Traffic Investigations and Enforcement (JSPT) Superintendent Dr. Bakri Zainal Abidin, as reported by Guangming Daily. He also emphasized that it is mandatory for drivers to drive skillfully, cautiously, and attentively under the Land Traffic Act of 1959. As a result, a motorist must be competent to drive and keep both hands on the wheel at all times.

Superintendent Dr. Bakri Zainal told the Guangming Daily reporters that although autonomous driving is not governed by any rules, it can cause the driver and any passengers to become totally unaware of their surroundings. Additionally, he mentioned that there are flaws in Tesla's Autopilot technology. He also cited an instance in which the autopilot system malfunctioned and killed a Californian couple in an automobile accident. Because they are still relatively new on Malaysian roads, electric self-driving cars are still considered a curiosity by local drivers. But a fresh argument about how well electrified self-driving cars would perform on our roads has emerged.

Asian Automated analysis reported that in June-2023, Malaysian automobile production get doubled and rise to 363,000 units, up 14.0% as compared to the previous year. It also reported that Chinese manufacturer are moving with the green energy into Malaysian factories and use solar energy for co2 emission.

1.7.6. Challenges of self-driving cars in Malaysia

If Malaysia is known for anything, it's our driving styles. Malaysia has been consistently listed among the top 10 most dangerous places to drive in the world by businesses and research agencies.

BFM news reported that Malaysia is eighth dangerous country in the world for the driving as per study conducted by driver’s education firm zutobi.

18 people are killed in traffic accidents per day on average, according to the Ministry of Transport. One need just examines the quantity of footage of accidents that often appear on Malaysian Facebook to support this. Furthermore, a recent article in Malaysian Daily stated that at least 42% of our drivers do not feel safe when driving. To be honest, how many drivers still speed and have a phone in their hand despite all the severe penalties and warnings? More importantly, how many bikers still ride recklessly on the roads?

Malaysia is renowned for its diverse population in terms of ethnicity, religion, and culture—not to mention its mouthwatering cuisine. However, our highways are notorious for something else entirely, particularly in Kuala Lumpur, the nation's capital, where traffic jams never stop. Those of us who grew up in Malaysia have undoubtedly encountered several driving customs that have the potential to prove deadly. There are some similarities in the driving of Pakistan and Malaysia.

People use hands gestures and park the car anywhere at the empty spot. People gives hand gesture to slow the cars and pass the road. If something happened on the road, people gather and drivers are also stopped and watched the scenario and that makes traffic jam on the road and street.

Even people do not care about emergency lane, signal lights and there are some impatient drivers who drive the cars. Rainy season and hole in the road are also effect driving in these countries**. (Ju Ying Ang et al, 2020)** in this paper, stated about child restraint system and its rule for the riding in the self – driving cars. In Malaysia some of the parents know about child restraint system of the car and they prefer to use it. Some parents do not know about it and they do not use it. Therefore, there is need of knowledge creation to use child restraint system in the electric and self-driving cars. **(Amr M Nasser Ahmed et al,2023)** stated that resale value of the self-driving cars, fuel price and Malaysian Automotive Association (MAA) showed that since 2010 more than seven million passengers cars have been added to the country's road. People thinks that high price is big hurdle in the green car adoption facility. Moreover, government has made the strategy which is called Green Technology Master plan (2017-2030) that will be about green cars, low energy and carbon emission for the environment sustainability in the Malaysia. People also think about that quality and safety are also obstacle for the utilization of the self-driving cars**. (Nadia Adnan et. al, 2018)** propose that population of Malaysia is growing rapidly. People rely on vehicle to move around so this automotive industry will grow on electric vehicle, plugin electric cars and self-driving cars but not much as compared to the developed countries. **(Salman Ahmed et al, 2014),** described about energy situation of Malaysia, electricity generated on fossil fuel. It is not reliable solution in long term. **(Boon Hong Ang et. al, 2019)** propose that older adults do driving freely and more commonly to move around. It is very important to be healthy (Visual issue, depression, low confidence and aging) for long and safe driving. Health condition is also one element which effect on the driving situation. According to the road transport act 1987, people has to arrange driving license for motorcycle and car**. (K Hong et al,2015)** propose that aging, complex traffic system and road structure are also impact driving and it cause accident in older people.

1.8 Comparison of Malaysia, Pakistan and India (Developing Countries)

Malaysia	Pakistan	India
1. Technological Advancements		
With a few research projects and partnerships between the government and business leaders, Malaysia has demonstrated interest in implementing self-driving technology.	Pakistan is just beginning to investigate self-driving technology. There are a few ongoing development and research projects.	India has witnessed a surge in interest in self-driving technology, with both local and foreign businesses engaged in R&D.
The development of the technologies required to enable driverless vehicles is the main goal.	The nation is concentrating on comprehending the technology and its possible uses.	India has multiple startups devoted to the subject of autonomous vehicle technology, and it is an active participant in the worldwide race in this area.
2. Regulatory Framework		
Malaysia has begun thinking about the legal structures that should be in place for testing and implementing self-driving car technology.	Pakistan is just beginning to create the necessary legal foundations for self-driving cars. Clearly defined rules and regulations are required.	India is currently developing extensive laws pertaining to autonomous vehicles. Discussions regarding testing and deployment requirements have been started in a number of states.
3. Infra-structure		
Malaysia's transportation infrastructure is being improved and modernized, and the country's roadways are generally in good condition.	The country's road infrastructure is beset with issues, with differing circumstances in both urban and rural regions. Smart infrastructure development is still in its infancy.	India offers a wide range of road conditions, from difficult urban settings to well-maintained highways. There is continuous work to improve infrastructure, with smart city projects taking place in large cities.

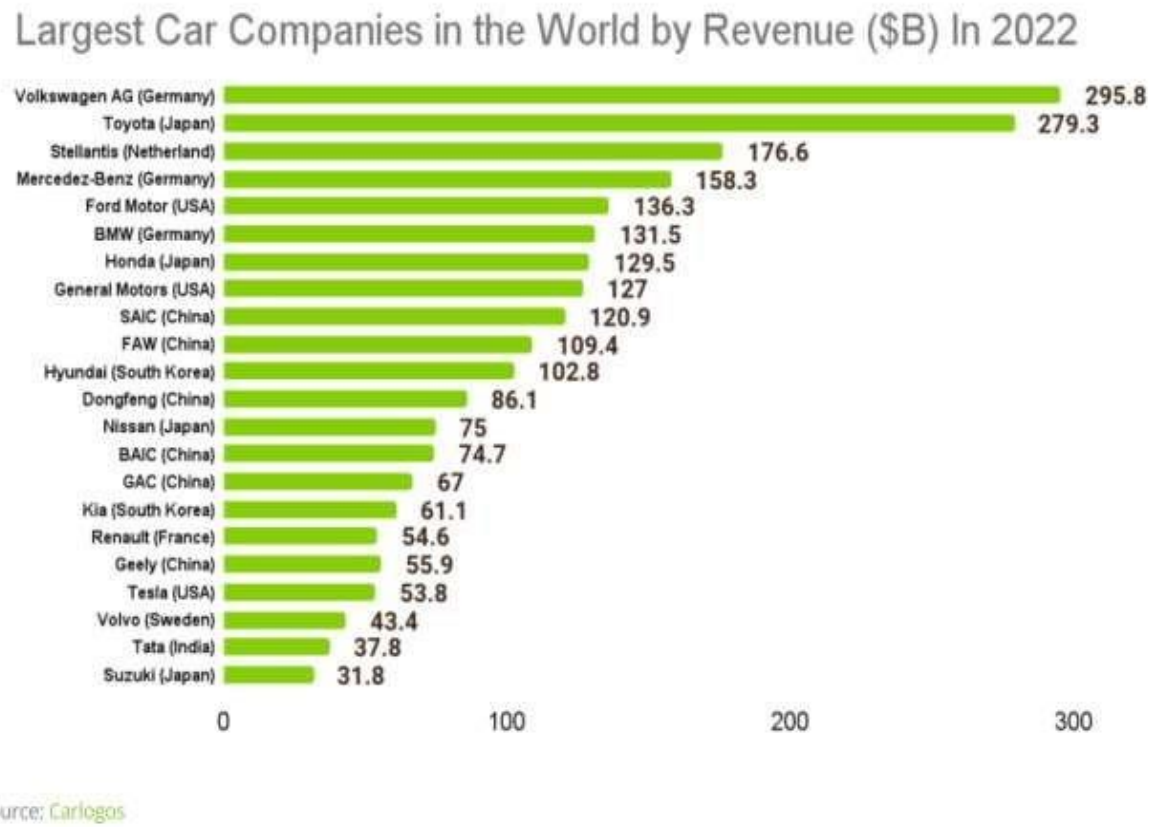
4. Public Acceptance		
Although there is a progressive increase in public understanding and acceptance of self-driving technology, additional education and awareness campaigns are still required.	In Pakistan, there appears to be a dearth of knowledge and mistrust regarding self-driving cars due to poor public awareness.	In India, public approval varies. Even while there is interest and curiosity, worries regarding job displacement and safety need to be addressed in order to get broader acceptance.
5. Economic Consideration		
Malaysia wants to establish itself as a player in the by global automobile major force and views the self-behind innovation of technology and economic progress. The nation opportunity. more pressing	Economic factors Pakistan might industry make advancement self-driving as an economic is trying to infrastructure and development requirements. development.	in Self-driving technology is seen large India as a expenditures in technology driving less important than establish itself as a center for autonomous vehicle research and
6.Opporunities and Challenges		
Malaysia sees chances to become a regional leader in autonomous technology, but it also faces obstacles in public awareness and infrastructure development.	Pakistan is still in its infancy and has obstacles in the form of public awareness, regulatory frameworks, and infrastructure, but there are also chances for progress.	India is aggressively seeking opportunities in the autonomous vehicle space, but it is confronted with obstacles related to public acceptability, infrastructural development, and legal clarity.

Although Malaysia, Pakistan, and India have similar obstacles in implementing self-driving technology, their strategies, advancements, and goals are not the same. Pakistan is just beginning to explore, India is aggressively competing in the worldwide battle for autonomous vehicle technology, and Malaysia is establishing itself as a regional competitor. The distinct attributes and development agendas of every nation influence how self-driving cars will evolve in that nation in the future. (My own Table 3)

1.9. Status of Large Companies (Waymo, Tesla and Volkswagen

(Bartl, 2013), described autonomous vehicles are not too far off; Audi and Mercedes, for instance, have stated that their highly automated features are virtually ready for production. It can gradually observe, as a reflection of the news, how technology is becoming more and more integrated into our daily lives. Examples include cars that drove a blind man to tacos in 2012 (Google), coast-to-coast journeys (CNN, 2015), a trip from Italy to China (Broggi et al., 2013), and Google's 700,000 miles traveled to date (Urmson, 2014). Waymo states that waymo self-driving cars has best driver's experience who do not get tired, drunk and distracted.

Despite the technology's relative readiness, major competitors including Audi, BMW, Cadillac, Ford, General Motors, Jaguar, Land Rover, Lincoln, Mercedes-Benz, Nissan, Tesla, and Volvo are attempting to gradually incorporate it into their cars. This may be seen as a fruitless attempt to slow down consumer integration overall and control this completely disruptive technology, but given the scope and impact of this technology, the previous paradigm will not suffice **(Bartl, 2015).**



https://oakbusinessconsultant.com/automotive-industry-overview-analysis-and-trends/

figure.21

Toyota and Volkswagen AG are the top two passenger car manufacturers right now. Toyota was the top business in 2021, but because of problems with its supply chain and poor domestic sales, it dropped to the second spot in 2022.

Waymo	**Tesla**	**Volkswagen**
(2009) Waymo is one of the leading self-driving company in the world. In 2009, Waymo started its self-driving technology project with the uninterrupted 100 miles' route in the Toyota Prius vehicle. It was successful experience.	(2003-2009) Tesla was founded in 2003 and named after the 19th century inventer Nikola Tesla. Elon Musk joined the company after one year of its establishment. He invested 30 million dollars. Company introduced first prototype Tesla Roadster in 2006 and they sent production in 2008. In June 2009, 500 Roadster were sold 98000 dollars a piece.	This year, Volkswagen introduced Techno classical. It has arranged classic car fair on the 50th anniversary of the Passat using the slogan (Immer wiedur nue" Always reinvesting itself) (motto). In the 1973, Passat launched by the Volkswagen, this model consists of water engine. It was global success story. Five Passat were exhibited on show in Essen. According to the company, Passat is forever. This car has wonderful improving capacity to reshape its structure till eighth generation. They have new drive and design, the family hatch back sedan launched in 1973.

In 2015, first fully autonomous car ride on the public road. It has custom sensors, computers steering and braking with no steering wheel or pedals. Steven Mahan who is legally blind person, took first drive in the self-driving cars on the road in Austin, TX. Waymo established under the Alphabet as a self-driving technology company with a	In 2017, Tesla introduced model 3 in the market and it became most popular in the world as electric car. In 2019, Netherlands, Germany and Norway bought lot of cars from Tesla. In 2021, Tesla sold and delivered lot of cars in China. 478,078 cars produced in the Tesla's production unit, Giga-factory shanghai. Tesla sold car 301,998	The larger rear lid extended to the roof was introduced in 1975. Volkswagen classic, Volkswagen Commercial vehicles old timers, Audi tradition, Skoda, the auto start, the Auto Museum foundation and Volkswagen classic parts can all found in all 3 halls. Volkswagen
mission to make it safe and easy for people and things to move around in 2016. In 2017, waymo began early rider program. Company invited resident in Arizona Metro Phoenix area to join in the first trial of autonomous ride hailing to obtain their feedback for updated technology, service and experience.	from Giga-factory Texas and Giga-factory California. The company is also getting famous in the Europe. In 2021, Tesla sold 169,507 in the Europe where the model 3 get popular in the European countries.	

