

Dr D Y Patil Institute of Engineering Management and Research

Department of Computer Engineering

**AY 2021-22 Semester I
Third Year Engineering**

Subject : Seminar and Technical Communication

Topic : Artificial Intelligence in Automobile Industry

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SUMMARY OF TOPICS

MAIN POINTS COVERED

Introduction to AI

AI in Automobile Industry

Literature Review

AI in V2X Application

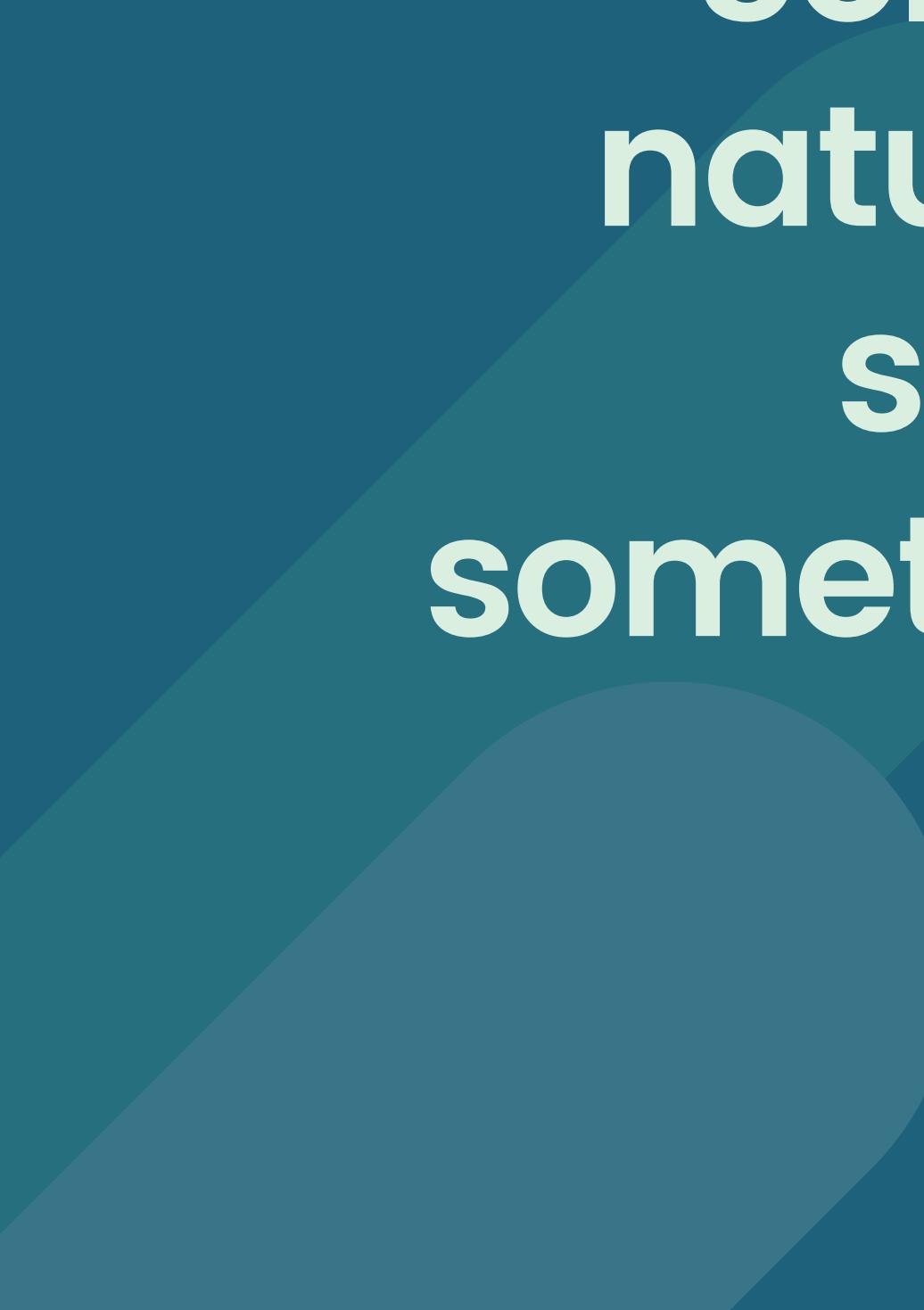
The Application of AI in Vehicle Control System

