Leveraging Operational Data from Urban Transportation EVs for Efficiency Improvement, Environmental Sustainability, and AI-Based Operational Optimization

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Abstract

In the field of sustainable transportation, urban electric last-mile logistics fleets represent a critical frontier. However, their operational efficiency remains constrained by limited data utilization as well as range limitations and charging infrastructure. This research presents a comprehensive analysis of how operational data from telematics systems can, and has been, utilized to improve fleet performance in the aspects of efficiency, environmental sustainability, and artificial intelligence-driven operational optimization.

By analyzing real-world case studies from fleet operators such as SIRO, Geotab deployments, and municipal EV programs, this research also underscores the significant benefits of using operational data such as extended driving range and lower energy consumption, while quantitative evidence from the case studies supports this.

The research particularly emphasizes the opportunity to harness the power of reinforcement learning (RL) applications for intelligent charging management and route optimization. Using Markov Decision Process models, RL agents can adapt charging and routing decisions to operational conditions, achieving near-optimal performance over time. Through the integration of telematics with artificial intelligence, operators can reduce operational costs, improve sustainability, and unlock the potential for autonomous fleet management. This paper also provides policy and technical recommendations, highlighting the significance of federated learning, edge computing, and smart-city integration for future research endeavors.

Using systematic evaluation, this paper argues that, in the current competitive landscape, data-driven optimization is not merely beneficial but essential for the future viability of urban electric transportation. The findings also provide insights for EV logistics companies seeking to leverage operational data for a competitive advantage while simultaneously contributing to wider sustainability objectives.

Introduction

Humans, from the very onset, have been involved in trading. This started in the form of barter, which then evolved with the advent of hard currency. In the early days, horse-drawn carriages were the primary mode of transportation, paving the way for the development of modern motor vehicles powered by internal combustion engines. Those who formed the agrarian backbone started migrating to cities. Fast-forward a few decades, and CompuServe, the first e-commerce company, was born in 1969. The World Wide Web, the internet that we know, was born in 1990, while the first secure online transaction was made in 1994. Amazon, eBay, Alibaba.com, and a thousand other online companies enabled $150 billion worth of business being conducted and fulfilled online by 1999 [1]. Today, in 2025, we expect e-commerce sales to reach an astronomical $7 trillion.

Same-day deliveries promised by Amazon and 30-minute delivery of groceries, all achieved by the click of a few buttons on the computer, has transformed the way we conduct business today. The fulfillment of these orders has resulted in a paradigm change in the way logistic companies function today. With millions of orders being delivered every day in every single city today, this has led to a phenomenal growth of vehicles and has astronomically added to pollution in cities. Global warming has become an existential threat today and this has led to an increased adoption of electric vehicles by logistics companies. At the face of it, electric vehicles appear to be the answer to all environmental challenges and the go-to option, either for transportation of humans or goods.

However, all new adoptions come with their share of challenges. Electric vehicles employed by logistic companies are no exception to the rule. Range anxiety, inadequate charging infrastructure, and slow charging times are some of the immediate challenges that EV logistic companies face today, which demand data-driven solutions for effective fleet management [2] [3].

This paper aims to demonstrate the substantial benefits that are available to EV urban logistics companies through the strategic utilization of operational data from telematics systems. Furthermore, the paper will argue that the application of advanced AI, specifically Reinforcement Learning, is the key to maximizing these benefits and achieving truly autonomous, optimized fleet management.

Research Methodology

To build a comprehensive argument, this paper uses a four-stage research methodology.

Stage 1: Foundational Concepts. The first stage establishes the paper's conceptual groundwork. It provides a detailed exploration of telematics systems and defines key operational data parameters. This foundational knowledge is essential for understanding the subsequent analysis.

Stage 2: Evidentiary Analysis through Case Studies. The second stage forms the evidentiary backbone of the paper. It involves the systematic analysis of real-world case studies from various fleet operators. This stage provides quantitative proof and qualitative insights to support the central thesis that telematics adoption yields substantial operational, financial, and environmental benefits.