In 2018, waymo one launched in metro Phoenix as commercial autonomous ride-hailing service with the Chrysler pacific hybrid minivan having waymo driver. In 2019, company started to offer fully autonomous ride through waymo one in Metro phoenix area. In 2020, waymo app has been started function through the google app and app store in the mobile phone.	In 2022, Tesla made 3742 charging station in all over the world. Tesla is producing electric cars in three main region USA, Germany and China. There are six production facilities in all over the world. They have added in three more operational unit in Giga-factory Nevada, Giga-factory New York and Giga-factory shanghai in 2016, 2017 and 2018. Giga-factory Berlin. In Germany 2022, they make batteries, battery pack and powers train which is used in the production of vehicles. Model Y is also	Volkswagen is focusing on Battery valley which will open new era in the automotive industry. Battery valley same as Silicon Valley. This brand is going to invest 18 billion euros in future technologies by 2026 alone. Electric car share 70% rise in the Europe by 2030, more than 50% in China and USA. Therefore, Volkswagen is manufacturing the way between the Lower Saxony locations of Wolfsburg, Salzgitter and Braunschweig into "Battery Valley"

	manufactured in Giga-factory Berlin. Model Y assembled with 2170 cells for performance. In 2021, Giga-factory Texas is also assembling model Y, cyber truck, Tesla semi and electric car in 2022, brought in the market. Giga-factory Texas in Austin is declared as corporate head quarter. Tesla is promising electric vehicle company in 2022.Tesla is facing also its competitors challenge in the recent time but along with it, Electric cars model Y and Model 3 having good market share 32.9% and 22.6% respectively. Therefore, these models are out class and out sell in the market as compared to the other companies' cars. (Daniel Shavrtsman Tesla , 25 oct. 2023)	

In 2021, Waymo's trusted tester research program in		The public limited company of Europe will come ahead the
which they can know the people observation to reshape the future. In 2022, waymo started service of ride in the San Francisco to the employee and public as well as airport pick and drop 24/7 on the paid basis. In 2023, waymo started service of ride-hailing with the employee in Los Angeles. They transitioned their all fleet into electric cars and prefer jaguar – IPace instead of Chrysler Pacifica Hybrid. Also, waymo one doubled the service in the downtown Phoenix in Arizona and added area of Scottsdale which was 180 miles. (Waymo LLC, 26 Oct. 2023.Latest updates).		expansion of the quick-development of battery business from that point. The company's headquartered in Salzgitter, is liable for all accomplishments from the buying of raw materials to the advancement steps of the Volkswagen unit cell and the management of initially six Giga-factories in Europe. Within the Volkswagen Group, battery activities are the responsibility of the Group Board of Management's Technology Division. It is no coincidence that the name "Battery Valley" alludes to California's Silicon Valley. Similar to the west coast of the USA, top experts from all over the world work in interdisciplinary teams to help design the world of tomorrow with new technologies and products. **(Volkswagen Technology 2023).**
Source: I made it.	**Table 4**	

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The goal of the literature review is that finding and review the gap in some areas for further development and process such as sensor technology, object detection and decision making, hardware system, testing and validation of system, infra structure and mapping, legal frame work, public awareness, safety and security, shift in job placement, social and economic factor, cybersecurity and ethical element. Moreover, what is happening in the developing and developed countries such as UK, Hungary, Malaysia and Pakistan. Developed countries are advancing towards the self-driving technology and bring the rules to upgrade the infra structure and trying to resolve the safety issue. Public, government and commercial organizations are also collaborating and cooperating each other to completely move in self-driving technology.

In the developing countries, it has been observed that decades will need to bring this upgrade technology in the automotive industry. There are several challenges for this such as population growth, lack of infra-structure, legal rule, environmental, political, economic and social issues. In Malaysia government is taking initiative but there are energy constraint and human driving issues. People do not want to follow the rule even traffic rules. Although, Singapore together with Malaysia ia trying to bring this technology on the road.

In the Pakistan, human behavior, road structure, complex traffic, lack of advance technology, Knowledge of self-driving cars, manufacturer, poor government management. There is a hope that it can start slowly to part of this automotive revolution.

Once the gaps are recognized, the further advancement is to initialized them based on their significance, potential safety implications, and the feasibility of addressing them. This prioritization can guide research, development efforts, and regulatory actions to bridge these gaps and advance the adoption of self-driving car technology.

2.My own research plan

2.1. Introduction

The purpose of this research paper to know the adoption rate, regulatory framework, safety implications, economic and cultural impact in the developed countries and developing countries. I have decided to investigate about four countries UK, Hungary, Malaysia and Pakistan due to its diversified economic, environmental, Political, Technological and culture condition. In my opinion, future of automotive industry will evolve soon globally. This development is a need of the coming time as population is growing, therefore, traffic system, solid infra-structure and self-driving cars are the solution.

2.2 Research Design

Types of Research

This research paper is exploratory, descriptive and explanatory means to investigate about the people perception and safety challenges due to the road accidents in case of self - driving cars in developed countries UK, Hungary and developing countries Malaysia, Pakistan.

Research Approach

This research is a qualitative and quantitative study that was designed to address a specific research question about demographic features, Technical aspects of self-driving cars for consumer concern, human behavior and safety issues of self-driving cars in the developed and developing countries to take more steps for self-driving cars implementations. Further, the reason to choose this approach to observe the direction and trend impacted by the self-driving cars.

2.3 Theoretical Comparative Analysis

I have decided to select data from the four countries as UK has minimum accident ratio as per data in 2018, population basis is 100,000. Hungary as situated in the Europe and it’s a hub for the innovation research of self-driving cars. Invention and innovation is the base for the successful plan of self-driving cars. This technique can be applied into the

developing countries to join in this race of self-driving cars. Malaysia and Pakistan both are developing countries and want to assess the car industry situation. This is how, I have described some differences in the developed and developing countries.

PESTLE model is applied for the comparative analysis.

- P Political
- E Economical
- S Social
- T Technological
- L Legal
- E Environmental

As this model explain about the risk and profit of the new product self-driving cars in the countries.

1. Political factor consists of safety regulation for driving a self-automated motor. Government and higher authorities of road accidents for the protection of the passengers are involve to form the policies and procedures.

2.Economical factor consists of Population, GDP, investment, income and development of the country. How much individual person can spend on the electronics base on AI items such as self-driving cars, people are earning more money year by year to increase their standard of life.

3. social factor is about people behavior that they feel happy and safe while using the self-driving cars.

4.Technology factor is increase with the passage of the time to prevent the cars accident and solve the problem of traffic jam.

5. Environmental factor is also main element as it helps to save the energy and increase electrification in the countries

6. Legal factor is consisting of government, safety organization and companies who are working all together for the implementation of the self-driving cars. Proper rules formation required to the self-driving cars networking.

Developed Countries UK & Hungary	**Developing Countries Malaysia & Pakistan**
Introduction	
1.Development stages	1. Idea exist
Technological Problem	
1.Technology advancement	1.Lack of Technology
2. High Tech cities	2.Urban rural division
3. Research and innovation activities	3.Less activities of research and innovation
4. Advanced infrastructure	4. poor infrstructure
Adoption & Consumer Behavior	
1. Higher adoption rate	1. Lower adoption rate
2. Technology literate	2. Education Barrier
Economical Problem	
1. Suitable salaries	Less income
2. Infra-structure pavement	Lack of infra structure
3. Manufacturer and investor	Lack of Manufacturer and Investor
4. Price stability	Price issue
5. Stable international market	International market infleuence

Cultural and Social Problem	
1.Social and Ethical management	1.Lack of social and ethical sense
2. Public awareness	2.Lack of Public Awareness
3. Acceptance and Trust	3. Cultural resistance
4. Culture shift to adoption	4. Difference in societical priority
Environmental Problem	
1. Environment care	1.Lack of awareness to protect environment
2. Strict regulations and compliance for the self-driving cars	2.Evolving regulations and trying to accommodate self-driving cars
3.Testing Infrastructure	3. Limited Infra-structure
Governmental Problem	
1. Responsibility and reliability in Governement	1. Lack of Transparency & Manipulation in Governement

Source I made it. Table 5

While industrialized nations are typically at the forefront of the research and use of self-driving cars, emerging nations also have certain potential and challenges. As technology advances and regulatory frameworks change, the gap between industrialized and poor nations may close. It's critical to acknowledge contextual variations and adjust the application of self-driving technology to the unique requirements and circumstances of every nation. Identification of unique factors influencing their adoption and perception & cross cultural studies. Further, I have categorized countries developed and developing

countries as per GDP per capita in general as it is also some disadvantages. In 2022, world indicator shows: Table 6.

Country Name	2022 GDP / Pop	Remarks
United Kingdom	45,850	over 40th
Hungary	18,463	between 16 and 40
Malaysia	11,972	between 10 and 16
Pakistan	1,597	under 10th

2.4 Data Collection & Questionnaire Design

Data will be collected through a questionnaire from students and general public.

No.	Research Questions	Data Source	Research Method	Type of Research
1	What are the factors contributing to prefer self-driving cars?	Students, Friends	Questionnaire	Qualitative & Quantitative
2	What are the impact of self-driving cars in the countries UK, Hungary, Malaysia and Pakistan?	Students, Friends	Questionnaire	Qualitative & Quantitative
3	How are the demographic differences feature affects the self-driving cars?	Students, Friends	Questionnaire	Qualitative & Quantitative
4.	What are the challenges of self-driving cars in UK, Hungary, Malaysia and Pakistan?	Students, Friends	Questionnaire	Qualitative & Quantitative

5.	What are the people perception about the self-driving cars in the UK, Hungary, Malaysia and Pakistan?	Students, Friends	Questionnaire	Qualitative & Quantitative

Table 7.

Source: I created to visualize it more clearly and precisely.

In this research, primary and secondary data has been used to explain the work. People who has already been done the research in the field of self- driving cars such as articles, Newspapers, books and personal observation.

Self-driving car structure and approach would be pretty comparable to those in other nations. To function properly, self-driving cars depend on a mix of hardware and software technologies as well as legal frameworks and infra structure.

To collect the data, I created the online questionnaire by using google form then shared with the students, friends and general public in UK, Hungary, Malaysia and Pakistan. I choose online questionnaire method as the tool for data collection because of its convenience and ease of use. With an online questionnaire, I understand its possibilities to reach a large number of respondents quickly and easily, and the data can be collected and analyzed efficiently. Additionally, it also allows for anonymity, which may encourage more honest and open responses from the participants which is good for the people to give their answers without mentioning their names. Once the data has been collected through the online questionnaire, it will be analyzed using statistical methods to identify trends and patterns in the responses (Lumsden & Morgan, 2005). The primary software tool that I utilize for statistical analysis is Excel, which is a latest program designed for the multi-purpose analysis. It allows me to carry out a variety of statistical processes and tests, from basic descriptive statistics to sophisticated analysis. Additionally, excel has a function for creating graphs and charts, which is useful for displaying the data. These graphs and charts may be exported in a variety of formats for use in presentations or reports. To further analysis, I have made correlation matrix to investigate the dependent variable of self-driving cars in the paper.

Sampling Strategy, sample size and selection, limitation

Overall, population is 310. Hungary 30, UK 80, Malaysia 55 & Pakistan 45. In my opinion sample size are appropriate to draw the results. It has 35 questions to analyze the safety issues and public behavior related to the self-driving cars in these countries. It also helps to find the trend and know how about the self-driving car's situation in the countries within the suitable time period. For huge sample size, cost and time are required.

Variation is also less. If sample size is larger than it also difficult to handle and manage. Data collection related to the no. of respondents have been done on my own. It is consisting of real life survey. People are my friends and class mates from these countries.

3. Evaluation of the Results

In this section, I will present all the results achieved from the questionnaire while discussing the relationship among the dependent and independent variables.

3.1. Demographic Analysis

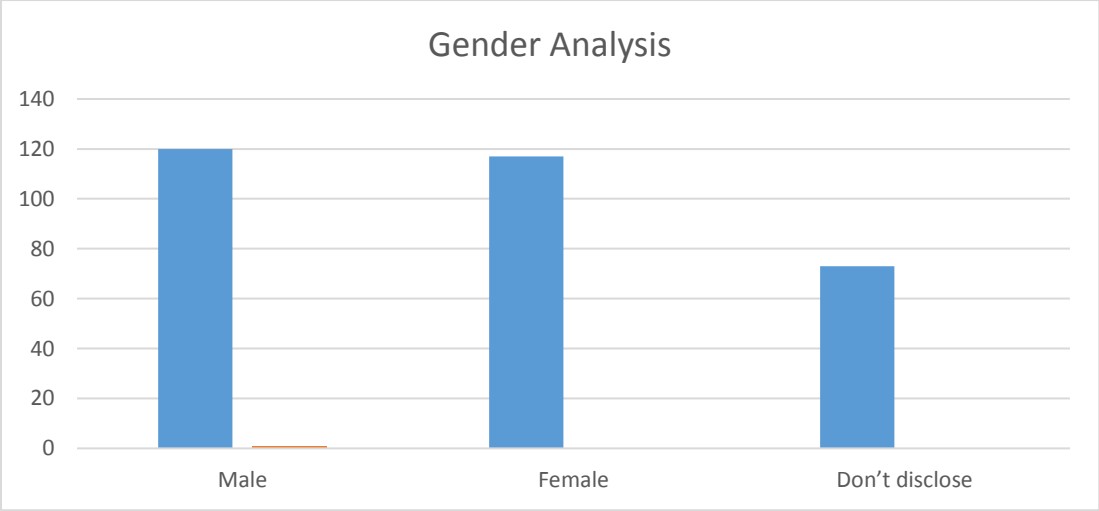
This first part describes about overview of the characteristics of the selected population. The purpose of collecting this data is to gain a better understanding of the sample population and to identify any potential patterns or trends that may exist within specific groups. There are six independent variables: 1. Gender 2. Location where people are living in their countries. 3. Countries 4. Education highest level of qualification and current level of studying 5. Age 6. Working status

1. **Gender Analysis**

This chapter examine the result from the data drawn from 310 sample including male respondents are 120 and female respondent are 117. Some respondents don't want to disclose their gender who are 73. Female share is 37.7% and male share 38.7%

Gender	Respondents	Share%	Explanation
Male	120	39	310 out of 39% people are male, 38 % are female and 24% doesn't show about the gender.
Female	117	38	
Don't disclose	73	24	

Table 8.



Gender distribution Figure no. 22

2. **Location Analysis**

Location	Respondents	Share%	Explanation
village	45	14.52	Total participants 310. 45,73,70,86,36 No. of respondent are chosen from the village, big city, city, capital and town. According to the result, 14.52 %,23.55 %, 22.55%,27.74% and 11.61% are from village, big city, city, capital and town respectively
big city	73	23.55	
city	70	22.58	
capital	86	27.74	
town	36	11.61	

Table 9.