AI Diagnostic Device for Vehicles

Future Scope of AI in Automobile Industry

Conclusion

References



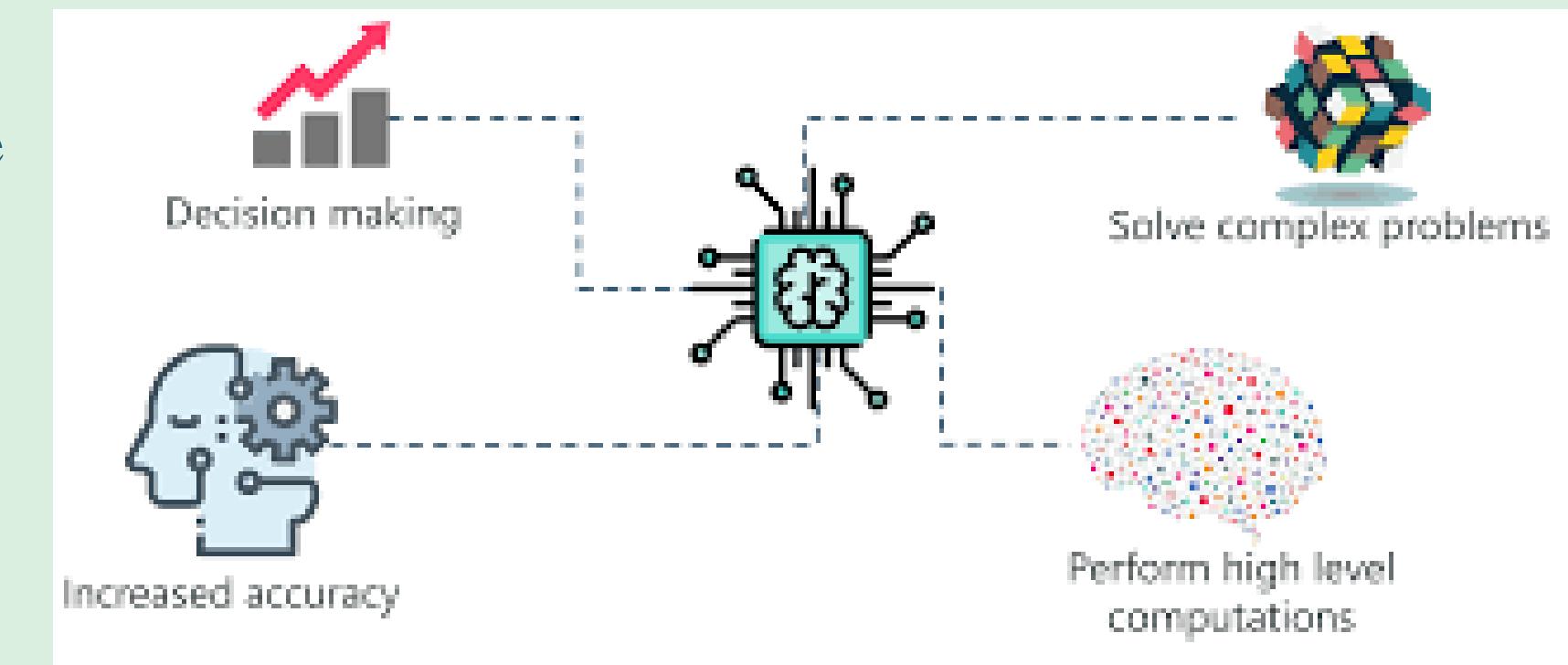
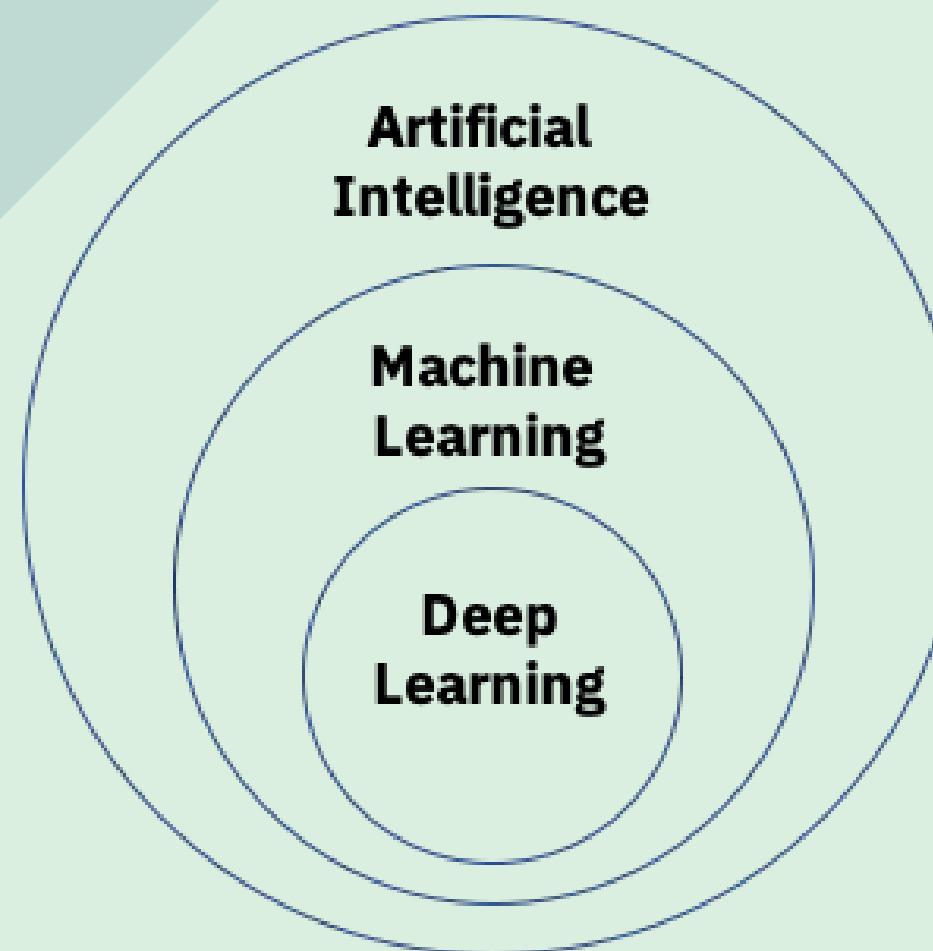
Self-driving cars are the
natural extension of active
safety and obviously
something we think we should
do.

ELON MUSK

ARTIFICIAL INTELLIGENCE

SEMINAR DOMAIN

It is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable.

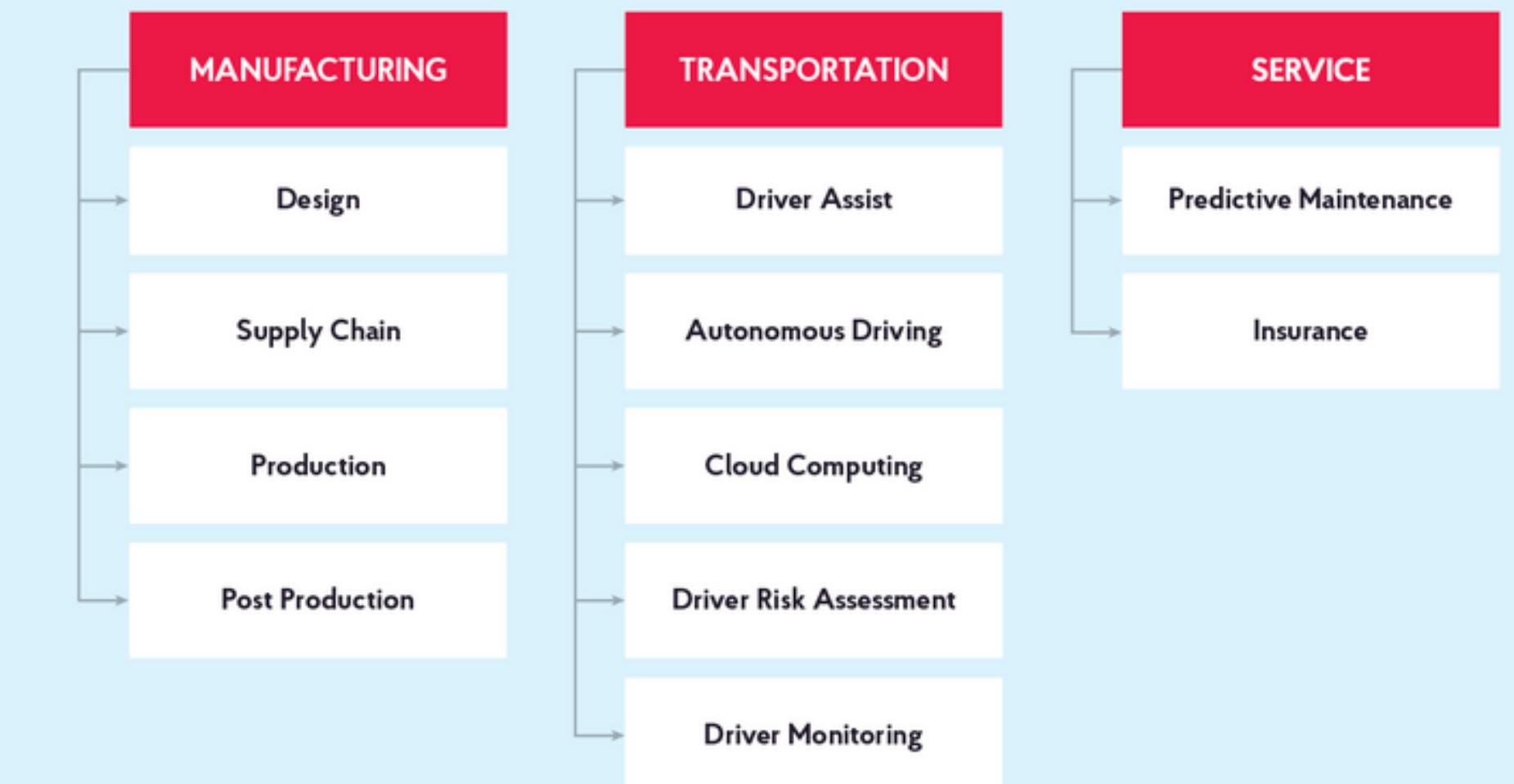


AI IN AUTOMOBILE INDUSTRY

AI for the automotive industry can improve user experience, enable faster innovation cycles, and enhance the entire workflow in manufacturing and maintenance. AI-powered solutions can collect and process enormous amounts of vehicle data, provide actionable insights, and increase privacy and data security.

