Thesis Project Portfolio

An Analysis of Vehicular Telematics and Geo-Location Data to Maximize Road Safety

(Technical Report)

Policy and Integration of Different Technological Enhancement Gear in Sports

(STS Research Paper)

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Sunho Chris Oh

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Department of Systems Engineering

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Sociotechnical Synthesis

In scores of vehicle fleets, telematic tracking systems provide fleet managers with information regarding energy consumption, obedience of safety regulations and driver performance. For a University's Facilities Management (FM) Fleet to take the next step towards an elevated Sustainable Fleet accreditation and overall team performance, the management has recognized the importance of effective energy and safety tracking methods combined with data analytics and a comprehensive systems analysis in order to aid the reinforcement, training and maintenance of safe and sustainable driving practices by fleet drivers. This paper aims to demonstrate an effective method of identifying safety hotspots by analyzing safety surrogate measures, such as harsh braking, harsh cornering, speeding, and harsh acceleration from vehicular telematics data and correlating them with their geo-location information to enhance the safety of the University of Virginia's facilities management vehicles. Instances of safety surrogate measure violations were first validated with preventable accident data and subsequently mapped onto a cluster map and overlapped with crash histories. Vehicles from the facilities management fleet that caused the most instances of surrogate measure violations, were identified to be larger vehicles that run on gasoline and petroleum. Furthermore, false positives and outliers were removed from the data to maximize the number of true events. Once the data was cleaned, we investigated the cluster maps to identify safety hotspots. From the investigations, we will develop a list of comprehensive safety countermeasures, based on prior research, to address the safety infractions identified at each hot spot. These safety countermeasures will be recommended based on their likelihood of reducing safety violations. In addition, we will provide a comprehensive analysis on the applications in the surrogate measure method and telematics research that can be drawn.

"Policy and Integration of Different Technological Enhancements Gear in Sports" delves into the impact of technological advancements in sports gear on athletic performance, governing bodies' policies, and ethical debates. The paper focuses on two contrasting pieces of technology one of which faced significant scrutiny by their governing body, and the other of which was met with minimal policy intervention despite technological improvements. Firstly, the Nike VaporFly's, which was met with much controversy as it boosted a runner's speed by 5% to 6% in 2018 Marathon events, and its technology, science, impact on policies, and ethical dilemmas were explored. Then, the tennis racquet, more specifically the Wilson Tennis racquet, and its evolution, and the lack of response in terms of policy from the International Tennis Federation. By focusing on these contrasting examples, the paper delves into the controversy of the integration of these performance-enhancing technologies in the sports world. As seen from the analysis, the integration of these performance-enhancing technologies does not only focus on increased performance, but also raises questions regarding fairness, accessibility, and the integrity of the sport. These questions were looked at and addressed using the Social Construction of Technology (SCOT) framework and Winner's Framework of a political artifact. This paper also aims to address the ongoing controversy of the balance of innovation, equity, and integrity in sports technology through data collection from sports regulations, articles, and interviews with professionals. After the analysis of the two technologies and the ethical considerations concerning sports technologies, it was brought to the conclusion that sports governing bodies need additional policies that consider both the technological and socio-economic impacts of sports gear enhancements to embrace competitiveness and technological progress at the same time.

Through both my technical project and STS project, I will explore how different technologies like vehicles on the UVA campus and telematics data trackers and the technological gear advancements in sports, influence the development of the policies of their two respective worlds: UVA traffic and sports. For my technical project, I suggested different countermeasures that UVA could implement on their grounds to decrease the risk of accidents on the hotspots our team identified. To accomplish this, we incorporated Geotab telematics data from Geotab devices which was installed in each of the FM vehicle's. For my STS project, I also gave a recommendation for sports governing bodies to better regulate the integration of performance enhancers in sports. Both projects also employ a methodological approach to data analysis and policy evalution, aiming to not only enhance performance and safety, but also make sure that these technologies are ensuring the safety and equity of society. To summarize, through my analysis on both of these papers, these projects highlight the criticality of comprehensive policy frameworks and incorporate different technologies (Geotab Tracker and two performance enhancers like the Nike Vaporfly’s) to accomplish this.