3. **Country Analysis**

Countries	Continent	Respondents	Share %	Explanation
UK		81	26.13	Total people are 310. Out of 81,42,56,45,764,5,1 are from UK, Hungary, Malaysia, Pakistan, Further, I categorized countries in continents Asia, Africa, Europe and America due to less in number.
Hungary		42	13.55	
Malaysia		56	18.06	
Pakistan		45	14.52	
	Asia	76	24.52	
	Africa	4	1.29	
	Europe	5	1.61	
	America	1	0.32	

Table 10.

In this section, I have selected four mainly four countries UK 81, Hungary 42, Malaysia 56 and Pakistan 45, out of 310. Other respondents are very few in numbers. Therefore, I have categorized it in the continent such as Asia, Africa, Europe and America wise to sum up and assess the country wise data.

4.**Education Analysis**

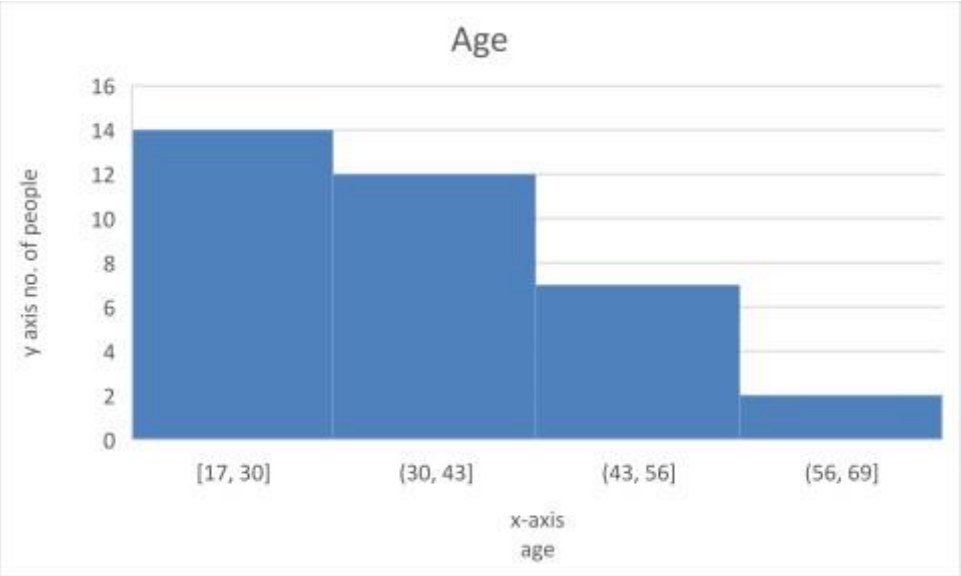
Qualification	Highest Education (A)	Currently studying level (B)	Share % A	Share % B	Explanation
MSc	8	3	3	1	Out of 310, 69 &78 people are under graduated students.91 & 89 people are PhD students. These are the highest education and status of currently student.45 & 34 people are belonging to secondary education.
BSc	69	78	22	25	
PhD	91	89	29	29	
Secondary	45	34	15	11	
Vocational	30	34	10	11	
Adult Education	38	35	12	11	
Primary	29	37	9	12	

Table 11.

5. **Age Analysis**

Sr. No	Age	Respondents	Share %	Explanation
1	Less than 20	9	2.90	9 people are below 20. 235 respondent fall in 21 to 30.2.26 % people are above 60.50 people fall in 3rd grade.
2	21-30	235	75.81	
3	31-50	50	16.13	
4	51-70	9	2.90	
5	71-80	7	2.26	

Table 12



Own figure 22

According to the age analysis minimum is 17 and maximum is 71,

Before delving into the specific results, it is crucial to acknowledge the limitations of our study based on the sample size of the international students. First, the sample size, although considerable, may not fully represent the almost evenness in the entire international student population.

6. **Currently working People**

Working	Respondents	Share%	Explanation
YES	161	51.94	161 people are currently working, out of 310.116 people are not working, some of them are retired and old. 10.65 % people don't show about their working status. However, it shows that more people are working recently.
No	116	37.42	
Don't provide	33	10.65	

Table 13

3.2. Statements of Factors of Self-Driving Cars Analysis

These questions are related to the safety and people opinion about the self-driving cars. These statements are analyzed on the basis of independent variables (Gender, Location, Countries, Study, age and Working Status). Now I will explain about the relationship between these variables.

What does people of UK, Hungary, Malaysia and Pakistan think about it? These statement questions belong to the people perception and these will help to observe people opinion:

1.How relevant are the below listed fears related to self-driving cars? a. Hackers tamper with the car b. The self-driving system breaks down c. The car decides different from how I would like it to d. Fear from the new technology e. People (in various professions, such as chauffeurs) will lose their jobs f. Control cannot be regained g. Too expensive. h. I lose the joy of driving i. The security of personal data cannot be provided

These statements are graded 1 to 5 as negligible to significant.

2. In how far do You agree with the following statements? These statement questions are also related to the people thinking and opinion about different declaration of self-driving cars. a. I would be afraid of self—driving cars in my environment b. I would love to buy a self- driving car later on. c. Self-driving cars will positively affect emission d. Self-driving cars will positively affect the society e. Self-driving cars will reduce the occurrence of accidents f. I would love to try a self- driving car g. I would support the initialization of self-driving cars. These statements options are 1. I completely agree 2. I don't agree 3. I mostly do not agree 4. I rather agree 5. Neither agree, nor disagree

In how far do You agree with the following statements?			
a. I would be afraid of self—driving cars in my environment	Respondents	Share%	Explanation
I completely agree	56	18	Based on the data, 56 people are not comfortable about self-driving cars in their surrounds but 68 people don’t agree on it and it more than the completely agree
I don't agree	68	22	
I mostly do not agree	68	22	
I rather agree	68	22	

Neither agree, nor disagree	50	16	share. Moreover, people are comfortable with AI Cars.
b.I would love to buy a self-- driving car later on.			Explanation
I completely agree	67	22	Based on the data, 67 & 71 people are love to buy self-driving cars however, 70 people don't agree on it. Somehow, it create balance that some people will buy or some people will not buy.
I don't agree	54	17	
I mostly do not agree	48	15	
I rather agree	71	23	
Neither agree, nor disagree	70	23	
c.Self--driving cars will positively affect emission			Explanation
I completely agree	48	15	As per data, 70 people are rather agree, 48 people are totally agree that car protect the environment. However, 70people are not agree. This description are true or not true some certain extent.
I don't agree	48	15	
I mostly do not agree	46	15	
I rather agree	70	23	
Neither agree, nor disagree	70	23	
d.Self--driving cars will positively affect the society			Explanation
I completely agree	60	19	As per data, 57 people are rather agree, 60 people are totally agree that self-driving car put positive impact on society. However, 66 &89 people are not agree. It means that this share is neutral or people are not sure about it.
I don't agree	50	16	
I mostly do not agree	66	21	
I rather agree	57	18	
Neither agree, nor disagree	89	29	
e.Self--driving cars will reduce the occurrence of accidents			Explanation
I completely agree	53	17	53& 68 people are totally and rather agree. 58 people don't agree. 72 people are neutral about that self-driving car will reduce the accidents. But mostly people are agreed as per share.
I don't agree	55	18	
I mostly do not agree	58	19	
I rather agree	68	22	
Neither agree, nor disagree	72	23	
f.I would love to try a self-- driving car			Explanation
I completely agree	86	28	This data shows that people are excited to try new technology as
I don't agree	40	13	

I mostly do not agree	50	16	86 people are completely agree with this staetment. However, 40 people don't agree. According to the share of totally agree is more.
I rather agree	67	22	
Neither agree, nor disagree	67	22	
g.I would support the initialization of self--driving cars			Explanation
I completely agree	59	19	As per data, 76 people are neutral about supporting the sself-driving cars. 33 people are not agree on it.However, agreed value is more than the disagreement.
I don't agree	33	11	
I mostly do not agree	56	18	
I rather agree	73	24	
Neither agree, nor disagree	76	25	

Table 14.

What do people think about safety issues in the developed countries (UK, Hungary) and (Malaysia, Pakistan)?

In this question, people preference has been observing while giving 5 options. 1. Owned by company 2. Owned by software 3. Owned Car 4. Ride- sharing 5. Tick more than one. This question is also showed about the safety element because people consider this option, keeping in mind security matter. Ride-sharing is risky situation and who will take the responsibility of the software? Owned Car is person's own liability. Therefore, this statement about the preference linked to the security and protection of the passenger while traveling the self-driving car.

2.What would you prefer in self-driving Cars? (Tick more than one).				
Sr. No	Options	Respondents	Share %	Explanation
1	Owned by company	61	20	As per data, Total no. of people are 310. Out of 26 % people like to have their own cars. Out of 18 % people selected more option preference of self-driving cars. 61 & 53 people prefer owned company and software cars. Ride-sharing is less preferable option.
2	Owned by Software	53	17	
3	Owned Car	82	26	
4	Ride-sharing	59	19	
5	More Option	55	18	

Table 15.

In this question, what do people think about the accidental liability? There are seven options for the people to think and decide that who is liable 1. The producer of the software 2. The Producer 3. The Owner of the car 4. The insurance company 5. The one sitting in the cars 6. Government 7. some people vote for the more option mean they choose all are the responsible for the accidents occurred by the self-driving cars.

3.Who should take responsibility if the self-driving car causes an accident? (Tick more than one).				
Sr. No	Options	Respondents	Share %	Explanation
1	The producer of the software	40	13	As per data, total respondents are 310. Out of 18 % people thinks that producer, insurance, govt, person who is in the car and producer of the software, all are liable for the accidents. Further, out of 18 % people consider that the person who is sitting in the car is responsible for the mishap.
2	The producer	39	13	
3	The owner	47	15	
4	The one sitting in the car	56	18	
5	The insurance company	41	13	
6	The government	32	10	
7	All of the above options	55	18	

Table 16

In this question, there are four option to choose by the public that what people require from the self –driving car. 1.Make random decisions 2. Always protect the passengers 3. Minimize the number of injured 4. All of the above. It shows that people are more concern about the safety of the persons whether person is driving the car or people are around the car. Self-driving car has to make sensible decision according to the environment.

4.On the basis of what principle shall the self-driving car decide? (Tick more than one).				
Sr. No	Options	Respondents	Share %	Explanation
1	Make random decisions	63	20	As per data, Total no of people are 310. Out of 39% people thinks that injuries must be less through the self-driving cars. 31 % people thinks that always protect the passengers. But 9% people selected more choice while the concern is about safety.
2	Always protect the passengers	97	31	
3	Minimize the number of injured	122	39	
4	All of the above options	28	9	

Table 17

In this question below, people has more concern about the safety of the people. There are 5 option and people consider to save everyone.1. A group of homeless people who would be hit if we try to save the pregnant lady in front of the car 2. Everyone 3. The driver 4. The pregnant lady on front of the car 5. All of the above options.

5.Who should the self-driving car save/protect in an accident situation, where stopping is not an option anymore? (Tick more than one).

Sr. No	Options	Respondents	Share %	Explanation
1	A group of homeless people who would be hit if we try to save the pregnant lady in front of the car	50	16	As per data, total respondents are 310. Out of 99 people think that everyone should be saved in the car accident. 32% is more share as compared to the other oprions.13 people choose more than one option. It showed that main purpose of the self-driving car is to increase protection and decrease accidents.
2	Everyone	99	32	
3	The driver	82	26	
4	The pregnant lady on front of the car	66	21	
5	All of the above options	13	4	
6				

Table 18

In this question below, there are five option related with technical features of the car handling during the driving and also consists of security and safety concern. This is also show that human brain and technology brain work together on the complex situation while driving the automated cars.1. Safe 2. Rather unsafe 3. Rather safe 4. Not safe 5. Neutral. Different statements are a. The driver is in full control b. The driver is in control the car is either parking or heeding the speed limit on its own c. The car can take control of the pedals and the steering wheel at the same time, but the driver keeps an eye on it and intervenes if. d The car can change lanes and react to the environment. The task of the driver is to pay attention take back control. e. The car is in control, but can ask for human f. The car is in full control

Rate, how far You think the below levels are safe?			
a. The driver is in full control	Respondents	Share%	Explanation
Safe	63	20	As per data, total are 310. Out of 63 & 70 safe and rather safe. Therefore, 133 people consider it safe when driver is in full control.78 people are neutral that they think there is chance of safety and unsafety.
Rather unsafe	56	18	
Rather safe	70	23	
Not safe	43	14	
Neutral	78	25	
b. The driver is in control the car is either parking or heeding the speed limit on its own			Explanation
Safe	63	20	As per data, 70 people are equitable that driver is in control and car is parking and heeding the speed limit. Out of 63 & 76 are consider it safe. Out of 41 & 60 consider it unsafe.
Rather unsafe	60	19	
Rather safe	76	25	
Not safe	41	13	
Neutral	70	23	
c. The car can take control of the pedals and the steering wheel at the same time, but the driver keeps an eye on it and intervenes if necessary.			Explanation
Safe	55	18	As per data, 310 out of 55 people consider this situation, car can take control of the pedal and steering wheel and driver is also keep eye on it. 85 people suggest it as rather safe. However, 53 & 49 people consider it unsafe.
Rather unsafe	53	17	
Rather safe	85	27	
Not safe	49	16	
Neutral	68	22	
d. The car can change lanes and react to the environment. The task of the driver is to pay attention take back control.			Explanation
Safe	55	18	As per data, out of 55 & 67 think about it safe and rather safe. So, 122 people take as safe which are more as compared to the unsafe share 18%.74 people think as impartial.
Rather unsafe	57	18	
Rather safe	67	22	
Not safe	57	18	
Neutral	74	24	
e. The car is in control, but can ask for human help			Explanation

Safe	60	19	310 out of 60 & 63 people think that car is in control but can ask for human help. 74 people think that it can be safe or unsafe.54 people think that it is not safe.
Rather unsafe	59	19	
Rather safe	63	20	
Not safe	54	17	
Neutral	74	24	
f. The car is in full control			Explanation
Safe	45	15	As per data, 73 people think that if car is in full control, it is not safe. 67 people are neutral impartial about it.15 % people think that it is safe situation that car is in control
Rather unsafe	58	19	
Rather safe	67	22	
Not safe	73	24	
Neutral	67	22	

Table 19

In this below question, it is linked with the above question, all about safety and technical sensitive decision about the situation:

7.Which of the previous 6 options would You be comfortable with?				
Sr. No	Options	Respondents	Share %	Explanation
1	The car can change lanes and react to the environment. The task of the driver is to pay attention take back control.	47	15	Out of 310, 63 people are in favor of the driver is in full control due to its % increase as compared to the other situations. 14 & 15 % share are less in the circumstances of the car can take control of the pedals and the steering wheel at the same time, but the driver keeps eye on it and intervene if require and car can change lanes and react to the environment. The task of the driver is to pay attention take back control.17 & 16 % people think that car can must be in control and ask human help.
2	The car can take control of the pedals and the steering wheel at the same time, but the driver keeps an eye on it and intervenes if necessary.	42	14	
3	The car is in control, but can ask for human help.	52	17	
4	The car is in full control.	51	16	
5	The driver is in control the car is either parking or heeding the speed limit on its own	55	18	
6	The driver is in full control	63	20	

Table 20.