Stage 3: Exploration of AI-Driven Optimization. The third stage investigates the advanced application of artificial intelligence to maximize fleet efficiency. This section focuses specifically on Reinforcement Learning (RL), detailing how this machine learning model can be used to solve complex, dynamic problems like intelligent charging management and real-time route optimization.

Stage 4: Practical Considerations and Future Outlook. The final stage addresses practical implementation challenges, including data privacy and economic considerations. It concludes by proposing future research directions and policy recommendations, such as the development of federated learning models and standardized data architectures, to ensure the full potential of telematics data is utilized.

By collecting and sharing real-world telematics data, EV logistics companies can provide data for AI algorithms that continuously improve decision-making. This creates a cycle where more data leads to better insights, which then drive improved efficiency and sustainability outcomes. If companies share their telematics data more widely, the entire industry can accelerate progress toward reducing carbon footprints and meeting sustainability goals. Since little research is publicly available today, this paper highlights the benefits already observed in companies using telematics, thereby encouraging broader adoption and data-sharing for collective improvement.

Background

a. What is Telematics?

Telematics encompasses the integration of telecommunication and information processing. In the field of vehicular or fleet telematics, this would consist of real-time capture of critical operational datapoints using onboard diagnostic systems, including sensors. These data points are transmitted via GPS, facilitating the storage and analysis of the collected information. In the field of fleet management, telematics is being used to track the location of vehicles, driver management, fuel management, health and safety management, and dynamic vehicle scheduling. [27].