AI powers autonomous driving, allowing the real-time recognition of objects around the vehicle, enhancing maintenance and fleet management. Moreover, AI automotive solutions enable better navigation systems, enhance understanding of voice commands and optimize routine processes leading to optimized business processes.

AI in Automotive Value Chain



Driver Experience

- Reducing Distracted Driving
- Learning & Analyzing Driving Habits
- Customer Accessibility
- Upgraded CX

Passenger Experience

- In-Car Delivery
- Personalized Accessibility
- Upgrade CX



Supply Chain

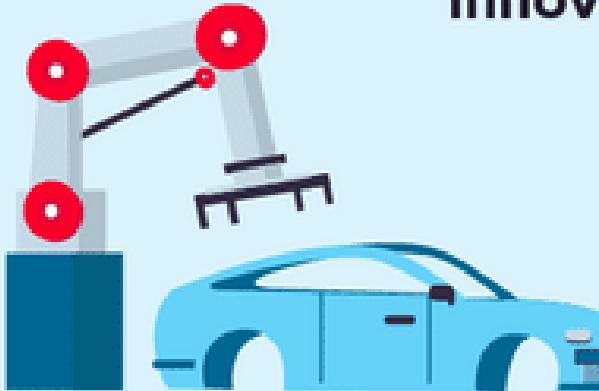
- Forecasting & Replenishment
- Automated Routing
- Volume Forecasting
- Automated SCM Decisions



AI in Automotive: Innovative Use Cases

Manufacturing

- Car Assembly
- Supply Chain Optimization
- Robots for Tedious Tasks
- Sensor Data that Improves Performance



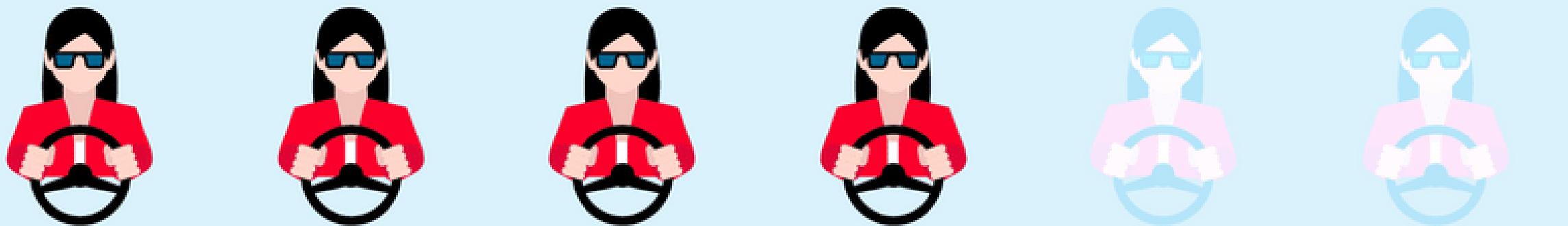
Quality Control

- Detecting Defects with Accuracy
- Predictive Monitoring
- Learning & Recognizing Defects
- Crack Detection

AI Use Cases In Automotive Vehicle

1. AI-powered GPUs for Computer Hardware
2. AI Applies To Telematics Data
3. Driving and User Conduct Monitoring
4. Car Insurance Auto Repair
5. Self-driving Vehicles and AI Driving Assistants

5 Levels of Vehicle Automation



0. No Automation

Zero autonomy;
the driver performs all
driving tasks

1. Driver Automation

Vehicle is controlled by
the driver, but some
driving assist features
may be included in the
vehicle design

2. Partial Automation

Vehicle has combined
automated functions,
like acceleration and
steering, but the driver
must remain engaged
with the driving task
and monitor the
environment at all
times

3. Conditional Automation

Driver is a necessity,
but is not required to
monitor the
environment. The driver
must be ready to take
control of the vehicle
at all times.

4. High Automation

The vehicle is
capable of
performing all driving
functions under
certain conditions.
The driver may have
the option to control
the vehicle.

5. Full Automation

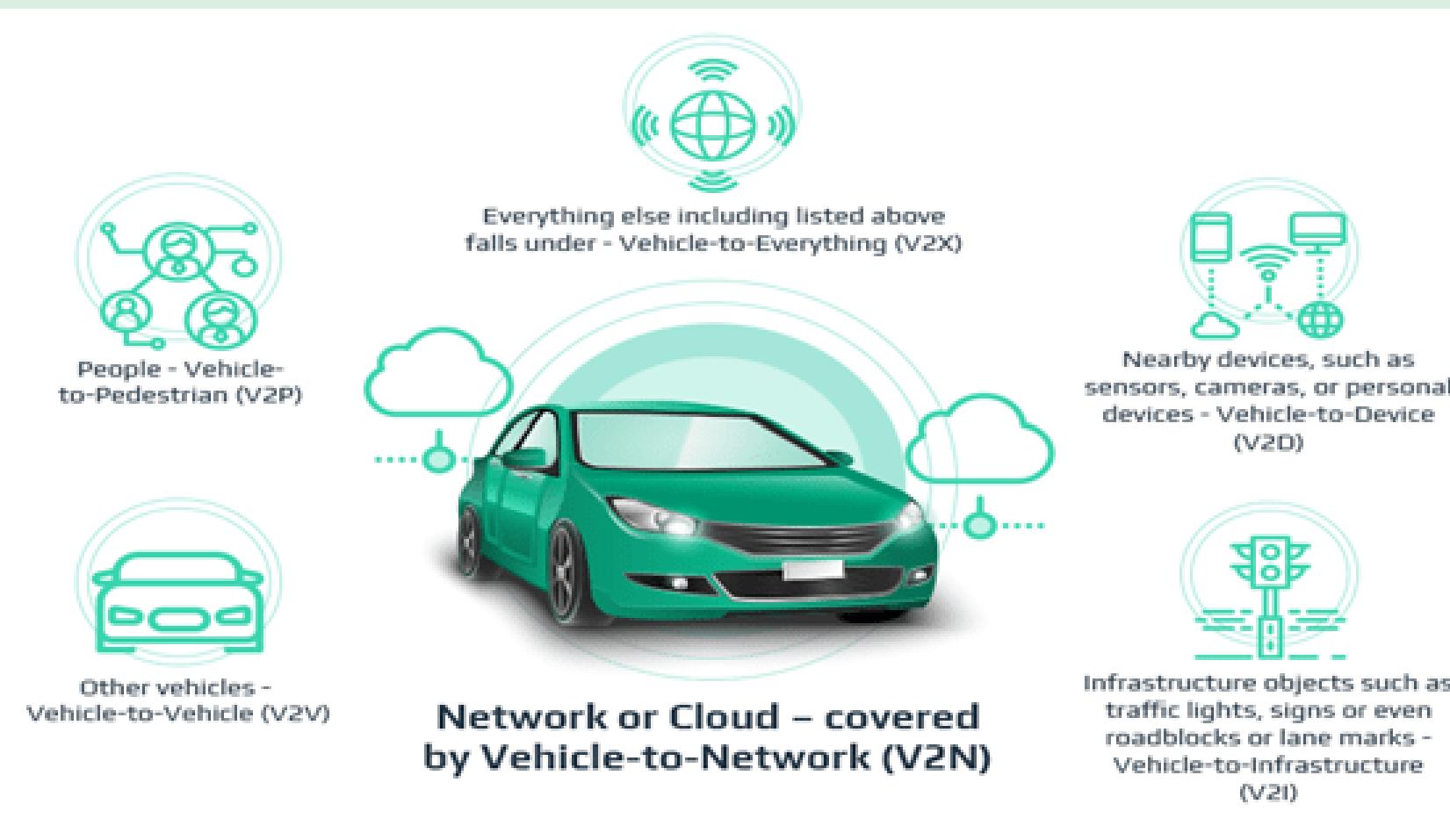
The vehicle is
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The driver may have
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This is where we are now