In this question below, there are three option a. You, b. The pedestrians, who are more in number c. Those who sitting in the other car. It is the situation where you realizing if I am driving the self-driving car then to whom I should save?

8.If You are the driver, who should the car save?				
Sr. No	Options	Respondents	Share%	Explanation
1	You	117	37.74	117 out of 310, people save themselves and then people think about pedestrians which share is 105. 28.39% share is less in the situation Those sitting in the other car, where there are children, even if they were at fault
2	The pedestrians, who are more in number	105	33.87	
3	Those sitting in the other car, where there are children, even if they were at fault	88	28.39	

Table 21

In this question below, ask about the challenges of the self- driving cars. There are seven options: 1. All 2. Fear 3. Income 4. Infra-structure 5. Legal affair 6. Technology 7. Other. I think this question is significantly applicable on the developing countries because there is no proper initiation for the self-driving cars however, in the developed countries, in some area it can be applied. Legal Policy formation, infra-structure, fear and income can be assessed in the developed countries.

Obstacles to adopt the self-driving cars				
No.	Obstacles	Respondents	Share%	Explanation
1	All	79	25	79 people out of 310 think that fear of new tech, income, infrastructure, legal affair and technology all are important. Income is a less share as compared to the other factors.
2	Fear	45	15	
3	Income	37	12	
4	Infra-Structure	40	13	
5	Legal affair	40	13	
6	Technology	47	15	
7	Others	22	7	

Table 22

3.3 **Answering Hypothesis and Research questions**

Descriptive Statistics	*afraid*	*buy*	*emission*	*society*	*redu_acci*	*love_try*	*sup_ini*
Expected Value	2.9226	3.1581	3.0194	3.0032	2.9355	3.3516	3.1387
Standard Error	0.0811	0.0788	0.0748	0.0780	0.0797	0.0780	0.0753
Median	3	3	3	3	3	3	3

Modus	1	4	3	3	1	5	3
Standard Deviation	1.4280	1.3879	1.3169	1.3736	1.4035	1.3732	1.3257
Relative Standard Deviation / Coefficient Variation	0.4886	0.4395	0.4362	0.4574	0.4781	0.4097	0.4224
Variance	2.0393	1.9264	1.7343	1.8867	1.9699	1.8857	1.7574
Skewness	-1.3528	-1.1936	-1.0535	-1.2101	-1.2872	-1.1382	-1.1010
Kurtosis	0.0565	-0.1906	-0.1128	0.0319	0.0093	-0.3058	-0.1479
Range	4	4	4	4	4	4	4
Relative Range	1.3687	1.2666	1.3248	1.3319	1.3626	1.1935	1.2744
Minimum	1	1	1	1	1	1	1
Maximum	5	5	5	5	5	5	5
Sum of Example	906	979	936	931	910	1039	973
Nr. Of Example	310	310	310	310	310	310	310
Confidence Level (95%)	0.1596	0.1551	0.1472	0.1535	0.1569	0.1535	0.1482

1.What are the factors contribute to prefer self-driving cars?

Table 23

Firstly, People love to try new technology in self-driving cars as score is 3.3. Secondly, buying and support initialization of self- driving cars get 3.1 score, so it means that people will buy and are in the favor of self-driving cars. Thirdly, people will prefer self-driving cars due to environment protection and society change as per score show 3.0. Fourthly, afraid in the environment and less in accident get score 2.9. so, it means that people will not afraid of self-driving cars. In this data standard error is close to the zero which means that data of the population is true. It shows that mean of the population is true.

2. What are the impact of self-driving cars in the countries UK, Hungary, Malaysia and Pakistan?

Descriptive Statistics	*hackers*	*sys_brk_dn*	*cr_dcid_df*	*6_B*	*prof.*	*C_not_gain*	*2_xpensv*	*joy*	*Pers_data*
Expected Value	3.1581	3.1516	2.8968	2.8290	3.0968	3.0355	3.0742	2.9581	3.1032
Standard Error	0.0817	0.0803	0.0788	0.0754	0.0788	0.0769	0.0790	0.0789	0.0772
Median	3	3	3	3	3	3	3	3	3
Modus	5	5	3	3	3	3	2	3	3

Standard Deviation	1.4383	1.4141	1.3873	1.3268	1.3878	1.3541	1.3903	1.3893	1.3590
Relative Standard Deviation / Coefficient Variation	0.4554	0.4487	0.4789	0.4690	0.4481	0.4461	0.4523	0.4697	0.4379
Variance	2.0688	1.9996	1.9246	1.7603	1.9259	1.8337	1.9330	1.9303	1.8469
Skewness	-1.2984	-1.2657	-1.2225	-1.0924	-1.2216	-1.1404	-1.2636	-1.2253	-1.1949
Kurtosis	-0.1285	-0.1395	0.0836	0.1583	-0.0866	-0.0568	-0.0171	0.0462	-0.0092
Range	4	4	4	4	4	4	4	4	4
Relative Range	1.2666	1.2692	1.3808	1.4139	1.2917	1.3177	1.3012	1.3522	1.2890
Minimum	1	1	1	1	1	1	1	1	1
Maximum	5	5	5	5	5	5	5	5	5
Sum of Example	979	977	898	877	960	941	953	917	962
Nr. Of Example	310	310	310	310	310	310	310	310	310
Confidence Level (95%)	0.1607	0.1580	0.1550	0.1483	0.1551	0.1513	0.1554	0.1553	0.1519

Table 22

This analysis of self-driving cars in UK, Hungary, Malaysia and Pakistan shows about the impact on the countries in the economic, social, technological and safety but more related with the technology factors.

Firstly, Technological impact: Hackers, system break down during the driving and personal data safety issue score 3.1, it means that this statement is more significant in the eye of the people.

Secondly, Economical impact: people think that car will be expensive and driving profession will get effected from these self-driving cars as per score indicated 3.0. skewness is positive due to positive value, curve is longer and fatter to the right side.

Thirdly, score get 2.8 to the social and security factor as people will be happy to use self-driving car. Kurtosis negative values in the security scenario means that more value located near the mean and less value located on the tail. In the social factor kortosis has positive values.

3.What are the challenges of the self-driving cars in the UK, Hungary, Malaysia and Pakistan?

Descriptive Statistics	*resp_acci*	*sv_acc_stP*	*Decide*	*surv*	*prefer*
Expected Value	3.9484	2.7129	2.0710	1.9613	2.8806
Standard Error	0.1164	0.0725	0.0531	0.0481	0.0783
Median	4	3	2	2	3
Modus	2	4	2	1	2
Standard Deviation	2.0489	1.2764	0.9355	0.8467	1.3778
Relative Standard Deviation / Coefficient Variation	0.5189	0.4705	0.4517	0.4317	0.4783
Variance	4.1980	1.6293	0.8752	0.7169	1.8983
Skewness	-1.3675	-1.3554	-0.6073	-1.6033	-1.2162
Kurtosis	0.0041	-0.0972	0.5264	0.0737	0.1863
Range	6	4	3	2	4
Relative Range	1.5196	1.4744	1.4486	1.0197	1.3886
Minimum	1	1	1	1	1
Maximum	7	5	4	3	5
Sum of Example	1224	841	642	608	893
Nr. Of Example	310	310	310	310	310
Confidence Level (95%)	0.2290	0.1426	0.1046	0.0946	0.1540

Table 25

As per data, safety is a main problem of the self-driving cars. Responsibility of a bad incident, how to save everyone around? How car will decide? What will public prefer in the self-driving car?

Firstly, responsibility of the accident get 3.9 score as this score is higher compared to the other factors.

Secondly people preference gets 2.8 score after the responsibility of misshaping during the self-driving car. People are not comfortable to share their car space to other person.

Girls, children will not feel safe while sharing the car with others. It is also implies to the men, disable people and old person.

Thirdly, score get where car has no option to stop. In this situation skewness is fairly skewed due to negative value. It means that curve is longer or fatter to the left side.

Standard error is low. It means that mean of the population is true.

What are the technical expected features of the self-driving cars?

Descriptive Statistics	*Driv_Fu_Co*	*dc_pa_spe*	*ped_ste_w*	*ch_lane*	*ask_HH*	*Car_Fu_Co*	*6_option*
Expected Value	2.9484	2.9484	2.8677	2.8032	2.8484	2.6323	2.3581
Standard Error	0.0707	0.0704	0.0696	0.0717	0.0728	0.0714	0.1004
Median	3	3	3	3	3	3	2
Modus	3	3	3	3	3	3	0
Standard Deviation	1.2453	1.2401	1.2248	1.2631	1.2820	1.2568	1.7674
Relative Standard Deviation / Coefficient Variation	0.4224	0.4206	0.4271	0.4506	0.4501	0.4775	0.7495
Variance	1.5507	1.5378	1.5003	1.5955	1.6436	1.5795	3.1238
Skewness	-0.5853	-0.5797	-0.4443	-0.5567	-0.6513	-0.4580	-1.3326
Kurtosis	0.3006	0.3239	0.3184	0.3562	0.3417	0.4461	0.1250
Range	4	4	4	4	4	4	5
Relative Range	1.3567	1.3567	1.3948	1.4269	1.4043	1.5196	2.1204
Minimum	1	1	1	1	1	1	0
Maximum	5	5	5	5	5	5	5
Sum of Example	914	914	889	869	883	816	731
Nr. Of Example	310	310	310	310	310	310	310
Confidence Level (95%)	0.1392	0.1386	0.1369	0.1412	0.1433	0.1405	0.1975

Table 26

In this above questions, four factors that driver has to take full control, driver can control speed and give attention pedal, steering and changing lane are get 2.8 score. Standard error is very low in the case of driver and car both coordinate with each other.

Secondly car full control does not get better score 2.6 as compared to the driver responsibilities during the cars. People think that car cannot function alone in the self-driving cars. Skewness is negative which means that distribution is fairly skewed and curve will be longer and fatter to the left side.

4.How are the differences in demographic features affect the self- driving cars in UK, Hungary, Malaysia and Pakistan?

Descriptive Statistics	*gender*	*age*	*country*	*live*	*HE*	*c_study*	*obst*	*C_Work*
Expected Value	1.1419	6.0161	3.6774	3.3839	4.4839	4.4387	4.3355	1.4129
Standard Error	0.0438	0.1028	0.0856	0.0783	0.1167	0.1182	0.1243	0.0384
Median	1	7	3	4	5	5	4	2
Modus	1	7	3	5	7	7	7	2
Standard Deviation	0.7712	1.8105	1.5070	1.3787	2.0554	2.0811	2.1879	0.6759

Relative Standard Deviation / Coefficient Variation	0.6753	0.3009	0.4098	0.4074	0.4584	0.4689	0.5046	0.4784
Variance	0.5947	3.2781	2.2710	1.9007	4.2247	4.3312	4.7868	0.4568
Skewness	-1.2788	0.3917	-0.9147	-1.0346	-1.2484	-1.1975	-1.4243	-0.5938
Kurtosis	-0.2495	-1.4401	0.8238	-0.4088	-0.1771	-0.2152	-0.1618	-0.7245
Range	2	6	6	4	6	6	6	2
Relative Range	1.7514	0.9973	1.6316	1.1821	1.3381	1.3517	1.3839	1.4155
Minimum	0	1	1	1	1	1	1	0
Maximum	2	7	7	5	7	7	7	2
Sum of Example	354	1865	1140	1049	1390	1376	1344	438
Nr. Of Example	310	310	310	310	310	310	310	310
Confidence Level (95%)	0.0862	0.2023	0.1684	0.1541	0.2297	0.2326	0.2445	0.0755

Table 27

Based on the data, age get more score 6 as compared to the other independent variable and then higher education, currently study level get score 4.4. After it, country and residing destination get 3.6 and 3.3 score.

Standard error is low which shows that there is no relationship between dependent variable of self-driving cars such as safety, technical, social and economic factor and independent variable like age, gender, country, education, working and obstacles.

So, it means that demographic feature does not effect on the other factors of self-driving cars.

