Civil Liability of Software Defects in Autonomous Vehicles and the Inefficiency of Existing Rules, With a Review of US Law

Nahid Parsa[1*]

1. PhD in Private Law, Mazandaran University, Mazandaran, Iran

[*] Corresponding Author Email: nahidparsa84@yahoo.com

Abstract

Artificial intelligence offers countless benefits to humanity, one of which is the development of self-driving cars. This research focuses specifically and on a case-by-case basis on the issue of civil liability arising from software defects in autonomous vehicles. Software plays a pivotal role in the functioning of self-driving cars, and traditional principles of liability no longer adequately address the emerging challenges in this field.

In the event of a defect in a software update, the question arises: who is responsible—the original designer or the party responsible for the update? A careful and in-depth examination of existing legal frameworks reveals that traditional principles of liability still hold the software manufacturer—considered the final producer—liable under vicarious liability doctrines. While Iranian law does not explicitly recognize supervisory liability, it is argued that such responsibility should logically rest with the software manufacturer once the product enters the market.

The expansion of human societies in recent centuries has led to the emergence of new needs, including the production and use of autonomous vehicles. If an accident involving a self-driving car results from a software or hardware defect—such as the failure of artificial intelligence to alert the driver in time to take control in the event of an imminent collision—this constitutes a software-related malfunction. Similarly, if a semi-autonomous vehicle catches fire due to a hardware defect like a fuel tank spark, the driver is no longer responsible, and the liability shifts to the hardware or software manufacturer. This principle is supported by Article 3 of Iran's 2007 Law on the Protection of Automobile Consumers, which imposes strict liability on manufacturers.

One of the key legal challenges is distinguishing between software and hardware defects—an issue that remains ambiguous even among experts. The uniqueness of autonomous vehicles lies in their integration of hardware, software, and services. This complex fusion challenges existing civil and product liability laws. According to Article 3 of the Law on the Protection of the Rights of Computer Software Creators, the designer and manufacturer of the software may be the same entity. Liability is sometimes assessed under the Law on the Protection of Goods Consumers or the Law on the Protection of Automobile Consumers. However, software does not fit neatly into the traditional definition of a "commodity," as commodities are usually tangible and

visible.

This raises questions: Can software be considered a service? Is there such a thing as an intangible commodity? Commodities are generally defined as specific, identifiable objects. Given that software lacks this tangibility and pointability, it is more appropriately treated as a service. Nevertheless, under Iranian law, there is no significant difference in the application of liability rules to goods and services. But this leads to a deeper inquiry: Are autonomous vehicles primarily vehicles, or are they software?

Currently, Iran's legal system lacks codified laws addressing civil liability for software defects in self-driving cars, forcing reliance on general legal principles. Previous literature has explored the issue of warranties in artificial intelligence (e.g., Valipour and Ansari, 2021; Alizadeh, 2021; Rajabi, 2019; Takhshid, 2021), and some works have examined vehicle defects and the foundational liability of autonomous car manufacturers.

The novelty of this research lies in its detailed, case-by-case approach to the issue, supported by global judicial precedents and practical recommendations tailored to Iranian law. One of the unique contributions of this paper is its focused analysis of the liability of software manufacturers, particularly in terms of defect development and production. It explores both vicarious and supervisory liability of software producers. The paper first categorizes types of software defects, then evaluates the responsibilities of designers and manufacturers, and finally addresses the insufficiency of current laws related to software safety and cybersecurity.

Although the 2016 Law on the Protection of the Rights of Car Consumers defines defects as including issues in design, production, assembly, and transportation (with assembly defects classified under production), vehicle defects are generally divided into three main categories: production defects, design defects, and warning defects.

A manufacturing defect occurs when a vehicle's raw materials, components, or production processes are flawed—for example, if car tires are correctly designed but sawdust contaminates the glue during production, increasing the risk of tire detachment and serious accidents. A design defect originates before the vehicle is manufactured, meaning the product was made according to specifications, but the design itself was flawed. A warning defect arises when the manufacturer fails to provide adequate information or warnings to the user.

Article 1 of the Consumer Rights Protection Law defines a defect as an excess, deficiency, or change in condition that reduces the economic value of a good or service. In the United States, the California Supreme Court ruled that a product must meet the expectations of an average consumer, based on common knowledge about its characteristics. According to paragraph 1 of Article 402 of the American Law Institute's Restatement, a defect is defined as a characteristic that makes a product "unreasonably dangerous." Thus, in most U.S. states, if a product contains a defect that poses an unreasonable danger to consumers, it is considered defective under liability laws.