Literature Review

Sr No	Paper Title	Journal Name, Year	Objective	Methodology/Technology/Algorithm used	Dataset /Features	Conclusion
1	Analysis on the Applications of AI in Vehicles and the Expectation for Future	IEEE Xplore, 2020	Understanding uses of AI in Automobile Industry	Artificial Intelligence, Machine Learning, IOT	1) Enables Autonomous driving 2) Increases driver safety	AI can be used to increase comfort, convenience and security of vehicles.
2	An Overview of Artificial Intelligence in Automobile Industry -A Case Study on Tesla Cars	ResearchGate, 2021	To study the concept of introducing AI and NLP (natural language processing) in automobile industry	Artificial Intelligence, Machine Learning, IOT, Chabot, Virtual Assistant, NLP (natural language processing)	1) Personal voice assistant 2) AI Chatbot	AI can be used to create more efficient vehicles.
3	Impact of AI on the Automobile Industry in the U.S.	SSRN Papers, 2021	To demonstrate the importance of Artificial Intelligence (AI) implementation in the automobile industry	Artificial Intelligence, Machine Learning, IOT	1) Supply chains are impacted by AI	AI make a drastic impact on companies and entire supply chains around the world.

AI IN V2X APPLICATION

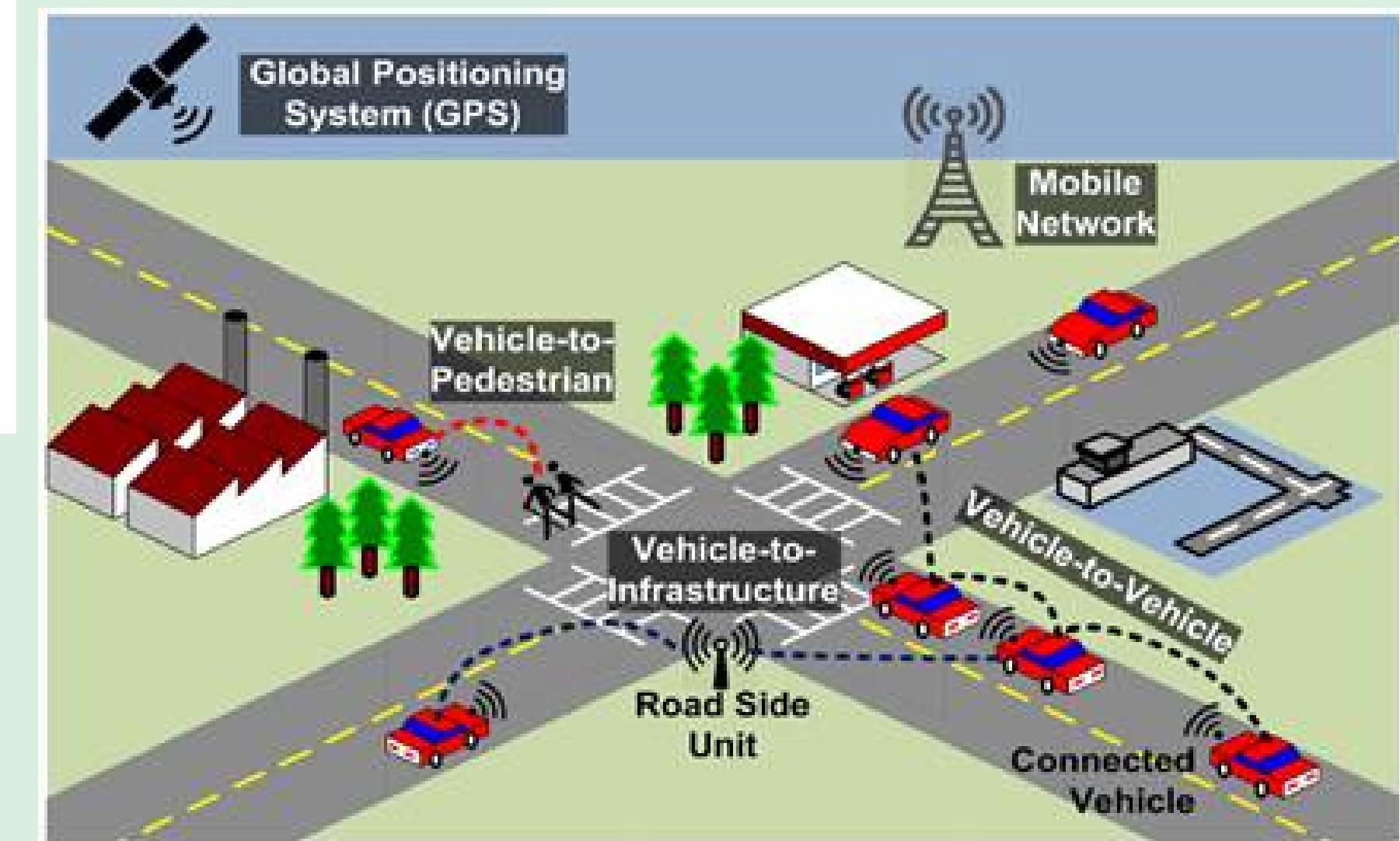
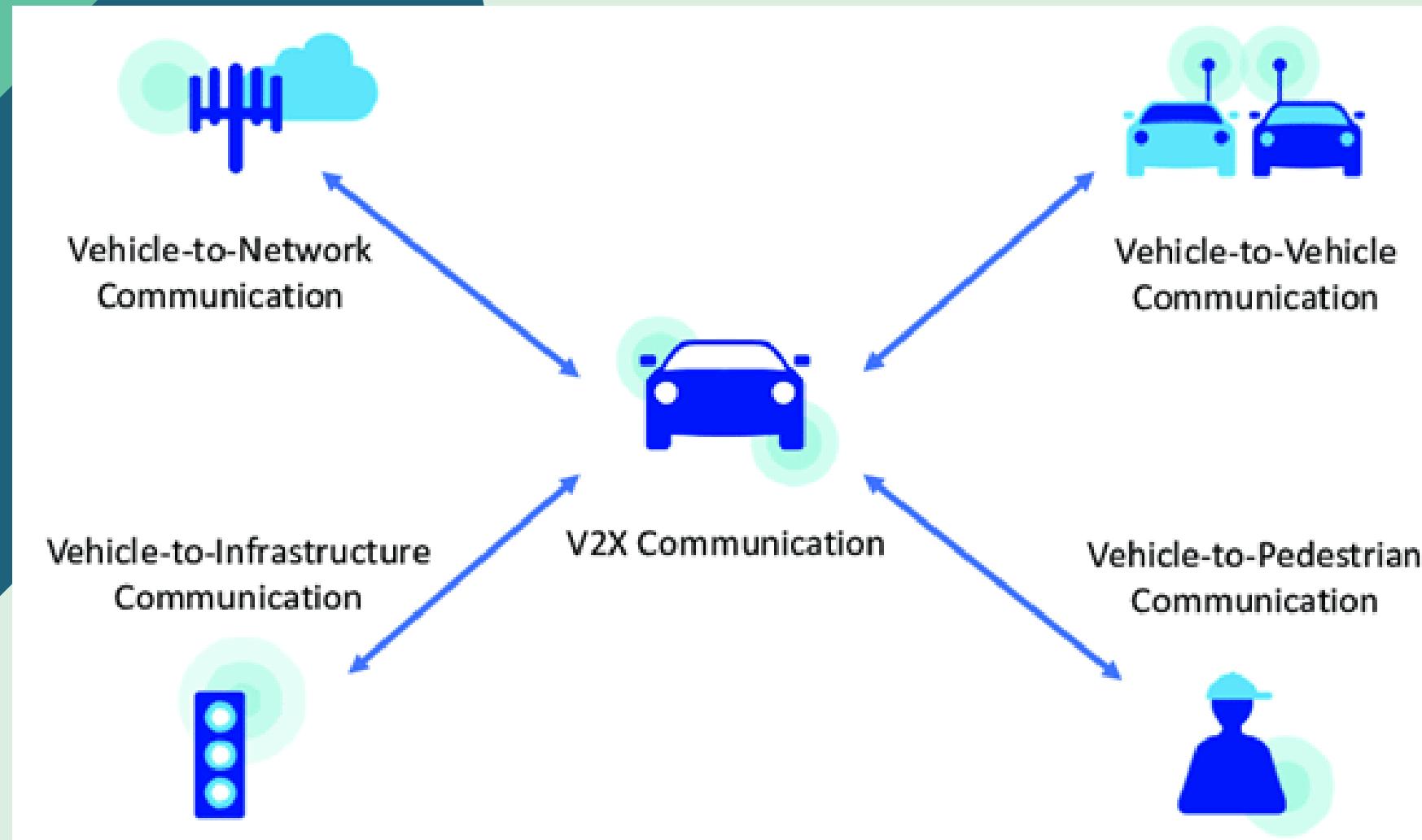