Evaluation of Correlation Matrix

Correlation Matrix	*afraid*	*buy*	*emission*	*society*	*redu_acci*	*love_try*	*sup_ini*
afraid	1.0000						
buy	-0.0869	1.0000					
emission	-0.0009	0.2657	1.0000				
society	-0.0081	0.1712	0.1825	1.0000			
redu_acci	-0.0025	0.0983	0.2633	0.1663	1.0000		
love_try	0.0304	0.0777	0.1734	0.0183	0.1293	1.0000	
sup_ini	-0.0285	0.1780	0.1820	0.0744	0.1579	0.2451	1.0000
Driv_Fu_Co	0.0469	0.0085	0.1072	0.0966	-0.0538	0.0939	-0.0094
dc_pa_spe	-0.0114	0.0706	0.0422	0.0970	0.1840	0.0411	0.0162
ped_ste_w	-0.0447	0.0352	0.1240	0.1291	0.1268	0.1085	0.0871
ch_lane	0.0113	0.2098	0.0081	-0.0034	0.0293	0.1557	0.2019
ask_HH	-0.0347	0.0753	0.0573	0.0517	0.1240	0.1333	0.0753
Car_Fu_Co	-0.1403	0.2245	0.0278	0.1169	0.0067	0.0264	0.1609
6_option	-0.0262	0.0573	0.0026	0.1088	0.1411	0.1213	0.0050
resp_acci	-0.0312	-0.0074	0.0759	0.0104	0.0900	0.0364	-0.1105
sv_acc_stP	-0.0371	-0.0949	-0.0044	-0.1268	-0.0429	0.0319	-0.0089
decide	-0.1485	0.0487	-0.0064	0.0275	0.0577	0.0838	0.0025
surv	0.0082	-0.0085	-0.1677	-0.1362	-0.0239	-0.0133	0.0365
prefer	0.0068	0.0234	0.0405	0.0122	0.0311	0.0411	0.0410
hackers	-0.0082	-0.0336	0.0291	0.0440	0.0163	0.0750	0.0903
sys_brk_dn	-0.0006	-0.0601	0.0384	0.0464	0.0066	0.0575	0.0751
cr_dcid_df	0.0368	0.0035	-0.0414	-0.0083	-0.0533	-0.0285	0.0254
6_B	0.0852	-0.0485	-0.0296	0.0447	-0.0285	0.0118	-0.0822
prof.	0.1524	-0.0735	0.0946	0.0253	-0.0799	0.0228	0.1053
C_not_gain	0.0315	-0.0305	-0.0367	-0.0140	-0.0890	0.0542	0.0856
2_xpensv	0.0583	-0.0916	-0.0043	-0.0933	-0.0241	0.1422	0.0611
joy	0.0310	-0.0352	0.0606	0.0136	-0.0811	0.0434	0.0647
Pers_data	0.0875	-0.0430	0.0260	0.0986	-0.1102	-0.0091	-0.1014
gender	0.0541	-0.0059	0.1439	-0.0371	0.0145	0.0658	0.0851
age	-0.0083	-0.0319	-0.0368	-0.0625	0.0182	0.0068	-0.0009
country	0.0741	-0.0978	-0.1273	-0.0339	-0.0405	-0.0905	-0.0456
live	0.0431	-0.0623	0.0422	0.0301	-0.0591	0.0618	0.0469
HE	0.0701	0.0423	0.0300	-0.0487	-0.0071	0.0370	-0.0508
c_study	-0.0604	-0.0095	-0.0196	0.0187	0.0042	0.0421	-0.1148
obst	0.0840	-0.0516	0.0056	-0.0434	0.0113	0.0726	-0.0663
C_Work	0.0131	-0.0146	-0.0672	-0.0014	0.0589	-0.0349	0.0803

In this Correlation matrix, I have found that some values are positive and some values are negative while comparing the factors together.
Buying and fear factors value -0.0869 are in opposite direction it means fear and buy will not move in same direction or increase or decrease. Buying, society and emission have positive correlation it means that it will increase in same direction. Preference and profession will be effected because it has negative relationship -0.0447, it means that one value will be increase and other will decrease. Overall, values are less than zero, correlation is low among variables.

Correlation Matrix	*Driv_Fu_Co*	*dc_pa_spe*	*ped_ste_w*	*ch_lane*	*ask_HH*	*Car_Fu_Co*	*6_option*
afraid							
buy							
emission							
society							
redu_acci							
love_try							
sup_ini							
Driv_Fu_Co	1.0000						
dc_pa_spe	0.1596	1.0000					
ped_ste_w	-0.0087	0.0530	1.0000				
ch_lane	0.1005	0.1402	0.1233	1.0000			
ask_HH	0.0437	0.0521	0.1438	0.1314	1.0000		
Car_Fu_Co	0.1346	0.0335	0.1071	0.0949	0.0496	1.0000	
6_option	-0.1460	-0.0004	0.0459	0.0288	0.0954	0.0362	1.0000
resp_acci	0.0129	0.1059	0.0669	-0.0127	0.0808	-0.0778	0.0087
sv_acc_stP	0.1413	0.0601	-0.0326	0.0150	0.0406	-0.0801	0.0299
decide	0.0615	0.1482	0.1494	0.0584	0.0441	0.0333	0.0081
surv	-0.0265	0.0443	0.0887	0.0443	-0.0412	-0.0347	0.0093
prefer	-0.0111	0.0210	0.0021	0.1185	0.0850	-0.0292	0.0854
hackers	-0.0063	0.0645	0.0064	0.0724	-0.0379	-0.0519	0.0770
sys_brk_dn	0.0651	-0.0398	0.1331	0.0294	0.0181	0.0005	-0.0231
cr_dcid_df	-0.0031	0.0176	0.0243	0.0401	0.0312	-0.0051	-0.0298
6_B	0.0025	-0.0034	0.0338	-0.0703	-0.0629	0.0049	-0.0345
prof.	-0.0214	-0.1099	0.0095	0.0072	-0.0699	-0.0630	-0.0102
C_not_gain	0.0395	0.0223	-0.0401	0.0098	-0.0920	-0.0798	-0.0472
2_xpensv	0.0714	-0.0053	-0.0588	0.0470	-0.0009	0.0286	-0.0912
joy	0.0792	-0.0501	0.1032	-0.0010	-0.0635	0.0264	-0.0334
Pers_data	0.0357	0.0128	-0.0559	-0.0843	-0.0709	-0.0364	0.0452
gender	0.0784	-0.0532	0.0816	0.1019	0.0611	0.0373	-0.0873
age	-0.0283	0.0494	-0.0472	-0.0892	-0.0115	0.0439	0.0488
country	-0.1382	-0.0418	-0.0512	-0.1457	-0.0773	-0.0116	0.0411
live	0.1718	0.0230	0.0302	0.0063	0.1411	-0.0658	-0.0460
HE	0.0035	0.0949	-0.0606	0.1091	0.0120	-0.0737	0.0528
c_study	0.0312	0.0991	-0.0153	0.0219	0.0262	-0.0049	-0.0296
obst	0.0765	-0.0425	0.0371	-0.0545	-0.0118	-0.0503	0.0015
C_Work	-0.0784	0.0139	-0.0511	0.0007	-0.0582	-0.0835	0.0682

Based on the data, if car is in full control, preference, hackers of the system, Car decision, age and country are less correlated negatively. Ask human help, Profession, control not gained, cost of the cars are also in opposite direction has very low relationship.

Correlation Matrix	*resp_acci*	*sv_acc_stP*	*decide*	*surv*	*prefer*
afraid					
buy					
emission					
society					
redu_acci					
love_try					
sup_ini					
Driv_Fu_Co					
dc_pa_spe					
ped_ste_w					
ch_lane					
ask_HH					
Car_Fu_Co					
6_option					
resp_acci	1.0000				
sv_acc_stP	0.1787	1.0000			
decide	0.0391	0.1851	1.0000		
surv	0.0604	0.0586	0.0607	1.0000	
prefer	-0.0137	0.0633	0.0166	-0.0206	1.0000
hackers	-0.0247	0.0125	0.0253	0.1140	0.0716
sys_brk_dn	0.1245	-0.0601	0.0408	0.0292	0.0425
cr_dcid_df	0.0619	-0.0442	-0.0367	0.0517	0.0477
6_B	-0.0092	-0.1170	-0.0006	-0.0462	-0.0006
prof.	-0.0301	-0.0720	-0.0078	-0.0078	-0.0447
C_not_gain	0.0438	0.0265	0.0159	0.0605	-0.0289
2_xpensv	0.0513	0.0394	0.0606	-0.0580	0.1026
joy	0.0368	0.0589	0.0670	-0.0537	0.0718
Pers_data	0.0565	0.0227	0.0019	0.0316	0.0343
gender	0.0313	-0.0768	-0.0005	0.0729	0.1866
age	-0.0643	-0.0890	-0.0026	0.0131	0.0358
country	-0.0693	-0.0500	-0.0434	-0.1189	-0.1698
live	0.0895	-0.0236	-0.0137	0.0654	0.1094
HE	-0.0102	0.0223	-0.0398	0.0313	0.1610
c_study	0.0691	0.0878	0.0172	0.0923	0.0285
obst	0.1504	0.0161	-0.0828	-0.0052	0.1089
C_Work	-0.0687	0.2579	0.1224	-0.0794	-0.0929

Preference, hackers, profession and responsibility has less negative value which mean variable moves in opposite direction. Accident situation, car decision and system break down are less negative values. Saving the people and preference is also moving in opposite direction, it mean one variable will increase and other will decrease.

Hypothesis 1 H0: There is no significant difference in the preferences for self-driving cars between higher- and lower-developed countries.

H1: People in higher-developed countries are more likely to prefer self-driving car compared to those in lower-developed countries.

According to the data of less negative value of correlation, variables are independent in higher developed countries and developing countries so, H0 is accepted and H1 is rejected.

Correlation Matrix	*hackers*	*sys_brk_dn*	*cr_dcid_df*	*6_B*	*prof.*	*C_not_gain*	*2_xpensv*	*joy*	*Pers_data*
afraid									
buy									
emission									
society									
redu_acci									
love_try									
sup_ini									
Driv_Fu_Co									
dc_pa_spe									
ped_ste_w									
ch_lane									
ask_HH									
Car_Fu_Co									
6_option									
resp_acci									
sv_acc_stP									
decide									
surv									
prefer									
hackers	1.00								
sys_brk_dn	0.13	1.00							
cr_dcid_df	0.15	0.27	1.00						
6_B	0.18	0.09	0.17	1.00					
prof.	0.19	0.19	0.14	0.23	1.00				
C_not_gain	0.20	0.22	0.26	0.15	0.18	1.00			
2_xpensv	0.27	0.20	0.13	0.18	0.16	0.15	1.00		
joy	0.23	0.21	0.16	0.08	0.17	0.15	0.16	1.00	
Pers_data	0.26	0.21	0.23	0.15	0.25	0.24	0.22	0.20	1.00
gender	0.06	0.04	0.03	0.08	0.01	0.04	0.07	0.05	-0.03
age	-0.06	-0.02	-0.01	0.00	0.05	0.02	-0.04	-0.04	-0.07
country	-0.01	0.00	-0.04	0.15	0.10	0.06	-0.03	-0.04	0.07
live	-0.01	0.16	0.05	-0.05	0.12	0.04	0.01	0.02	0.15
HE	-0.04	-0.03	0.05	-0.04	-0.06	-0.02	0.05	0.02	-0.03
c_study	-0.03	-0.03	-0.02	-0.10	-0.08	-0.03	0.01	-0.06	0.06
obst	0.10	0.15	0.05	0.03	0.05	0.07	0.05	0.04	0.10
C_Work	-0.05	-0.12	-0.05	-0.07	-0.04	-0.05	0.00	-0.03	-0.06

Age and system hackers negative less correlation it means that moves in opposite direction. System break down, car will decide differently, personal data security and car could not gain control are positive values 0.27, 0.26,0.13. It means it moves in same direction. Demographic situation with hackers have negative values -,0.06, -0.01, -0.01,-0.04,-0.03,-0.05, there are opposite connection exist. Expensive aspect and personal data protection are in same shift 0.27 & 0.26.

Hypothesis 2

H0: There is no significance difference between age and technical features of self-driving cars
H1: There is a significant relationship between age and technical feature of the self-driving cars

H0: There is no significance difference between gender and technical features of self-driving cars
H1: There is a significant relationship between gender and technical feature of the self-driving cars

H0: There is no significance difference between education and technical features of self-driving cars
H1: There is a significant relationship between education and technical feature of the self-driving cars

H0: There is no significance difference between country location and technical features of self-driving cars
H1: There is a significant relationship between country location and technical feature of the self-driving cars

H0: There is no significance difference between currently working and technical features of self-driving cars
H1: There is a significant relationship between currently working and technical feature of the self-driving cars

So, H0 is accepted and H1 is rejected on the above based data.

Correlation Matrix	*gender*	*age*	*country*	*live*	*HE*	*c_study*	*obst*	*C_Work*
afraid								
buy								
emission								
society								
redu_acci								
love_try								
sup_ini								
Driv_Fu_Co								
dc_pa_spe								
ped_ste_w								
ch_lane								
ask_HH								
Car_Fu_Co								
6_option								
resp_acci								
sv_acc_stP								
decide								
surv								
prefer								
hackers								
sys_brk_dn								
cr_dcid_df								
6_B								
prof.								
C_not_gain								
2_xpensv								
joy								
Pers_data								
gender	1.0000							
age	-0.1430	1.0000						
country	-0.1888	0.2854	1.0000					
live	0.1251	-0.0699	-0.2003	1.0000				
HE	0.1137	-0.2239	-0.0957	0.0690	1.0000			
c_study	0.0095	-0.0517	-0.0858	0.0742	0.2014	1.0000		
obst	0.0906	-0.0406	-0.0260	0.1117	0.0782	0.0223	1.0000	
C_Work	-0.0880	-0.0028	0.0931	-0.1463	-0.0744	-0.0303	-0.2975	1.0000

Age and country has moderate positive correlation 0.2854. based on the data, if age increase and staying in region will affect or increase or decrease in same direction. Main obstacle and currently working situation has -ve value -0.2975 which shows that it will move in opposite direction. Overall, values are negative and less than zero which shows less correlation.

Hypothesis 3

H0: There is no significant difference in the concept of self-driving cars between higher and lower developed countries.

H1: People in higher-developed countries think self-driving car are convenient than those in lower-developed countries.

This hypothesis is more generalized about this research paper, according to the data or correlation values above: H0 is accepted and H1 is rejected.

Results

			Nr.	Share
Relation type	Pearsons type correlation coefficient value	Relation type	Cases	
Independent	-0,25 < □ < 0,25	Independent	621	98.57%
Stochastic	-0,75 < □ < -0,25 or 0,25 < □ < 0,75	Stochastic	9	1.43%
Deterministic	□ < -0,75 or 0,75 < □	Deterministic	0	0.00%
		Sum	630	100.00%

Overall, Variation is low. Variable are independent. To achieve the results, Pearson correlation is measured to analyze the demographic factors and other factors related with technology, safety and human preference.

In the case of demographic scenario, level of significance is low and relationship does not exist among the Independent variable gender, age, education, location, country and working and dependent variable such as safety aspects, technical features, economic and social factors of the car.

In the case preference and conception of the self-driving car's impact in the future, this study shows that more education is required, special attribute related to the self-driving car must be specific, condition of area to get specific result and special technical features related with specific consumer and location requirements. I think that Generalized study is challenging in this specific area of the self-driving cars. Unfortunately, there is no strong relationship among the variables, so we have to focus on some other alternative ways to get the required results. Although, self-driving cars bring convenient in the society and help the traffic jam in the rush and peak hours as there is heavy traffic load in the Berlin, London, Budapest, Lahore and Kualalumpur.

If self-driving cars are the future, Communication lamp or tower must be integrated in the infra-structure. Uber mode must be introduced, formal public transportation system eliminates, if consumer use ride-sharing or Uber cab for the mobility.

