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

1. Methodologies for the assessments of Artificial Intelligence in Autonomous Vehicles

Purpose of research

Discussion in methods for assessing Artificial intelligence (AI) in the use of autonomous vehicles (AV) in the aspects of quality and safety.

Expected results from research:

In order to allow the operation of AV freely, it is required to Define safety criteria for artificial intelligence at each of the autonomous driving levels[1] to ensure sufficient supervision of AI on the according on the road, expending and adding to current standards ISO 26262 and ISO/PAS 21448 (SOTIF).
Following that, its crucial to find a method to evaluate AV, whether it is by tests and standards relying on long distance road testing and adopting deep or quality coverage and learning[2].
Also, to help developers achieve the standards and promote the assimilation of AV, it will be benefitable to examine and compare the quality, safety and efficiency of the common AI methods used in vehicles, to help them match between an AI to it's appropriate use or to find one, superior method to suggest to developers to integrate in their systems.
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Literature review:

Fields that have been researched sufficiently:

- Comparison between the safety of human-driven vehicles and machine-driven vehicles[3].

[1] P. Koopman, U Ferrell (2019), A Safety Standard Approach for Fully Autonomous Vehicles.
[2] D. Karunakaran, S. Worrall (2020), Efficient statistical validation with edge cases to evaluate Highly Automated Vehicles.
[3] S. S. Banerjee, S. Jha, J. Cyriac, Z. T. Kalbarczyk, R. K. Iyer (2018), Hands Off the Wheel in Autonomous Vehicles?

- The efficacy of deep learning in the predictions of different safety scenarios[4].

Fields requiring further research:

- Evaluation of the performance of uncommon or difficult scenarios such as off-road driving, snowy or rainy terrain.
- Through and extensive simulations of as many possible scenarios in lab and on road, including use of statistical systems of automatically generated test cases towards the worst-case scenarios, to identify potential unsafe edge cases.
- The abilities of AI to take "on the fly" ethical decisions, and the developments of such abilities.
- Evaluation of the mentioned above scenarios and other required tests of AI in AV in a well supervised lab environment.
- Recommendations for standards of advanced AI in use in AV (L3+) for legal purpose such as laws and regulations governed by the authorities.

Companies of interests:

- Ministry of Transport and Road Safety
- VayaVision Sensing Ltd.
- SagivTech Ltd.
- IMVC
- Rail Vision
- Hamilton
- INNOVIZ TECHNOLOGIES LTD
- AMSTAF-UGV

2. Drones in industrial and commercial use:

Purpose of research:

Evaluation of the challenges of commercially operating drones in distribution and deliveries of goods.

Expected results from research:

The use of drones for commercial purposes will require to increase the supervision after hovering air vessels and improve the current processes of licensing them, for personal

[4] J. Hanhirova, A. Debner, M. Hyyppä, V. Hirvisalo (2020), A machine learning environment for evaluating autonomous driving software.

use or commercial use. In addition to that, a system or a program is required to monitor drones and their flights around sensitive areas and enforce aviation crimes[5] and prohibitions such as surpassing maximum carrying capabilities and irresponsible or dangerous flying. Considering all the above, it is clear that joining forces with governmental bodies is inevitable.

On the aspect of encouraging companies to invest in drones' technologies, it is important to provide them with a solid base for planning their aviation program Therefore, it is necessary to research and discuss the best algorithms for determining the flight efficiency of drones from a stationary or mobile distribution center to a destination in the context of the very different characteristic of metropolis in Israel.

Literature review:

Fields that have been researched sufficiently:

- The efficiency of skimmers in the context of energy per kilometer and greenhouse gas emissions, according to various parameters and in comparison to vehicles used for shipments in the present[6][7].
- Combination of delivery trucks and drones in the deliveries of goods[8].
- Comparisons between different algorithms for determining the ideal point for sending a drone from a truck.
- Distribution of sensitive goods, such as medicines and food, in the flight conditions of drones[9]

Fields requiring further research:

- Dangers associated with operating drones in high crime areas, such as interception and theft.
- Operation around security-sensitive areas.

[5] R. R. Beck. A. Vijeev, V. Ganapathy (2020), Privaros: A Framework for Privacy-Compliant Delivery Drones

[6] D. Wang , P. Hu, J. Du, P. Zhou , T. Deng, M. Hu (2019), Routing and Scheduling for Hybrid Truck-Drone Collaborative Parcel Delivery With Independent and Truck-Carried Drones.

7 M. W. Ulmer, B. W. Thomas (2018), Same-day delivery with heterogeneous fleets of drones and vehicles.

[8] J. K. Stolaroff, C. Samaras, E. R. O'Neill, A. Lubers, A. S. Mitchell, D. Ceperley (2019), Energy use and life cycle greenhouse gas emissions of drones for commercial package delivery.

[9] M. Sing Yee Hii, P.Courtney, P. G. Royall (2019), An Evaluation of the Delivery of Medicines Using Drones.

- Cost effective drones: Durable and expensive construction compared to cheap and available[10].

Companies of interests:

- Civil Aviation Authority of Israel
- Nando Technologies
- Israel Police
- Amazon
- Google

3. Preservation of private car shops and updating their knowledge, tools and set of skills

Purpose of research:

In the close future we will likely to see more smart cars driving around. Those are expected to be operated mostly by electric and have computerized OS which will have a direct connection to the headquarters of the manufacturers. The maintenance of those cars will be coordinated with the shop of the manufactures or updated via internet. Despite that, cars that are not modernized to level of smart cars will still need to go through their regular maintenance, but they will not be accepted in manufactures shop because the support to them will not be available any more. Therefore, it is important to creating a space that will allow the operation of private owned car shops in an era where car manuals aren't available to the mechanic and car systems are technologically challenging and computerized.

Expected results from research:

- Establishing a cooperation between car manufacturers and licensed garages with private garages in order to encourage skill and knowledge share.
- Collaborative storage of parts that are no longer in production in order to enlarge the repairing abilities of shops
- Encouraging garage workers to peruse formal and informal education in software and troubleshooting.

[10] M. Milhouse (2019), Framework for Autonomous Movement of Drones.

- Improving parts fabrication capabilities, with an emphasis on computerized machining and 3D printing.
- Methodology for routine maintenance and inspections of EV.

Literature review:

There are little to no literature in this subject, and therefore all subjects require deep and extensive research.

Companies of interests:

- Israel Garage Association
- All Car Manufacturer

Subjects not included in this paper

- 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.חוסר
  - Lack of familiarity with the many vehicle systems.שיטות לבדיקת
- 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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