Vehicle-to-Everything (V2X), a system that allows automobiles to communicate with moving portions of the traffic system around them, when integrated with AI, can enable novel applications in Vehicular Ad-hoc NETworks (VANETs). It may, for example, predict and manage real-time traffic flow, store data in cars, and carry facilities autonomously.

Information from vehicle sensors and other sources passes across high-bandwidth, high-reliability links in a V2X communication system, allowing it to communicate with other automobiles, infrastructure such as parking spots and traffic signals, and smartphone-tossing people.

The technology improves the driver's awareness of potential threats by sharing information such as speed with other entities around the car. This helps to lessen the severity of injuries, road accident fatalities, and collisions with other vehicles. Additionally, the technology improves traffic efficiency by alerting vehicles to impending traffic, offering other routes to avoid traffic, and locating vacant parking spaces.

Working of V2X



ADVANTAGES OF V2X

Following are the benefits or advantages of V2X Communication:



1. It allows driver to reach destination quickly, safely and in cost effective manner. This is possible due to availability of traffic information, parking lot assistance, optimized fuel consumption and so on.
2. Drivers utilizes vehicle management functions to reduce operational costs and ease in usage. Drivers and owners get information on condition of vehicle, service related reminders etc.
3. Owners get information on vehicle breakdown prevention via phone, SMS and other notifications.
4. Various safety functions warn drivers about external hazards and internal vehicle hazards. This helps in prevention of crashes. Moreover drivers can drive in low visibility conditions.
5. Various entertainment functions are available for drivers and passengers.
6. Partial and fully automatic driving functions are available.

DISADVANTAGES OF V2X COMMUNICATION

Following are the challenges or drawbacks or disadvantages of V2X Communication:

1. As vehicles in V2X are connected to internet, they are prone to hacking. Hackers can access and control the vehicle.
2. Malfunctioning of cars or sensors or networks lead to incorrect data. This leads to faulty communications.

Applications Of V2X

Through its instant communication V2X allows road safety applications such as (non-exhaustive list):

- Forward collision warning
- Lane change warning/blind spot warning
- Emergency electric brake light warning
- Intersection movement assist
- Emergency vehicle approaching
- Roadworks warning
- Platooning