Correlation matrix for Prediction of Future Directions

London

1. Social and Environmental factors

Correlation Matrix	*afraid*	*buy*	*emission*	*society*	*redu_acci*	*love_try*	*sup_ini*
afraid	1						
Buy	0.096132	1					
emission	0.119772	0.220248	1				
society	-0.06923	-0.09014	0.033462	1			
redu_acci	-0.08486	-0.10121	0.111103	-0.083	1		
love_try	-0.05161	-0.17468	0.084138	-0.19947	0.160153	1	
sup_ini	-0.22629	-0.0291	0.015437	-0.15338	0.003785	-0.0308	1
Driv_Fu_Co	0.051728	-0.01052	-0.11731	-0.02413	-0.18957	0.061823	-0.13529
dc_pa_spe	0.112651	0.09016	-0.09433	0.116556	0.140993	-0.18512	-0.22897
ped_ste_w	-0.13634	-0.11631	0.029664	0.230543	0.048118	0.007259	0.019766
ch_lane	-0.03964	0.020485	-0.07374	-0.2025	0.040449	0.005694	0.12364
ask_HH	-0.1134	-0.10669	-0.06761	0.008213	0.091654	0.195434	-0.118
Car_Fu_Co	0.051526	0.081187	-0.23889	-0.06892	-0.18917	-0.05081	-0.0117
6_option	-0.20585	-0.08949	-0.1408	0.170551	0.233243	0.14548	-0.11811
resp_acci	0.006272	0.009531	0.20385	-0.00891	0.154983	-0.06888	-0.13074
sv_acc_stP	-0.08461	-0.17156	-0.11368	-0.25698	-0.07632	-0.10243	0.052994
decide	-0.17148	-0.01875	-0.06614	0.169977	0.06226	-0.05921	-0.07684
Surv	0.106604	-0.01192	-0.22011	-0.26374	-0.09124	-0.11122	0.058852
prefer	-0.14804	0.064344	-0.14992	0.005422	0.031982	-0.20773	-0.06558
hackers	-0.02526	-0.08421	-0.10559	0.002093	0.03087	0.096547	-0.0083
sys_brk_dn	-0.24406	0.020723	0.020274	0.099975	-0.08173	-0.0601	0.028556
cr_dcid_df	-0.01584	-0.04367	-0.10802	-0.07882	-0.12527	-0.07582	-0.0667
6_B	-0.17454	-0.09299	-0.11749	0.157751	0.209359	-0.00348	-0.05495
prof.	0.00911	-0.11396	0.190145	0.108714	-0.01524	0.015024	0.200458
C_not_gain	-0.0401	0.107154	0.038949	-0.21735	-0.05347	-0.11618	0.117772
2_xpensv	-0.08724	-0.04948	-0.09008	-0.16968	0.021171	0.186989	0.125192
Joy	0.013048	-0.02651	0.115019	-0.07053	-0.18859	-0.09903	0.09403
Pers_data	-0.02906	-0.11293	-0.03553	0.123127	-0.0613	-0.08243	-0.28231
gender	0.110174	-0.02825	0.172405	0.012492	-0.04009	0.091659	0.092925
Age	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Live	-0.15089	-0.00553	-0.18481	0.070408	-0.08422	0.183298	-0.0313
HE	0.082756	0.083808	0.074224	-0.07597	-0.01421	0.014805	-0.13186
c_study	-0.01251	-0.00053	0.071816	-0.00449	0.149173	-0.06899	-0.15874
Obst	0.028827	-0.06595	0.000484	-0.09548	0.081009	0.084925	-0.20046
C_Work	-0.03812	-0.09247	-0.02212	-0.20735	0.341735	0.14031	-0.02484

2. Technical Factor

Correlation Matrix	*Driv_Fu_Co*	*dc_pa_spe*	*ped_ste_w*	*ch_lane*	*ask_HH*	*Car_Fu_Co*	*6_option*
afraid							
Buy							
emission							
society							
redu_acci							
love_try							
sup_ini							
Driv_Fu_Co	1						
dc_pa_spe	0.063286	1					
ped_ste_w	-0.0646	-0.19747	1				
ch_lane	-0.0172	0.03192	-0.10991	1			
ask_HH	-0.08215	0.030661	0.05496	-0.07746	1		
Car_Fu_Co	0.248045	-0.0323	0.047693	-0.13607	0.005818	1	
6_option	-0.10567	0.062254	-0.01385	-0.08872	0.144806	0.035462	1
resp_acci	-0.18474	-0.09166	0.003891	-0.05816	0.079489	-0.19516	-0.14967
sv_acc_stP	0.112991	-0.10164	-0.24008	0.25199	-0.15292	-0.10044	-0.10578
decide	0.00268	0.160338	0.111675	-0.02746	0.088379	0.061386	-0.15937
surv	0.081976	-0.09604	0.09254	0.053666	0.016056	0.067866	-0.0111
prefer	-0.11827	-0.05637	-0.11103	0.202462	0.058292	-0.08033	0.186372
hackers	0.06271	0.014938	-0.01513	0.216328	-0.04804	-0.02028	0.061908
sys_brk_dn	-0.02313	-0.21047	-0.04949	0.003159	0.059899	0.005587	-0.05594
cr_dcid_df	0.073325	-0.00955	-0.12136	0.065797	0.076458	0.054098	-0.18796
6_B	-0.05655	0.099613	0.058399	-0.06907	-0.02997	0.062918	0.213443
prof.	-0.15458	-0.0652	0.198076	0.004734	-0.0842	-0.18818	0.037801
C_not_gain	0.003256	0.163172	-0.11892	0.014895	-0.04533	-0.02746	-0.18334
2_xpensv	0.14542	0.017521	-0.27677	0.144197	-0.11927	-0.04313	-0.21511
joy	0.078458	-0.10574	-0.05159	0.093308	-0.18554	0.101436	-0.11943
Pers_data	-0.02171	0.01668	-0.01178	-0.19968	-0.18082	0.110704	0.182273
gender	0.079733	-0.21013	0.158863	-0.02426	-0.01893	0.014654	-0.05496
age	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

live	0.15518	-0.10842	-0.02841	0.017915	0.191112	-0.0616	0.189575
HE	0.020544	0.191428	-0.44749	0.097777	-0.12112	-0.1843	-0.03268
c_study	0.110925	0.223122	-0.09872	0.052917	-0.05023	-0.01222	0.050267
obst	0.090226	-0.17928	0.066629	-0.11983	-0.18135	-0.03428	0.046944
C_Work	-0.05365	0.183986	-0.19868	0.136396	-0.00927	-0.16818	0.11329

Safety & Technical Factors

Correlation Matrix	*resp_acci*	*sv_acc_stP*	*decide*	*surv*	*prefer*	*hackers*	*sys_brk_dn*	*cr_dcid_df*	*6_B*
afraid									
buy									
emission									
society									
redu_acci									
love_try									
sup_ini									
Driv_Fu_Co									
dc_pa_spe									
ped_ste_wch_lane									
ask_HH									
Car_Fu_Co									
6_option									
resp_acci	1								
sv_acc_stP	0.035935	1							
decide	0.067307	-0.13331	1						
surv	-0.00939	-0.10838	-0.15538	1					
prefer	-0.11775	0.255863	-0.02778	-0.10755	1				
hackers	-0.12876	0.107306	-0.17776	0.066246	0.076907	1			
sys_brk_dn	0.062803	-0.07543	0.165332	-0.04405	-0.06315	-0.17692	1		
cr_dcid_df	0.045029	-0.05472	0.047357	-0.12176	-0.13957	-0.04153	0.180399	1	

6_B	0.021631	-0.30205	0.157015	-0.12735	-0.02041	-0.02206	0.028079	-0.00823	1
prof.	-0.04065	-0.25672	0.010302	-0.04111	-0.10774	-0.04234	0.099915	0.102704	0.096646
C_not_gain	0.067742	0.159886	-0.0043	0.042554	-0.08781	-0.10327	-0.0414	0.030362	-0.22208
2_xpensv	-0.10687	0.110854	0.10274	-0.17659	0.004221	0.035363	-0.02044	0.068819	0.169775
joy	-0.1112	0.151435	0.158959	-0.08712	0.090412	0.230086	0.032141	0.129017	-0.09164
Pers_data	-0.07665	0.044853	0.046827	-0.05486	0.065171	-0.07669	-0.01295	0.055104	0.095228
gender	0.172156	-0.17292	-0.04533	0.07498	-0.25712	0.016826	-0.11	0.055468	-0.00968
age	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
live	0.047996	-0.06809	0.093279	-0.07912	0.161009	-0.19837	0.036859	0.031338	0.01651
HE	-0.04687	0.200018	-0.08443	-0.04138	0.081227	-0.07676	-0.13947	-0.01473	-0.11016
c_study	0.096982	0.066724	0.143417	-0.02593	0.068805	-0.07337	0.07156	-0.18978	-0.27824
obst	0.066619	0.142153	-0.14629	0.021963	0.09306	0.084139	0.006053	-0.02779	-0.03015
C_Work	0.019592	0.284686	0.021871	-0.07483	0.09309	0.08912	-0.13786	-0.01504	-0.09238

4. Correlation matrix for Prediction of Future Directions

Hungary

Social and Environmental factors

Correlation Matrix	*afraid*	*buy*	*emission*	*society*	*redu_acci*	*love_try*	*sup_ini*
afraid	1						
buy	-0.32093	1					
emission	-0.4843	0.45928	1				
society	-0.11167	0.361048	0.442648	1			
redu_acci	-0.28912	0.213527	0.618363	0.383223	1		
love_try	-0.13819	0.381287	0.348086	0.166294	0.139432	1	
sup_ini	-0.22506	0.569591	0.504438	0.473992	0.270527	0.507597	1
Driv_Fu_Co	0.093509	-0.1988	-0.16973	0.171603	-0.04326	0.052352	0.073574
dc_pa_spe	-0.10652	0.021971	0.156267	0.101041	0.158893	0.393579	0.266138
ped_ste_w	-0.00841	0.087467	0.22362	0.280243	0.408374	0.126045	0.224439
ch_lane	-0.02172	0.37802	0.187746	0.199064	0.26114	0.058945	0.274948
ask_HH	-0.11382	0.247652	0.099782	0.086805	0.039077	0.101359	0.32776
Car_Fu_Co	-0.32619	0.523244	0.415984	0.465079	0.308691	0.117068	0.606722
6_option	0.045183	0.444324	0.257882	0.345403	0.336998	0.157071	0.423399
sp_acci	0.009868	-0.27566	-0.25538	-0.24952	-0.01072	-0.19089	-0.44433
sv_acc_stP	0.212691	-0.00984	-0.09806	-0.02157	-0.05467	0.121439	-0.01453
decide	-0.00348	0.145215	0.014887	0.055706	0.056314	0.107188	0.120694
surv	-0.0243	-0.01651	0.026376	-0.10917	0.035022	-0.00185	0.106998
prefer	-0.13671	0.239842	0.06841	0.176367	-0.06154	0.309	0.190663
hackers	0.091234	-0.11918	0.147899	-0.18274	0.041134	0.09449	0.020482
sys_brk_dn	0.167099	-0.30494	0.078648	0.236704	0.055864	-0.13351	0.002437
cr_dcid_df	0.059812	-0.25877	-0.039	-0.14398	-0.16403	-0.04335	-0.12008
6_B	0.425868	-0.19047	-0.17805	-0.14417	-0.15438	-0.03855	-0.18031
prof.	0.349026	-0.31616	-0.10982	-0.29334	-0.21626	-0.08334	-0.2288
C_not_gain	0.270415	-0.39183	-0.23632	-0.04125	-0.19347	-0.02441	-0.12164
2_xpensv	0.214142	-0.16814	-0.02359	-0.22097	-0.0341	0.025381	-0.16487
joy	0.13206	-0.15551	0.020848	0.098581	0.105657	-0.07632	-0.07905
Pers_data	0.19284	-0.13132	-0.26384	-0.06823	-0.32169	-0.04159	-0.23783
gender	-0.01215	-0.25586	0.056985	-0.20777	0.03774	0.046449	-0.00537
age	-0.26495	0.174834	0.147924	0.04172	-0.00802	0.113963	0.145349
live	0.069232	-0.36135	-0.16953	-0.31965	-0.36494	-0.14653	-0.12181
HE	0.01796	0.034051	-0.11041	0.018251	-0.04334	0.041885	0.103668
c_study	0.149106	-0.15873	-0.149	0.10018	-0.12843	-0.13938	-0.34496
obst	-0.09438	-0.13059	-0.03672	-0.00491	-0.13359	0.006927	-0.0309
C_Work	0.20109	0.098831	-0.03754	0.120819	0.151386	-0.19283	0.081371

Technical Factor

Correlation Matrix	*Driv_Fu_Co*	*dc_pa_spe*	*ped_ste_w*	*ch_lane*	*ask_HH*	*Car_Fu_Co*	*6_option*
afraid							
buy							
emission							
society							
redu_acci							
love_try							
sup_ini							
Driv_Fu_Co	1						
dc_pa_spe	0.356669	1					
ped_ste_w	0.148682	0.517711	1				
ch_lane	0.035775	0.225167	0.383342	1			
ask_HH	-0.03764	0.023571	0.151229	0.284925	1		
Car_Fu_Co	0.022122	0.139036	0.19212	0.314994	0.326598	1	
6_option	-0.23192	-0.11327	0.157318	0.28028	0.312482	0.43779	1
resp_acci	0.077822	-0.02611	-0.18155	-0.14057	-0.11012	-0.23067	-0.06471
sv_acc_stP	0.20432	0.112386	0.093568	-0.08928	0.156965	-0.11904	0.228739
decide	-0.02508	0.154633	0.143522	0.185218	0.073945	-0.07546	0.177454
surv	-0.01372	0.077245	-0.11644	-0.10905	-0.21347	-0.01942	-0.0181
prefer	0.126686	0.027497	0.029205	0.138247	0.246781	0.011136	0.054999
hackers	-0.07694	-0.04681	-0.18285	-0.3021	-0.25872	-0.21263	0.009598
sys_brk_dn	0.290639	0.030382	0.136255	-0.21219	-0.31104	-0.14339	-0.08037
cr_dcid_df	0.135881	0.126992	0.154914	-0.17746	-0.20988	-0.29388	0.016482
6_B	-0.09904	-0.09801	0.003899	-0.1828	-0.31054	-0.33244	-0.11576
prof.	-0.05272	-0.29951	-0.29128	-0.2131	-0.10948	-0.35671	-0.16081
C_not_gain	0.059162	-0.06069	-0.02543	-0.34807	-0.44488	-0.43103	-0.0742
2_xpensv	0.01227	-0.22645	-0.10865	-0.29673	-0.07044	-0.22838	-0.20593
joy	0.182035	0.035204	0.113798	-0.15473	-0.11526	-0.13593	-0.15598
Pers_data	0.186074	-0.07005	-0.01305	-0.28126	-0.09666	-0.23891	-0.13862
gender	0.049223	0.090339	-0.0599	-0.17398	0.013677	-0.0075	-0.17731
age	-0.18305	0.004462	-0.17464	0.034167	0.148529	0.232312	-0.03548
live	0.057762	0.247517	-0.00892	-0.22795	0.155553	-0.22133	-0.47424
HE	-0.08998	-0.02943	-0.04667	-0.02869	-0.02531	0.154197	-0.02089
c_study	0.024991	0.029239	0.007771	-0.06729	-0.0785	-0.32049	-0.34681
obst	0.219041	-0.08394	-0.06141	-0.09767	-0.08615	-0.05372	-0.0606
C_Work	-0.04763	-0.08531	0.077426	0.056646	0.011647	0.049927	0.329105