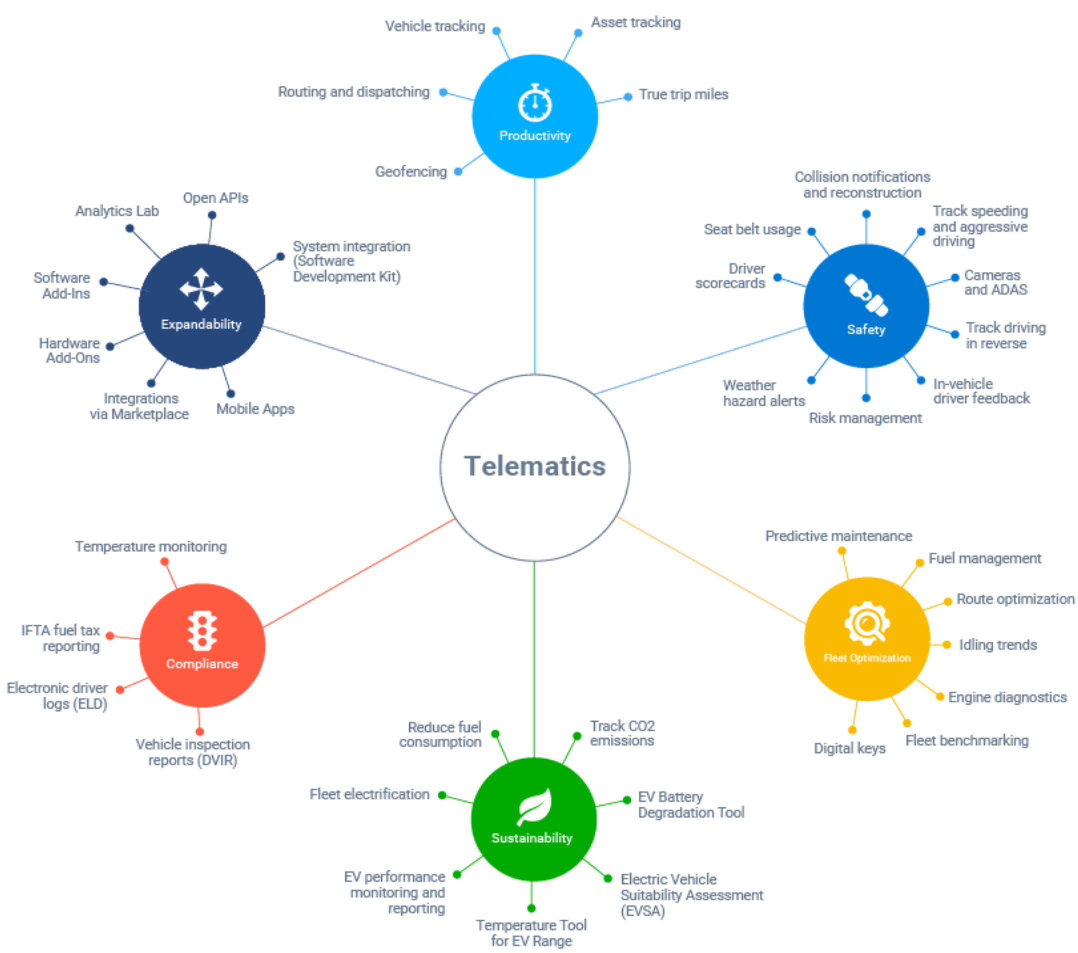


Figure. 1: The various applications of telematics [27]

b. Operational Efficiency Parameters/Performance Metrics in EVs and Telematics

Today, logistic companies look at a host of parameters and analyze them for effective electric vehicle fleet management.

- Vehicle Movement and Location Monitoring – this includes the real-time tracking of the vehicle location using GPS. Today, GPS systems are integrated with accelerometers and gyroscopes. Very often, accelerometers and gyroscopes are integrated into the Inertial Measurement Unit (IMU) [16]. Hence, while GPS helps track the start and end points of a trip, the IMU provides insights into the "how" of the journey. It gives insights about vehicular pitch and roll or any sudden lane changes. In other words, it gives information about driver behavior. Usage of GPS systems along with real-time traffic conditions along the route can enable proactive route optimization to stay away from traffic congestions, thereby saving time and money for the logistic companies.
  Unnecessary idling and aggressive driver behaviors reduce the driving range and can be used for training drivers not to do so. [4]

- Powertrain and EV diagnostics – On-Board Diagnostics (OBD) plays a critical role in measuring the performance of powertrain components, including the battery, motor, and power electronics. The battery is at the heart of an electric vehicle. The measurement of parameters such as the State of Charge (SoC, the measure of current battery level), State of Health (SoH, the measure of remnant lifespan of the battery) is critical in assessing the driving range, thereby reducing the range anxiety [5][17]. OBDs can also communicate with the charging infrastructure, enabling optimizing current flow based on battery temperature and thereby maximizing battery efficiency and elongating SoH. OBD also monitors motor performance, which includes RPM, motor temperature, current flow, and power output. If the actual operating parameters are outside of the optimal limits, the relevant Diagnostic Trouble Code (DTC) is generated and stored. At the time of maintenance, the codes are downloaded and reviewed, resulting in appropriate correctional steps being taken[18]. Regenerative braking systems enable the conversion of kinetic energy into electrical energy, which is then used to 'regenerate' the battery, thereby increasing the driving range of the vehicle. OBDs enable the monitoring of the efficiency and effectiveness of such braking systems [19][20].

- Driver behavior – AI-powered dashcams and telematics can be utilized extensively to study the driver's behavior. Details on instant acceleration, harsh braking, sharp maneuvering, and speeding incidents are captured for recursive training and coaching programs. Lesser accidents mean fewer injuries, lower repair costs, and reduced liability. Insurance companies promote the use of such devices by EV logistics companies by offering lower insurance premiums. [7]

- Energy Usage and Charging – Many EV logistics companies have onboard displays which show the current battery status and vehicle's energy consumption, including energy being generated through regenerative braking. Details about charging infrastructure available along the route and real-time occupancy of charging stations along with the kWh rates are available online, enabling the drivers to choose the appropriate route for maintaining charge for optimization and cost-effectiveness. At the end of each charging session, the charging equipment or companion app displays detailed information about the amount of energy transferred to the vehicle, the average charging rate, and the cost of charging the EV. [8][9][10][11].