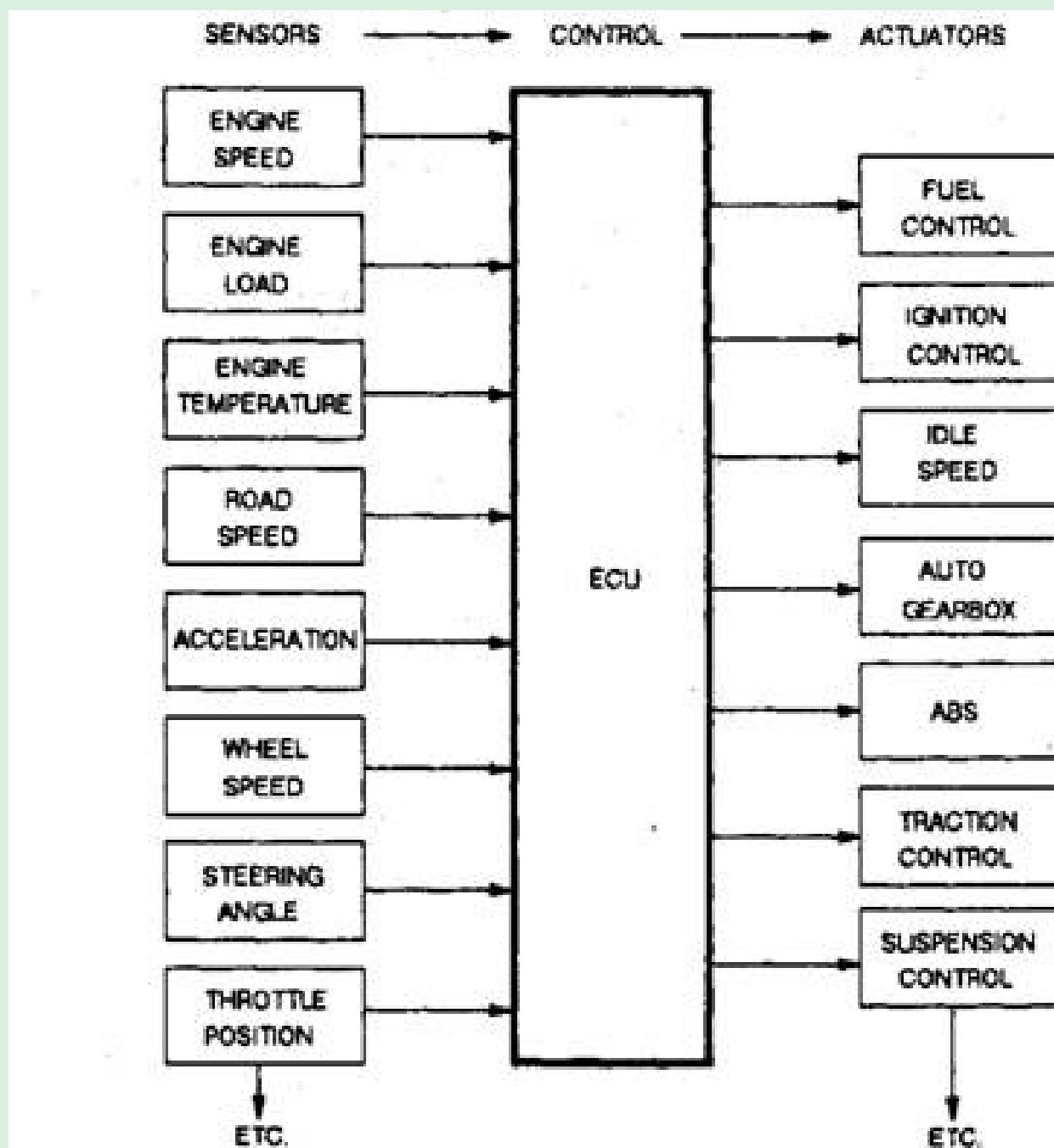
THE APPLICATION OF AI IN VEHICLE CONTROL SYSTEM

In theory, a full vehicle control system consists of a single ECU that manages all aspects of the vehicle. A complete vehicle control system is depicted in the diagram. Separate ECUs, rather than a single control unit, are employed in practise and can communicate with one another.

The benefits of central control are most noticeable in the primary areas of inputs and outputs. Consider all of the inputs required to operate each of the three systems below on the input side.

- Ignition system
- Fuel system
- Transmission system.

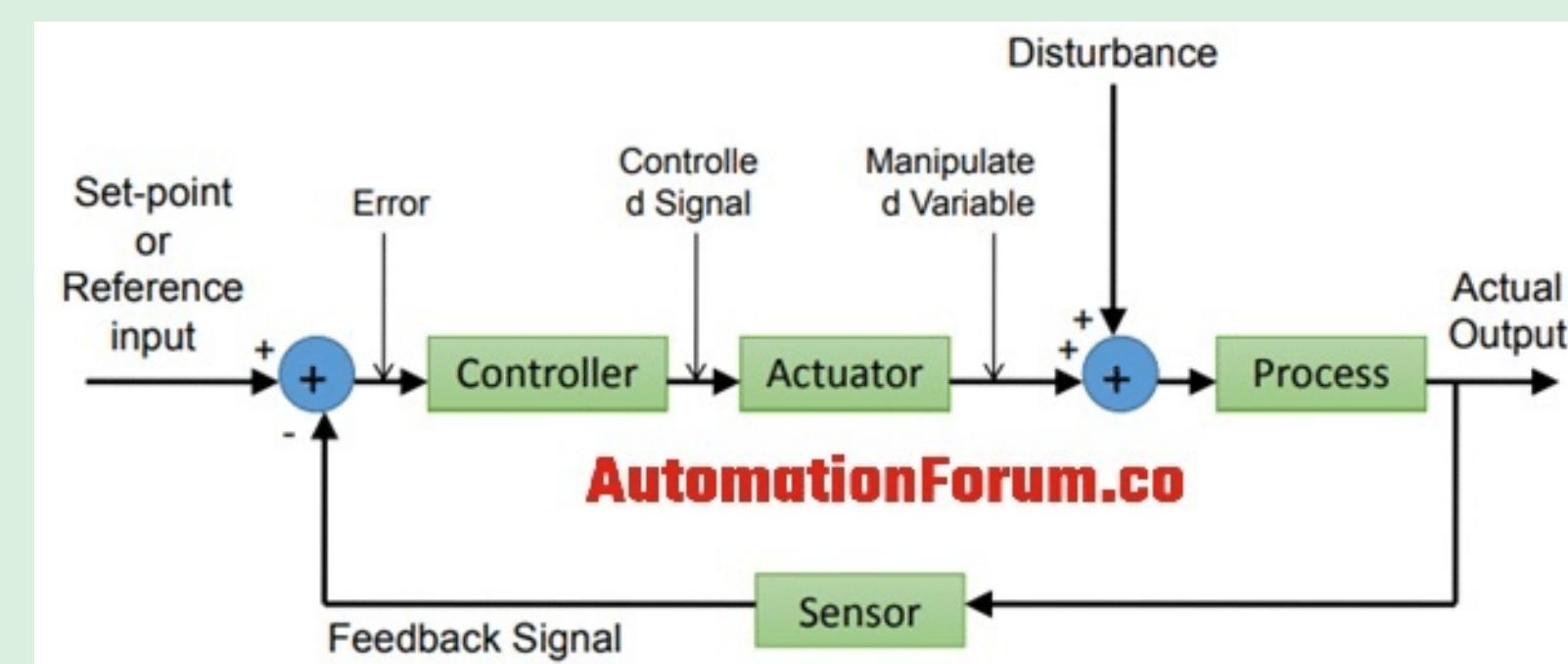
Even with only three possible domains of vehicle control, it is clear that there are many common requirements. One central control system has the ability to reduce wiring complexity while enhancing control possibilities. This is, in fact, the outputs' advantage.