Safety & Technical Factors									
Correlation Matrix	*resp_acci*	*sv_acc_stP*	*decide*	*surv*	*prefer*	*hackers*	*sys_brk_dn*	*cr_dcid_df*	*6_B*
afraid									
buy									
emission									
society									
redu_acci									
love_try									
sup_ini									
Driv_Fu_Co									
dc_pa_spe									
ped_ste_w									
ch_lane									
ask_HH									
Car_Fu_Co									
6_option									
resp_acci	1								
sv_acc_stP	0.09663	1							
decide	-0.39043	0.228209	1						
surv	0.06023	0.134834	0.19922	1					
prefer	-0.14537	-0.14224	0.135701	-0.08806	1				
hackers	0.055253	-0.11639	0.002669	0.328602	-0.04205	1			
sys_brk_dn	0.091553	-0.014	-0.11165	0.118903	-0.15478	0.409502	1		
cr_dcid_df	0.127937	0.026881	-0.0274	-0.07135	0.056034	0.377721	0.545858	1	
6_B	-0.03212	-0.11167	0.01246	0.030182	-0.12014	0.221112	0.081831	0.163014	1
prof.	-0.03648	-0.04061	-0.06264	-0.01543	-0.22867	0.474625	0.149927	0.139934	0.394108
C_not_gain	0.039222	0.020536	0.085456	0.120357	-0.15513	0.496731	0.475213	0.617196	0.397334
2_xpensv	-0.06023	-0.01121	-0.04501	-0.2447	-0.15727	0.300951	0.150844	0.107271	0.198772
joy	-0.05785	-0.21269	0.068966	-0.14701	-0.0755	0.220394	0.471714	0.213118	0.155987
Pers_data	0.092499	0.117521	-0.1601	0.135714	-0.19631	0.157613	0.409035	0.452984	0.153187
gender	-0.04058	-0.03057	0.089726	0.008501	-0.33649	0.218625	0.368181	0.177847	0.05827
age	-0.1608	-0.29141	-0.14874	-0.19818	-0.01106	-0.1879	-0.29142	-0.2927	-0.18008
live	0.103735	0.155928	-0.09049	0.108789	-0.1658	-0.01781	0.086426	0.080305	0.019691
HE	-0.0479	-0.17273	-0.09597	0.094253	0.096627	-0.10713	0.011941	-0.12796	0.157122
c_study	-0.09411	0.223615	0.007001	-0.0567	-0.05616	-0.21968	-0.05025	-0.04267	-0.05301
obst	0.237424	-0.20562	-0.1124	-0.16664	-0.01328	0.252518	0.504003	0.465323	-0.09801
C_Work	-0.29443	0.463344	0.262614	-0.14741	-0.19076	-0.0974	-0.07319	-0.04812	0.007599

Correlation matrix for prediction of Future

Asia (Malaysia &Pakistan)

Social and Environmental factors

Correlation Matrix	*afraid*	*buy*	*emission*	*society*	*redu_acci*	*love_try*	*sup_ini*
afraid	1						
buy	-0.09624	1					
emission	0.083685	0.228292	1				
society	0.074385	0.233545	0.191572	1			
redu_acci	0.139231	0.154324	0.245804	0.23836	1		
love_try	0.147094	0.082595	0.151628	0.079172	0.081042	1	
sup_ini	0.143557	0.154374	0.18343	0.083928	0.192528	0.293616	1
Driv_Fu_Co	0.059965	0.082544	0.250702	0.156633	0.00929	0.110183	0.032999
dc_pa_spe	-0.0398	0.077568	0.074502	0.085616	0.21248	0.066899	0.093419
ped_ste_w	0.01303	0.075103	0.137609	0.021343	0.066482	0.118946	0.056268
ch_lane	0.068266	0.208491	-0.04012	0.009045	-0.06131	0.217552	0.201158
ask_HH	0.048772	0.089356	0.087903	0.040117	0.141312	0.080191	0.092447
Car_Fu_Co	-0.16708	0.176167	0.037467	0.091672	1.12E-17	0.018418	0.103483
6_option	0.050825	0.003643	0.026427	0.003165	0.036999	0.109575	-0.05939
resp_acci	-0.02176	0.050758	0.077489	0.071075	0.057025	0.095858	-0.05716
sv_acc_stP	-0.07255	-0.08027	0.066762	-0.08062	-0.02386	0.06193	-0.04475
decide	-0.15873	0.056355	0.00973	-0.03177	0.044927	0.112757	-0.0275
surv	-0.04036	-0.01312	-0.21164	-0.06649	0.010377	0.036694	0.024173
prefer	0.108019	-0.12982	0.086768	-0.07452	0.053953	0.042461	0.039951
hackers	-0.02438	0.041316	0.05512	0.147911	0.013607	0.054293	0.164276
sys_brk_dn	0.058973	-0.01149	0.035438	-0.00674	0.053541	0.165894	0.125328
cr_dcid_df	0.029255	0.093592	-0.0148	0.069092	0.02598	0.005222	0.119349
6_B	0.076955	0.064288	0.091496	0.078619	-0.09151	0.079321	-0.03224
prof.	0.136515	0.057442	0.130931	0.098196	-0.04973	0.092459	0.1851
C_not_gain	-0.01632	0.04967	-0.0114	0.1317	-0.0614	0.178228	0.145403
2_xpensv	0.076117	-0.08887	0.033298	-0.01395	-0.03321	0.154806	0.097663
joy	0.026271	0.003553	0.039998	0.057161	-0.07081	0.148964	0.090226
Pers_data	0.089099	0.036618	0.148287	0.153013	-0.06142	0.065448	0.037986
gender	0.0439	0.063824	0.11767	-0.00728	0.049125	0.029565	0.108402
age	0.0335	-0.04399	-0.05163	-0.09159	0.031477	0.003372	-0.03037
live	0.144163	-0.01115	0.174955	0.120959	0.044329	0.027592	0.133727
HE	0.065684	0.000474	0.035175	-0.05487	0.015528	0.045068	-0.0426
c_study	-0.13967	-0.00107	-0.04031	0.006891	-0.03129	0.138386	-0.04399
obst	0.119042	-0.02382	0.023715	-0.00901	0.037843	0.092033	0.001953
C_Work	0.009915	-0.01962	-0.08457	0.020929	-0.08896	-0.03868	0.109907

Technical Factor

Correlation Matrix	*Driv_Fu_Co*	*dc_pa_spe*	*ped_ste_w*	*ch_lane*	*ask_HH*	*Car_Fu_Co*	*6_option*
afraid							
buy							
emission							
society							
redu_acci							
love_try							
sup_ini							
Driv_Fu_Co	1						
dc_pa_spe	0.147104	1					
ped_ste_w	-0.03671	0.060787	1				
ch_lane	0.151265	0.166719	0.131648	1			
ask_HH	0.122102	0.064168	0.166631	0.155008	1		
Car_Fu_Co	0.120126	0.03855	0.097615	0.113614	-0.03736	1	
6_option	-0.11503	0.006146	0.053735	0.008381	0.016419	-0.10552	1
resp_acci	0.062468	0.230632	0.125714	0.008471	0.105308	0.007059	0.10695
sv_acc_stP	0.111022	0.119179	0.012217	-0.04155	0.104171	-0.04101	0.028649
decide	0.091339	0.134464	0.144227	0.04659	0.014097	0.071124	0.018738
surv	-0.11077	0.108663	0.160383	0.072996	-0.0149	-0.06449	0.042915
prefer	-0.00149	0.077008	0.070229	0.035774	0.036917	-0.04259	0.046686
hackers	-0.05092	0.114121	0.080566	0.116323	0.035302	-0.00224	0.115333
sys_brk_dn	0.042831	0.036459	0.249094	0.108091	0.09566	0.059031	0.010947
cr_dcid_df	-0.07918	0.01624	0.089373	0.081537	0.081002	0.065054	0.035505
6_B	0.092987	-0.02705	0.063696	0.006916	0.024929	0.113175	-0.1166
prof.	0.079753	-0.07467	0.029565	0.108197	-0.02162	0.13311	0.025508
C_not_gain	0.055885	-0.03138	0.017184	0.132605	0.004189	0.030387	0.031725
2_xpensv	0.037986	0.045645	0.087629	0.100462	0.090424	0.170413	0.000121
joy	0.062265	-0.04852	0.183578	-0.01022	0.009169	0.04344	0.036765
Pers_data	0.042563	0.04173	-0.06217	0.032243	0.013794	-0.03016	0.030678
gender	0.027355	-0.00961	0.078794	0.19619	0.116756	0.089688	-0.05248
age	0.032742	0.078661	-0.0467	-0.07985	-0.03133	0.003174	0.0871
live	0.164801	0.022526	0.08273	0.025539	0.11477	0.001264	-0.01223
HE	0.01179	0.081071	0.150053	0.132051	0.089581	-0.07945	0.118627
c_study	-0.00695	0.061388	0.035709	0.010195	0.087665	0.094956	0.005793
obst	0.030041	0.045927	0.065434	-0.01949	0.101025	-0.03962	0.022176
C_Work	-0.09156	-0.02683	-0.06054	-0.03631	-0.10905	-0.12791	-0.04786

Safety & Technical Factors

Correlation Matrix	*resp_acci*	*sv_acc_stP*	*decide*	*surv*	*prefer*	*hackers*	*sys_brk_dn*	*cr_dcid_df*	*6_B*
afraid									
buy									
emission									
society									
redu_acci									
love_try									
sup_ini									
Driv_Fu_Co									
dc_pa_spe									
ped_ste_w									
ch_lane									
ask_HH									
Car_Fu_Co									
6_option									
resp_acci	1								
sv_acc_stP	0.25903	1							
decide	0.117851	0.249421	1						
Surv	0.107389	0.077619	0.092986	1					
Prefer	0.067874	0.105044	0.051468	0.002747	1				
hackers	-0.01234	-0.017	0.089049	0.077866	0.106889	1			
sys_brk_dn	0.165551	-0.08309	0.021918	0.031574	0.120093	0.164213	1		
cr_dcid_df	0.077882	-0.06151	-0.05921	0.120242	0.06359	0.172527	0.238522	1	
6_B	0.016962	-0.02554	-0.04453	-0.02835	0.096626	0.268929	0.104921	0.255302	1
prof.	0.003808	0.015135	0.02779	0.009664	0.049761	0.218601	0.238265	0.151961	0.205938
C_not_gain	0.045656	-0.03655	-0.00021	0.055533	0.037931	0.232681	0.239739	0.266228	0.227106
2_xpensv	0.15895	0.017812	0.076407	0.023054	0.167568	0.343728	0.283088	0.130516	0.176669
Joy	0.12054	0.094596	0.030391	-0.02776	0.124729	0.242204	0.245652	0.188028	0.149952
Pers_data	0.135462	-0.01436	0.035292	0.032755	0.09831	0.429698	0.255696	0.246311	0.153232
gender	-0.03802	-0.08398	-0.03148	0.032789	0.490073	-0.0072	0.010909	-0.04603	0.153469
Age	-0.06729	-0.05947	0.01669	0.136775	0.225933	-0.04749	0.047348	0.089248	-0.01477
Live	0.089216	-0.10264	-0.06906	0.067715	0.090561	0.029359	0.196512	-1.7E-05	-0.07033
HE	0.028673	0.004061	0.008152	0.011631	0.145032	-0.01045	0.004095	0.080217	-0.04914
c_study	0.113112	0.071274	-0.01529	0.150162	-0.05874	0.02778	-0.09707	0.011941	-0.02236
Obst	0.179853	0.035276	-0.04583	-0.00256	0.130021	0.05271	0.107964	-0.0539	0.070997
C_Work	-0.0368	0.192715	0.099604	-0.0262	-0.04726	-0.0497	-0.09793	-0.02417	-0.06361

Overall, when data is large and consisting of negative values and less than zero values, correlation matrix can be used for predicting the future values. It is useful when there is no relationship between two variables. So I try to use this correlation matrix to forecast as there are more negative values in the selected countries and region which shows that we should

improve our target such safety, social, environmental and public awareness for the self-driving cars. In this scenario, purpose, aim and objective is focused and decrease the features such as age, education level, country etc. but we have to more inclusive and progressive for the self-driving car implementation on the road.

4. Future directions and opportunities

Commercial and Research Efforts are required in businesses and academic organizations, such as Tesla, General Motors, Waymo, and several startups, are presently developing technologies for self-driving cars. Autonomous vehicle development and implementation are being fueled by these initiatives. Self-driving vehicles have the potential to improve overall transportation efficiency, lower traffic accidents, and provide mobility for those who are unable to drive. Regulatory obstacles, safety concerns, and the requirement for additional testing and development remain, though, before self-driving cars become a regular sight on our roads.

Among the most recent advancements in self-driving automobile safety technologies are:

1. More sophisticated sensors are being used by self-driving cars, such as upgraded radar and LiDAR systems with greater resolution and range. Currently, ARS430 is a best in class radar, especially for the stationary target detection and separation. Its capability to detect stationary objects without the help of a camera system emphasizes its performance.Better environmental awareness and obstacle recognition in a variety of situations, including low visibility, are made possible by these sensors.