Keywords: Autonomous Vehicles, responsibility, inefficiency, software, defect.

References

Books

1. Alsubaei, Faisal (2022). Reliability and Security Analysis of Artificial Intelligence-Based Self-Driving Technologies in Saudi Arabia: A Case Study of Openpilot. *Journal of Advanced Transportation*, Volume 2022, Article ID 2085225, 25 Pages.
   Doi: 10.1155/2022/2085225

2. Daewon, Kim, (2022). Potential Liability Issues of AI-Based Embedded Software in Maritime Autonomous Surface Ships for Maritime Safety in the Korean Maritime Industry. *Ocean Engineering*, 10 (4), 498.

3. Ebers Martin (2022). Civil Liability for Autonomous Vehicles in Germany. Humboldt University of Berlin-Faculty of Law; University of Tartu, School of Law, Available at SSRN: https://ssrn.com/abstract=4027594 or, (2022).
   Doi: 10.2139/ssrn.4027594,pp36-39

4. Kaplanoglu, Erkan (2023). Evaluation of Artificial Intelligence Techniques in Disease Diagnosis and Prediction. *Discover Artificial Intelligence*, 3(1), 12.

5. Jaiden Xuan (2023). A multi-Output Network with U-Net Enhanced Class Activation Map and Robust Classification Performance for Medical Imaging Analysis. *Discover Artificial Intelligence*, 3(1), 11.

6. Sellat, Qusay (2022). Intelligent Semantic Segmentation for Self-Driving Vehicles Using Deep Learning Computational. *Intelligence, and Neuroscience* Article ID 6390260, 10 pages Doi: 10.1155/2022/6390269

7. Stix, Charlotte (2022). Artificial Intelligence by any Other Name: a Brief History of the Conceptualization of "Trustworthy Artificial Intelligence". *Discover Artificial Intelligence*, 2(1), 12.

8. Swanson, Derek & Dr. Lin Wei Zhonglun (2011). *China, a Corporate Approach to Preventive Management, Risk Reduction*, *and Case Coordination for Chinese Automakers*., Second Edition October 2009, McGuire Woods LLP Richmond, VA. 1-29.

9. Uzair Muhammad (2021). Who Is Liable When a Driverless Car Crashes? Faculty of Engineering, Islamic University of Medina, Medina 42351, *World Electr*. Veh. J., 12 (2), 62. Doi: 10.3390/wevj12020062

10. Wise, Aarron (2009). American Product Liability, Good News for Business! Resent Trends, and Development a Guide U.K. Companies. Partnergallet Dreyer & Berkey. LLP Attorneys at Law 845 Third Avenue. 8th Floor New York: New York 10022-6601. USA. www.gdblaw.com

11. Wright .Richard (2007). The Principles of Product Liability, in Symposium, Products Liability: Litigation Trends on the 10th Anniversary of the Third Restatement, 26 Rev. Litig. 1067. 26 (4), P1076, 1067-1152.

12. Yineng Xiao (2022). Accident Liability Determination of Autonomous Driving Systems Based on Artificial Intelligence Technology and Its Impact on Public Mental Health**.** *Journal of Environmental and Public Health*, Article ID 2671968, 1-12.
    Doi: 1155/2022/2671968

13. Ziemianin Karolina (2021). Civil Legal Personality of Artificial Intelligence. Future or Utopia? *Internet Policy Review Journal on internet regulation*, 10(2) 14.

- Awards

14. Aerotek, Inc. v. Boyd, 598 S.W.3d 373 (Tex. App. 2020).

15. Darty v. Columbia Rehabilitation and Nursing Center, LLC, 2020 U.S.

16. Djemil et al v. Tesla Inc. 3:2021cv05251-2021

17. Gill v. Whitford (138 S. Ct. 1916 (2017))

18. Figueroa v. Kronos Incorporated, 2020 U.S. Dist. LEXIS 64131 (N.D. Ill. 2020);

19. Monet v. Tesla, Inc.-cv-00681-EJD (N.D. Cal. Jul. 13, 2022)

20. Rucho v. Common Cause (139 S. Ct. 2484 (2019)

21. Sevatec, Inc. v. Ayyar, 102 Va. Cir. 148 (Va. Cir. Ct. 2019).

22. Spokeo, Inc. v. Robins (136 S. Ct. 1540 (2016)

23. Ford Motor Co. v. Zahn, 265 F.2d 729,731 (8th Cir. 1959)

24. Caterpillar Tractor Co. v. Beck, 593 P.2d 871, 881 (Alaska 1979)

25. Camacho v. Honda Motor Co., 741 P.2d 1240,1247 (Colo. 1987)