- Maintenance and Health Tracking – With the deployment of sensors and telematics, a large amount of data is generated and transmitted real-time to the cloud, where AI-driven predictive maintenance ensures that the maintenance is not limited to the odometer-based maintenance alone. AI has enabled fleet managers to make note of any anomaly noticed through the battery management system (temperature, voltage, and current) or in tire pressure or brake-pad wear assessments. OBD interfaces provide access to standardized diagnostic trouble codes and readiness monitors that signal potential system malfunctions. Proactive and preventive maintenance thereby ensures less unscheduled downtime for the vehicles and ensures that the subsystems work efficiently and have an increased lifespan. [6][21][22][24]

- Environmental Metrics – AI can seamlessly integrate renewable energy sources into the charging ecosystem by predicting when solar or wind energy would be most abundant at a specific charging station. It directs the EVs to charge during those times rather than relying on electricity generated through fossil fuels. This not only helps cut emissions but also helps EV charging truly green. [13][23]

- Cargo and Asset monitoring – Theft of valuable cargo while in transit is the biggest contributor to goods being lost. Only a miniscule percentage of goods lost in transit are ever recovered. Logistics companies have employed sensors that alert the fleet managers if the cargo hold door is opened. This data is transmitted real-time to the fleet managers while the vehicle is en route to its destination. For electric vehicles that transport perishables like food, vaccines, and other pharmaceutical products, IoT temperature sensors are deployed in the cargo hold to monitor the temperature.[14] [15]

Real-World Case Study Analysis

During initial research, the primary goal was to find raw operational data from telematics systems. However, due to the novelty of this technology and certain NDA restrictions placed on this data, this raw data is not available to the public.

To overcome this issue, the idea to analyze pre-existing case studies came into view. This would allow for the primary goal of providing evidence for the arguments in this paper while

also implicitly utilizing data from telematics systems.

Milk & More

Milk & More is one of the UK's leading online grocery and milk delivery companies operating a fleet of close to 500 electric vehicles that include vans, trucks and trailers. With the aid of Geotab and LEVL Telematics, the company could now track the location of their delivery vehicles real-time and was always aware of the charging status of all vehicles. [26][27] The solution also enabled the company to measure the economic and environmental impact by transitioning to an EV fleet.

Andy Sandison, Head of Fleet at Milk & More, described 2 main challenges:

- “We needed access to real-world information on the use of our EVs so that we don’t have to rely on the manufacturer-stated capabilities, which are often quite different to reality.
- We wanted to assess driver behavior including harsh braking, acceleration, cornering, and speeding, in order to improve the safety of our drivers and other road users, and to optimize the ‘fuel’ economy of our electric vehicles.”

Starting 2019, Milk & More started with the installation of Geotab GO and GO RUGGED devices across all their fleet vehicles. The company hereby started receiving real-time information (operational data) on the location of the vehicles, speed and charge status. The Green Fleet dashboard provided customized reports also enabled the Milk & More fulfillment center managers to expand their weekly driver talks to include reports on driver behavior. Driver behavior also improved significantly with the active use of the Driver Challenge App.

The introduction of the Geotab telematics solution resulted in:

- A 21% reduction in speeding incidents
- A 19% increase in the EV range

Andy Sandison in his closing remark states –

“The benefit of having Geotab’s fleet management solution is that all the data flows into one stream. This allows us to see every vehicle’s performance on one screen, irrespective of vehicle type, which is of real value to our business.”

Overall, this case study explicitly demonstrates some of the benefits that can be gained by implementing telematics systems to receive real-time operational data.

SIRO’s Comprehensive EV Fleet Transformation

SIRO is a broadband network provider in Ireland with a fleet of 54 vehicles with 80% of them being electric. Nevo, their EV education-focused reseller conducted a 3-month trial using 3 EVs and 3 diesel-based vehicles. SIRO's implementation of Geotab's comprehensive telematics system demonstrates substantial quantifiable improvements across multiple operational metrics.

Metric	Performance vs Peer Group	Improvement
Fuel Efficiency (Diesel Vehicles)	5.4L/100km vs 7.1L/100km peer average	24% better efficiency
CO_2 Emissions	13kg/100km vs 17kg/100km peer average	27% reduction
Safety Score	88/100 vs 83/100 peer average	27% better performance
Speeding Events in Target Zones	Reduced over 3 months	76% reduction
DC Charging Overstays	Reduced over 3 months	6% reduction

SIRO has continued to replace their diesel fleet with electric vehicles based on data captured and analyzed through the telematics system. The data provides robust reasons to encourage their fleet drivers to adhere to cost-effective charging at home locations versus using expensive public infrastructure for their charging. The company continues to educate their drivers to use public infrastructure to minimal levels to enable them to come to their home charging depots for their full charges [28].

