Knowledge Gaps and Review of Literature in the Field of Automotive Technologies

Stav Biton and Amir Shapiro

Department of Mechanical Engineering,

Ben Gurion University of the Negev, Beer-Sheva, Israel

stavavr@post.bgu.ac.il, amir.shapiro@gmail.com

1. Addressing the Last Mile Problem through Automotive Technology Innovations

Purpose of research

Explore the role of autonomous vehicles and electric vehicles in solving the last mile delivery problem, focusing on efficiency, sustainability, and urban mobility.

Expected results from research:

The research is expected to showcase how autonomous and electric vehicles can revolutionize last mile delivery by making it more efficient and sustainable. It will delve into strategies for integrating these technologies into urban logistics, overcoming regulatory and technological hurdles, and evaluating their economic impact. By highlighting the benefits and proposing solutions to existing challenges, the research aims to pave the way for future advancements and wider adoption of these technologies in solving the last mile problem, ultimately contributing to smarter, greener urban environments.

The Israeli Smart Transportation Research Center
Technion City, Haifa 32000, Israel

Email: istrc@technion.ac.il
Tel: 04- 8292373

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Literature review:

Fields that have been researched sufficiently:

- The first public release of real-world operational routing data for last-mile logistics research [1].
- The efficacy of deep learning in the predictions of different safety scenarios [2].
- Using Autonomous Delivery Robots (ADRs), Unmanned Aerial Vehicles (UAVs), and two-tiered systems for last-mile logistics operations. These innovations aim to tackle urban challenges such as congestion, air pollution, and the efficiency of deliveries [3].
- Effectiveness of cargo bikes in urban last-mile deliveries [4].

Fields requiring further research:

- Identifying regulatory frameworks and societal integration of Autonomous Delivery Robots (ADRs) emerges as a pivotal research area to further last-mile logistics innovations [5].
- Study of consumer trust, acceptance, and interaction with autonomous and unmanned delivery services.
- How cities need to evolve in terms of roads, parking, and dedicated lanes to accommodate new last-mile delivery technologies.
- Developing technologies and systems that allow for personalized delivery experiences, such as adjustable delivery times and locations.
- Ensuring that new delivery technologies cater to the needs of all users, including those with disabilities.

Companies of interests:

- Amazon
- UPS
- DHL
- Nuro
- Starship Technology

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2. Vehicle-to-Everything (V2X) Communication

Purpose of research:

The primary goal of researching Vehicle-to-Vehicle (V2V) Communication is to enhance road safety, traffic efficiency, and automate driving features by enabling direct communication between vehicles. This technology aims to reduce traffic collisions and congestion by allowing vehicles to share information about their speed, direction, and location in real time.

Expected results from research:

The research is expected to yield a comprehensive framework for implementing V2V communication technologies that can be standardized across the automotive industry. This includes the development of protocols for data sharing, encryption, and privacy to ensure secure and reliable communication. Additionally, the research aims to demonstrate the potential of V2V to reduce accidents, improve traffic flow, and pave the way for the integration of autonomous vehicles into the transportation system.

Literature review:

Fields that have been researched sufficiently:

- Intelligent Traffic Signal System (I-SIG) and Intersection Movement Assist (IMA) are improving traffic flow and safety at intersections through V2V and Vehicle-to-Infrastructure (V2I) communications [6].
- Improving collision avoidance in automated vehicles through cooperation among multiple vehicles, using AI for decision-making [7].
- Time Synchronization Methods for V2V Communications which This ensures more reliable and efficient data exchange [8].

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Fields requiring further research:

- Development and implementation of scalable and dynamic security mechanisms that can adapt to the evolving threats in V2X communication systems [9].

- developing integrated approaches for addressing routing complexities and minimizing control overheads in Vehicular Ad Hoc Networks (VANETs).

- The increasing volume of data transmitted in V2V communications requires further research into more efficient data processing algorithms to reduce latency and improve system performance.

- There is a need for ongoing research into developing more robust security protocols to protect against evolving cybersecurity threats within V2V networks.

Companies of interests:

- Tesla , BMW , Toyota
- Verizon
- AT&T
- Qualcomm
- Cisco

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3. Advanced Driver-Assistance Systems (ADAS) Calibration and Validation

Purpose of research:

The research aims to explore methodologies for the calibration and validation of Advanced Driver-Assistance Systems (ADAS) to enhance automotive safety and performance. By focusing on the development and application of rigorous standards, this study seeks to identify gaps in current practices and propose innovative solutions to ensure the reliability and effectiveness of ADAS technologies.

Expected results from research:

This study is expected to yield a comprehensive framework for ADAS calibration and validation, addressing both technical and regulatory challenges. Anticipated outcomes include the establishment of standardized procedures for testing and assessment, recommendations for industry best practices, and the identification of key areas requiring further innovation. The research will contribute to the advancement of ADAS technologies, improving vehicle safety and supporting the transition towards autonomous driving.

Literature review:

Fields that have been researched sufficiently:

- Scenario Engineering (SE) focuses on enhancing the variety and accuracy of scenarios for the development of advanced driver assistance systems [10].
- Sensor technology in ADAS is well-researched, focusing on radar, lidar, cameras, and ultrasonic sensors for vehicle environmental perception, crucial for safety features like adaptive cruise control and emergency braking [11].
- Integrating Advanced Driver Assistance Systems (ADAS) functions in a Connected Vehicle (CV) environment, focusing on collaborative effectiveness rather than individual functionalities [12].

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Fields requiring further research:

- Development of universal calibration standards adaptable across different vehicle platforms and environments.
- Evaluation of real-world effectiveness of ADAS post-calibration.
- Integration of machine learning and artificial intelligence in ADAS calibration and validation processes.

Companies of interests:

- Bosch
- Continental AG
- Mobileye

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Subjects not included in this report

- Cybersecurity in Automotive Systems
- Human-Machine Interface (HMI) and User Experience (UX)
  - study of user experience (UX) design
  - accessibility
  - integration of these technologies into daily life
- Materials Science and Engineering
  - battery technology
  - Innovations in lightweight materials
  - sustainable manufacturing processes
- The future transportation habits of the alpha generation and the preparations required by governate bodies in order to accumulate those.
- The necessity of a magnetic train to transport goods and cargo from Ashdod to Eilat.
- Computerized system for supervision and maintenance of railway carriages.
- Technological advances in vehicle systems and their consequences:
  - Distractions resulting from these systems and other devices.
  - Confusion in symbols and marking of different systems between different manufacturers as a result of non-existence of standard.
  - Lack of familiarity with the many vehicle systems.
- Methods for examining the financial profitability of smart transportation.
- Charging of electrical vehicles:
  - Improving charging times by improving existing current charging methods and searching new and emerging tech in the field
  - construction of wireless charging infrastructure: static and dynamic.
  - Use of vehicles as energy storage of the electricity grid.

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Special thanks to the members of the Committee Vehicles and Transport Modes:

Joel Nahum

Leon Altarac

Prof. Hillel Ben Gera

Tamar Keinan

Dror Levy

Edwark Yusilavski

Guy Yehuda

Erez Nur

Rotem Barak

Avihai Dagani

Dr. Michelle Oren

Saar Dickman

Hilla Haddad

Sharon Hornstein

Prof. Reuven Katz

Prof. Shuki Wolfus

Kobi Avital

Omri Alon

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Research Center
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