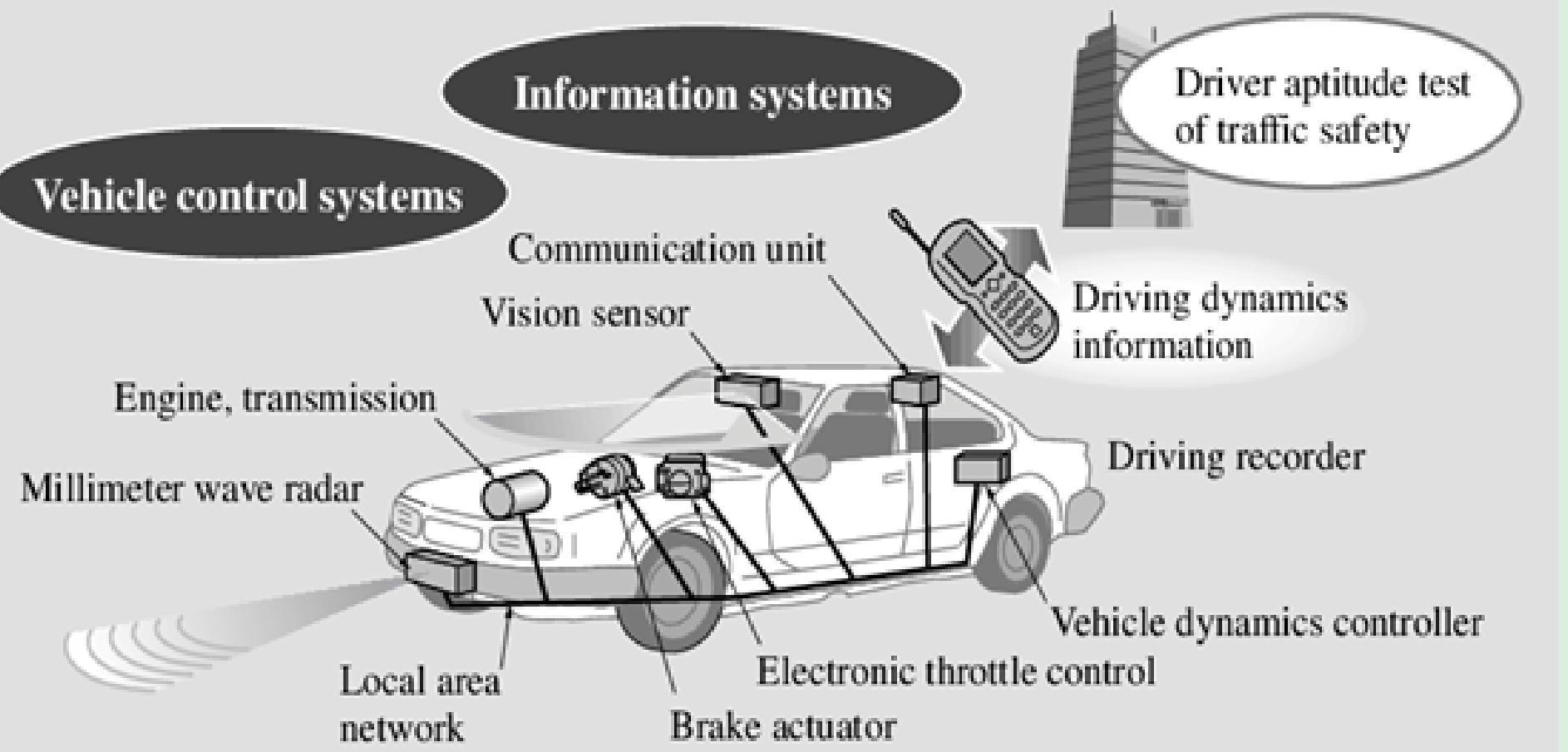


WORKING OF AI IN VEHICLE CONTROL SYSTEM

Applying AI technique in vehicles is also capable of controlling the velocity of a vehicle regarding to the driver's driving habit. During the follow-up driving which corresponds to the driving characteristics of the driver, the environment is related to vehicles. The distance between the vehicle and the vehicle in front, the relative speed, and the relative position are measured. The danger index will be calculated from the measured vehicle environment and moving state regarding the driver's sense of driving. To be more precise, the distance that is necessary for stopping the vehicle preventing crash, between the automobiles and automobiles in front is calculated while the automobile in front decelerates is detected by the automobile itself.

The danger index will be measured by a special sensor and then conveyed it to a display unit. Then the display unit or the special sensor will judge whether to accelerate or decelerate the automobile from the danger index and provide a command to the driver so as to automatically control the brake and the accelerator. In this case, driving security has been once again largely ensured by the application of AI in the vehicle control system





Advantages of AI in Vehicle Control System

1. Decreased the number of accidents

Autonomous cars prevent human errors from happening as the system controls the vehicle. It leaves no opportunity for distraction, not just like humans who are prone to interruptions. It also uses complicated algorithms that determine the correct stopping distance from one vehicle to another. Thereby, lessening the chances of accidents dramatically.

2. Lessens traffic jams

Driverless cars in a group participate in platooning. This allows the vehicles to brake or accelerates simultaneously. Platoon system allows automated highway system which may significantly reduce congestion and improve traffic by increasing up the lane capacity. Autonomous cars communicate well with one another. They help in identifying traffic problems early on. It detects road fixing and detours instantly. It also picks up hand signals from the motorists and reacts to it accordingly.

3. Stress-free parking

Autonomous cars drop you off at your destination and directly heads to a detected vacant parking spot. This eliminates the wasting of time and gas looking for a vacant one.

4. Time-saving vehicle

As the system takes over the control, the driver has a spare time to continue work or spend this time catching up with their loved-ones without the having the fear about road safety.

5. Accessibility to transportation

Senior citizens and disabled personnel are having difficulty driving. Autonomous vehicles assist them towards safe and accessible transportation.

Disadvantages of AI in Vehicle Control System

1. Expensive

High-technology vehicles and equipment are expensive. They prepare a large amount of money for research and development as well as in choosing the finest and most functional materials needed such as the software, modified vehicle parts, and sensors. Thus, the cost of having Autonomous cars is initially higher. However, this may lower down after 10 years giving way for the average earner people to have one.

2. Safety and security concerns

Though it has been successfully programmed, there will still be the possible unexpected glitch that may happen. Technologies are continuously updating and almost all of this equipment may have a faulty code when the update was not properly and successfully done.

APPLICATIONS OF AI IN VEHICLE CONTROL SYSTEM

- Sensor Data Processing

Some of these sensors can provide better perception than the average humans so one of the main tasks is to detect and identify objects ahead and around the vehicle.

- Path Planning

Path planning is important in order to optimize the trajectory of the vehicle and to lead to better traffic patterns. This can help reduce delays and avoid congestion on the road.