2. The vehicle's comprehension and reaction to its surroundings are enhanced by these technologies. To improve safety, redundant systems are being incorporated into the simple and advance design of assembling the part of self-driving automobiles. Backup systems are able to take over in the event of sensors or component failure, guaranteeing the vehicle can continue to function safely.

3. Develop and implement more sophisticated sensor technologies on a constant basis, such as LiDAR, radar, cameras, and ultrasonic sensors with greater precision, better resolution, and longer detection ranges.

Investigate novel sensor technologies to offer redundancy and improved perceptual capacities, such as solid-state LiDAR and multi-modal sensors. Connectivity and Vehicle-to-Everything Communication means that V2V, Vehicle to vehicle: It helps to process data in real time and vehicle respond on the road situation accordingly. It leads to the intelligent transport system. A self-driving car's control unit must process a large variety of data from

many peripheral systems, including cameras, LiDAR, and other sensors. Travel safety and convenience can be further enhanced by V2V communication, which can help provide a more full view of the surroundings of the vehicle 1. V2P,Vehicle to Pedestrian 2.V2I, Vehicle to Infrastructure 3.V2N, Vehicle to Networking.Standardize data formats and V2X communication protocols to guarantee dependability and compatibility. Improve Information sharing system among self-driving cars and other vehicles, infrastructure, and traffic control management is made possible through direct and advance communication. By giving real-time data on traffic conditions, potential collisions, and road hazards, this can assist improve safety.Adavnce wireless technology helps to increase safety as it exchange the information about the speed, positioning and surrounding objects movements. Add several levels of redundancy to crucial systems, such as communication networks, control units, and sensors.

4.Create fail-operational and fault-tolerant architectures to make sure self-driving cars can safely withstand component or sensor failures. Better Mapping and Localization Technologies for high-definition are always improving. These innovations enable selfdriving cars to navigate and know its position precisely, keeping them on course and enabling them to make wise driving judgments.

5. Enhanced Cybersecurity Measures for self-driving cars are putting strong measures in place to guard against cyber threats and stop illegal access to their systems and data. Safety requires that the data and software in cars be kept accurate and protected. Further, Through the routinely patching and updating software to guard against potential vulnerabilities, safeguards of cybersecurity can be strengthening. To protect data transmission and stop unwanted access, use encryption and security protocols.

6.Hardware Designed to Meet Safety-Critical Requirements in advanced hardware of self driving cars for the security solutions. These could include more durable electronic control units (ECUs) and computer platforms that unable to fail the operation. Utilize systems and hardware certified for safety that satisfies strict safety requirements, such as ISO 26262 for automotive functional safety. Make use of electronic control units (ECUs) and safety microcontrollers that have safety measures built in.

7. The techniques for testing and validating autonomous vehicle software are always being improved. This entails extensive testing in a variety of settings, even difficult ones, to make sure the device can withstand a broad range of circumstances.

8. Driver-monitoring Systems are being used in cars with automation levels that call for human supervision to make sure the driver stays alert and prepared to take over when needed. These technologies monitor driver behavior and attention using cameras and sensors. Ethical Decision-Making Algorithms Research is required more in order to create moral decision-making algorithms that will assist self-driving cars in making difficult decisions in complex situations e.g crowdy place that could be hazardous or unclear. The goal of these algorithms is to put everyone's safety on the road first.
9. Integration of the Vehicle and Infrastructure in Self-driving automobiles are being made to integrate more and more with networked infrastructure, like intelligent traffic signals and road signs. Enhancing safety and traffic flow can be achieved with this connection. Constant Learning and upgrades in autonomous vehicles are able to get software upgrades via the air, which enables them to adjust to shifting circumstances, traffic patterns, and road settings. To ensure the safe integration of self-driving cars into the current transportation networks and to foster public trust in these vehicles, continuous safety technology advancements and innovations are essential. Self-driving cars have the potential to greatly reduce accidents caused by human error and increase overall road safety as technology advances and legal frameworks solidify.

The automative industry is developing globally. The progress and extensive acceptability of self-driving cars, also known as autonomous vehicles, carry major applications and prospective benefits across various aspects of society, including: Safety Improvement: One of the most significant advantages of self-driving cars is their potential to reduce road accidents. The majority of accidents are caused by human error, such as distracted driving, speeding, and impaired driving. Autonomous vehicles can operate without such human limitations, potentially leading to a substantial reduction in accidents and fatalities.Self-driving cars can communicate with each other and traffic infrastructure, allowing for more efficient traffic management cause. This can lead to smoother traffic flow, shorter commute times, and reduced congestion, particularly in urban areas. **Increased Mobility:** Autonomous vehicles can provide mobility solutions for people who cannot drive, such as

the elderly, disabled individuals, and those who are too young to obtain a driver's license. This increased accessibility can enhance the quality of life for many people.

Environmental Benefits: Self-driving cars can be programmed to drive more efficiently, reducing fuel consumption and emissions. This could contribute to a decrease in air pollution and greenhouse gas emissions, supporting environmental sustainability goals.

Cost Savings: Ride-sharing and autonomous taxi services could reduce the need for personal vehicle ownership, saving individuals money on car purchases, maintenance, insurance, and fuel. Moreover, autonomous vehicles could enhance fuel efficiency, further reducing operating costs.

Enhanced Productivity: Passengers in self-driving cars can use travel time more productively, whether for work, entertainment, or relaxation. This can boost productivity and improve the overall travel experience.

Economic Growth: The development and deployment of self-driving cars can create new economic opportunities, from manufacturing and maintenance to software development and data analysis. It has the potential to stimulate economic growth in various sectors. **Urban Planning**: Autonomous vehicles can reshape urban planning by reducing the need for parking space, promoting efficient land use, and enabling urban areas to be designed with a focus on people rather than cars.

Ridesharing Services: Self-driving technology can enable the growth of autonomous ridesharing services, making transportation more affordable and accessible for a broader range of people.

Reduced Infrastructure Costs: Self-driving cars can potentially decrease the need for costly infrastructure expansion and road maintenance by optimizing traffic flow and reducing wear and tear on roads.

Emergency Response: Autonomous vehicles can be programmed to communicate with emergency services in the event of an accident, potentially reducing response times and saving lives.

Spatial Efficiency: Self-driving cars can travel closely together on highways and use road space more efficiently, increasing overall capacity and potentially reducing the need for road expansion.

Invention and Innovation Hub: In the developing countries (Pakistan & Malaysia), to related them with this huge transformative task, developed countries can make manufacturer place in the developing countries while keeping in mind about the natural resources conditions, legal framework and political stability.

Integration and collaboration of big investment companies

I have observed that there must be coordination required among the companies, investor, Government and safety control authorities for the smooth implementation of the self-driving cars.

Role Academic institution and Automotive business

Institution must fully involve into this new automotive solution for safety and better mobility to educate young students and campaign must be arranged on the global basis. Public awareness must be created for the improvement of the self-driving cars.

Introduction of the initial level technology of self-driving cars

It is specifically in the developing countries such as Asian and African countries to start this technology for the first level to the advancement step.

Small City initiatives

In the developed countries this initiation must be promoted to bring complete autonomous car function on the roads.

High population management in developing countries

In the developing countries, there high population growth which cause heavy irregular traffic on the road. People do not follow the traffic rule and there is no proper signal and traffic monitoring system**.**

1. Summary and Recommendations

The findings of this study are data efficiency of observation is required for safety and public reliance. Advance method of deep learning are required in lidar, radar and camera in the external and internal side of the cars. Visualizations and sound identification issue needs to be addressed properly for the safety and security of the passenger. Awareness and practical knowledge must be given to the people. Trust and reliability needs to be created among the people. Cost of the cars, Pool car system, the ride sharing must be economical. According to the recent situation, system of watching object and sound identification needs more development because cameras are unable to identify the image more clearly e.g whether its human being or animal or both and how to decide about the complex situation in a proper time. According to the research paper, people are more concerned about security, safety of the people, Technical features of the self-driving car while sensing the complex situation. However, people like to drive self-driving car and they are happy to support this new initialization.

People prefer to drive self-driving car due to the energy saving, avoid traffic congestion and enjoying drive. Variance is low it means that variable don't depend each other.

In my opinion, car production is very interesting industry. There are several amazing developments occurred in this industry such as electric cars, trains, trucks and self- driving cars. There is some suggestion to improve self-driving cars safety and security services. It is a major sector of the economy which impact the globally in a positive way. Firstly, there must be multi-integrated model introduced in the self- driving cars which can be easily linked with the Scoters, cyclist and other vehicle through speaking device to save them. Secondly, Health care software for the self -driving car's operations and passenger's health is also a suggestion to promote this transportation system in the society. Self-driving car can be used as mobile services for the disabled people to take care of their medical condition.

Thirdly, there must be energy saving device in the grid of the self-driving cars. I think that there is a system which will identify the human emotion while these cars operate on the road. Fourthly, there must be personalized and customized system for the passengers that they can feel comfortable, air purification, ambient light to release the stress, read books, enjoy the driving time. Its digital material and interior must be inspiring and relaxing for

the customer. Fifthly, there must be mode shifting for getting relax or remote working while on long trip.

Sixthly, 3D working system can be introducing in the self-driving cars to deposit, join and construct through the computer control with the components of the cars for smooth functions.

Seventhly, there must be system self-parking by the self- driving cars that passenger can advise the car to stay in the parking and return back to pick the customer again. I think that Car must have such mechanism in which car can visualize or sense the curvy and disruptive roads to work properly. It will also lead a new era of self-driving cars in the hilly area.

For the public awareness, practical events of trial and testing must be arranged for the public by the Government and related alliance companies. This is how, people will take interest and know about the technology system in the self-driving cars. Small seminars and surveys must be performed to bring about the light on the self-driving cars. On the institutional level, Government must prepare young generation through the small talk and awareness about this specific system for this modern revolution in the self – driving cars. Companies such as Waymo, Audi, BMW, Tesla, they have to organize some events and activities in which they can brief and update about the system that how self-driving cars function and safe for public more often so that people can trust and fear of tech will be minimized.

Further, Legal framework and modern infrastructure must be informed to the general public that we are moving in the new pace of intelligent transportation system which are integrated in the multi model mechanism. Government, reputable organizations and social media can play important role in this whole scenario.

Overall, the car industry is deeply integrated into modern society and has far-reaching implications for the economy, technology, transportation, and environmental sustainability. Its continued evolution, including the transition to electric and autonomous vehicles, will shape the future of mobility and transportation systems worldwide.

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ANNEXES

In how far do You agree with the following statements? *

	I don't agree	I mostly do not agree	Neither agree, nor disagree	I rather agree	I completely agree
I would be afraid of self—driving cars in my environment					
I would love to buy a self-driving car later on					
Self-driving cars will positively affect emission					
Self-driving cars will positively affect the society					
Self-driving cars will reduce the occurrence of accidents					
I would love to try a self-driving car					
I would support the initialization of self-driving cars					

2 Rat ho fa Yo thinth belo level ar safe*

				Nosaf	Rathe unsaf	Neutra	Rahe saf	Saf
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Thdrivercontr thcai either orheedith speelimitit ow									
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The car change an reat th environme									
Thtasof drivi t pa attenta bac contr									
Thcai i contr burcanask humahelp									
Thcai i fu contro									

This question requires one response per row

Which of the previous 6 options would You be comfortable with? *

Who should take responsibility if the self-driving car causes an accident? * Tick more than one.

- [ ] the owner
- [ ] the one sitting in the car
- [ ] the producer
- [ ] the producer of the software
- [ ] the government
- [ ]

Who should the self-driving car save/protect in an accident situation, where stopping is not an option anymore? Tick more than one.

- [ ] The driver
- [ ] The pregnant lady on front of the car
- [ ] A group of homeless people who would be hit if we try to save the pregnant lady in front of the car

On the basis of what principle shall the self-driving car decide? *Tick more than one

- Always protect the passengers
- Minimize the number of injured
-

If You are the driver, who should the car save? *

- You
-
- The pedestrians, who are more in number

What would you prefer in self-driving Cars? * Tick more than one

- Owned Car
- Ride-sharing
- Owned by company
- Owned by Software

3. How relevant are the below listed fears related to self-driving cars? *

	1 (negligible)	2	3	4	5 (significant)
Hackers tamper with the car	○	○	○	○	○
The self-driving system breaks down	○	○	○	○	○
The car decides differently from how I would like it to	○	○	○	○	○
Fear from the new technology	○	○	○	○	○
People (in various professions, such as chauffeurs) will lose their jobs	○	○	○	○	○
Control cannot be regained	○	○	○	○	○
Too expensive	○	○	○	○	○
I lose the joy of driving	○	○	○	○	○
The security of personal data cannot be provided	○	○	○	○	○

What is your gender? *

- Female
- Male
-

How old are You? *

Which country are You from? *

Where do You currently live? *

- capital
- big city
- town
- village

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ABSTRACT

As Technology is increasing, human life and perception are also changing. Automotive industry is one of the major sector of technology revolution. This sector keeps attracting public and investors towards it by bringing advance technology in the form of self-driving cars. Developed countries are progressing in this area because researchers, investors, Governments and interlinked organizations are visioning something fruitful for the public, social, environmental and technology in the near future. These developments are also impacting on the developing countries to think about this technology system in the transportation system. Although, developing countries are far behind from this advancement. It also influences about the people conceptions and life style.

Strong infra-structure and legal frame work are required, most importantly awareness of this technology needs to be initiated in the developing countries side by side. Global dialogue must be arranged for this advancement between developed and developing countries. Challenges are distinctive in the developed and developing countries related with the self-driving cars. It is all depend on the country's economic, social, political and environment structure because they have limited resources, inconsistent legal and social norms. In the developed countries, they are facing advance technology, cyber security and public issue. In this research paper total no. of people are 310 who respond to the questionnaire. Four countries have been selected to do the study, I try to manage about theoretical and practical part of the study to probe the self-driving future in the developed and developing countries. I have found that there is no correlation among the variables.

I have used descriptive statistics analysis and correlation matrix to prove hypothesis and future prediction for the self-driving cars.

In summary, the adoption of autonomous vehicles is a multifaceted undertaking that is shaped by the distinct features of individual nations. While industrialized countries are more technologically advanced than developing countries, developing nations can provide creative solutions to particular problems and help create transportation ecosystems that are more sustainable and inclusive.