SIRO's success demonstrates the efficacy of comprehensive data utilization. The company can now track the proportion of charging events occurring at cost-effective home locations rather than expensive public infrastructure using charge-zone monitoring. Moreover, real-time SoC data allows for driver coaching, showing drivers when they could complete routes with lower battery levels rather than waiting for full charges, thus successfully highlighting the benefits of the inclusion of telematics systems.

GEOTAB's Comprehensive case study on Factors Impacting EV batteries

Beyond immediate fleet metrics, telematics data provides important long-term insights into asset management, most critically the EV battery. Geotab's analysis of data from 10,000 vehicles reveals how operational data from these vehicles can be used to determine factors that impact battery longevity.

Significant improvements have been made to the battery which now has reduced the annual degradation rates (amount of energy a battery can store) of the EV batteries from 2.3% per year in 2019 to 1.8% in 2024. This degradation is a measure of State of Health of the battery.

The below chart shows the battery degradation rates of 11 different EV models with age analyzed using Geotab telematics information.

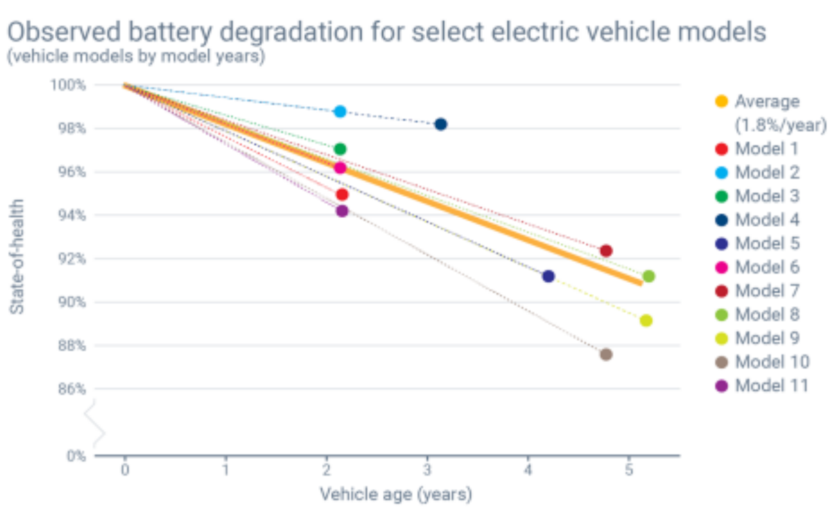


Figure. 2: Observed battery degradation for select electric vehicle models over five years of operation [29]

Batteries also degrade faster when operated in areas experiencing hotter climate.

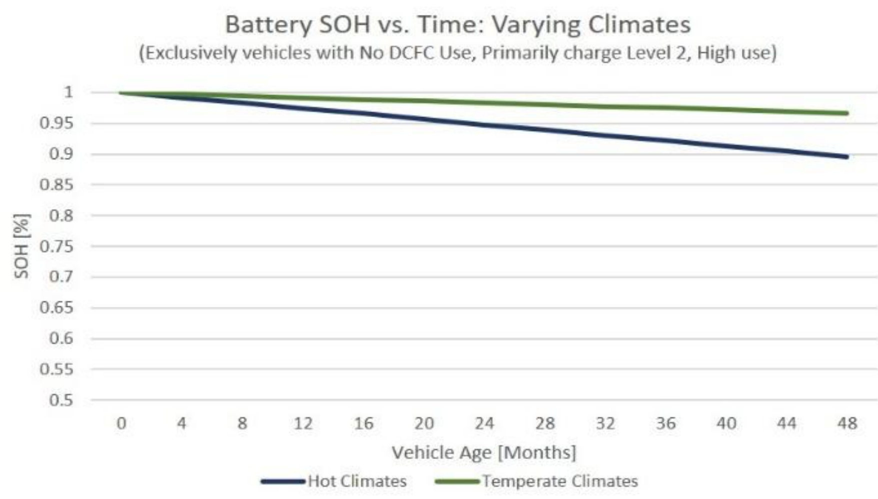


Figure. 3: *Observed relationship between battery degradation and climate type* [29]

Further analysis also has indicated that the rate of degradation in high-use vehicles is slower in comparison to EV that were sparingly used.