- Path Execution

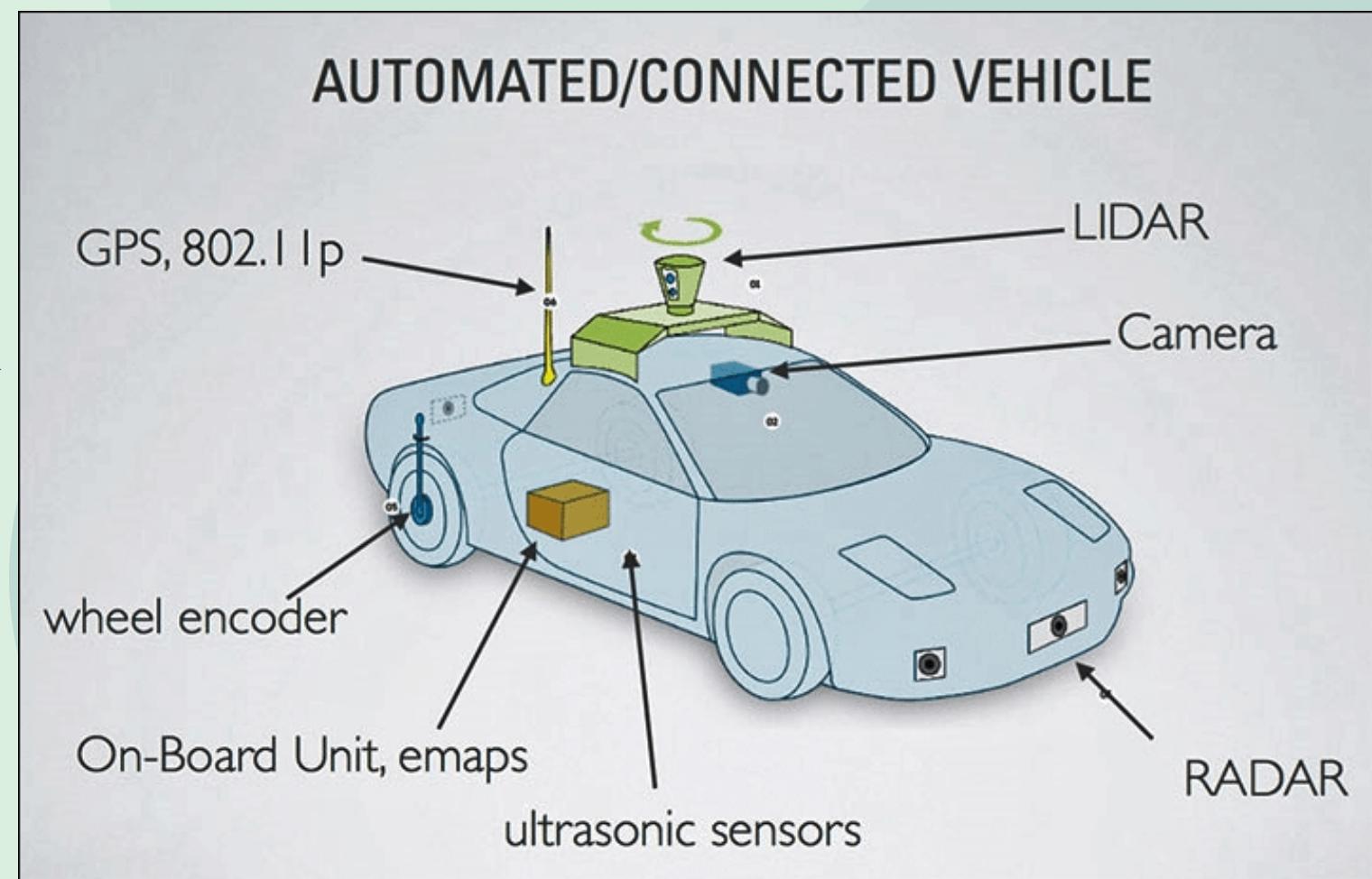
After the path is planned the vehicle is able to navigate the road conditions, by detecting objects, pedestrians, bicycles and traffic lights in order to reach the destination. The object detection algorithms are a primary focus of the AI community as they make it possible for human like behavior.

- Monitoring Vehicle's Condition

The most promising type of maintenance is predictive maintenance. It can be defined in the following way: “Predictive maintenance employs monitoring and prediction modelling to determine the condition of the machine and to predict what is likely to fail and when it is going to happen”

- Insurance Data Collection

Data logs from a vehicle can contain information about the driver’s behavior and this can be used in the analysis of traffic accidents. These data can be used for processing of claims.



AI Diagnostic Device for Vehicles

An artificial intelligence diagnosis device is offered, which can be utilized to centrally manage a vehicle's electrical and control equipment utilizing a separate diagnostic central processing unit to diagnose malfunction in real-time and transmit the results to the driver.



Working of AI Diagnostic Device for Vehicles

An electronic time and alarm control system diagnostic unit, a junction box diagnostic unit, the diagnostic central processing unit, and the output unit are all part of the AI diagnostic equipment. The electronic time and alarm control system diagnostic unit is used to diagnose the electronic time of the electronic systems of the control car and the state of the alarm control system; the junction box diagnostic unit is used to diagnose various fuses and the state of the relay; the diagnostic central processing unit is used to receive and analyze the diagnostic signals output from the electronic time and alarm control system diagnostic unit, the junction box diagnostic unit, and the diagnostic central processing unit; the diagnostic central processing unit is used to receive and analyse the diagnostic signals output from the electronic time and alarm control. The diagnostic central processing unit's signal is received by the output unit, which then reports the abnormal situation to the driver. The driver is then informed of the normal or abnormal state of the electrical equipment so that he or she may readily determine which part of the vehicle is malfunctioning while driving. As a result, the vehicle can be simply fixed in a short period of time for a reasonable cost. When the car breaks down, swift action might also be performed. Furthermore, because the car's failure is checked automatically every day, accidents caused by improper maintenance can be avoided.



Advantages of AI Diagnostic Device for Vehicles

1. The vehicle can be simply fixed in a short period of time for a reasonable cost.
2. When the car breaks down, swift action might also be performed.
3. The car's failure is checked automatically every day, accidents caused by improper maintenance can be avoided.



Disadvantages of AI Diagnostic Device for Vehicles

- Even though diagnostic devices are useful, they can malfunction. During the diagnostics, defects may appear that do not manifest themselves, but create the risk of an emergency.



Future Scope of AI in Automobile Industry

AV use cases are the most valuable and difficult applications for AI technology. The goal is a software driver that is better than the best human drivers with none of the drawbacks of human behavior.

Software development is ripe for AI-based technology improvements. Identifying and fixing software bugs is likely to happen in the next decade via innovative AI technology.

Cybersecurity advances derived from AI technology are perhaps the most pressing need for the automotive and other industries. The requirements are attracting large, ongoing investments.



Conclusion

With Artificial Intelligence skills, you can see a new kind of driving experience. That is due to the great calculation ability that is ultimately in which engineers are obliged to design applications that have taken artificial intelligence at a completely different level of perfection. Today's automotive industry cannot rely solely on careful drivers and other road users who take all their steps carefully. The automotive technology stack for every car is an important step towards our safety and good experience as car users.



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Thank
you!