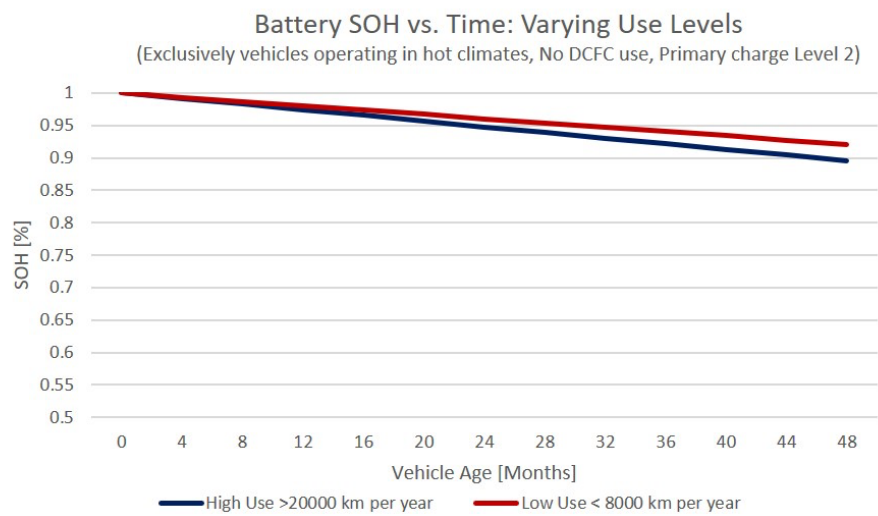


Figure. 4: *Observed relationship between battery degradation and relative EV use* [29]

North American EV charging stations are categorized into 3 types:

- AC Level 1 (120 volts) – a regular home outlet in North America
- AC Level 2 (240 volts) – typical for home or fleet charging
- Direct current fast charging (DCFC) – for faster top-ups

Batteries charged on level 2 have a slower degradation rate in comparison to level 1

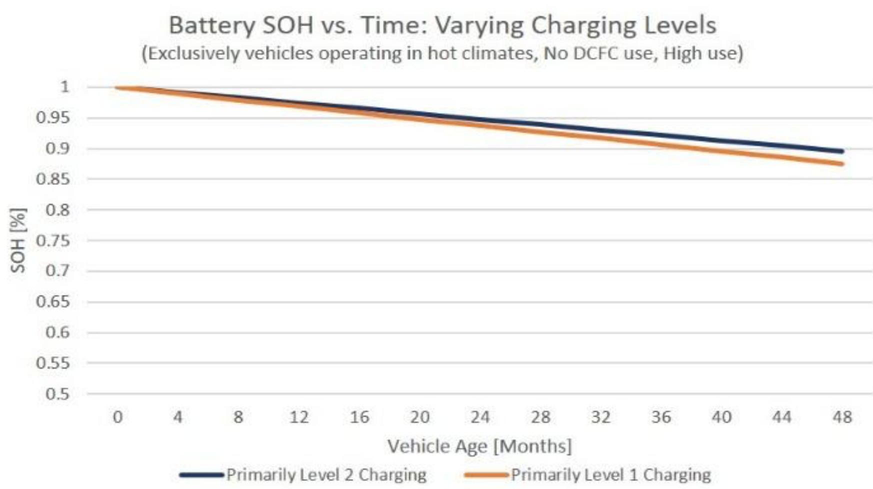


Figure. 5: Observed relationship between battery degradation and charging type [29]

And the degradation is a lot more pronounced when batteries undergo fast charging using DC current.

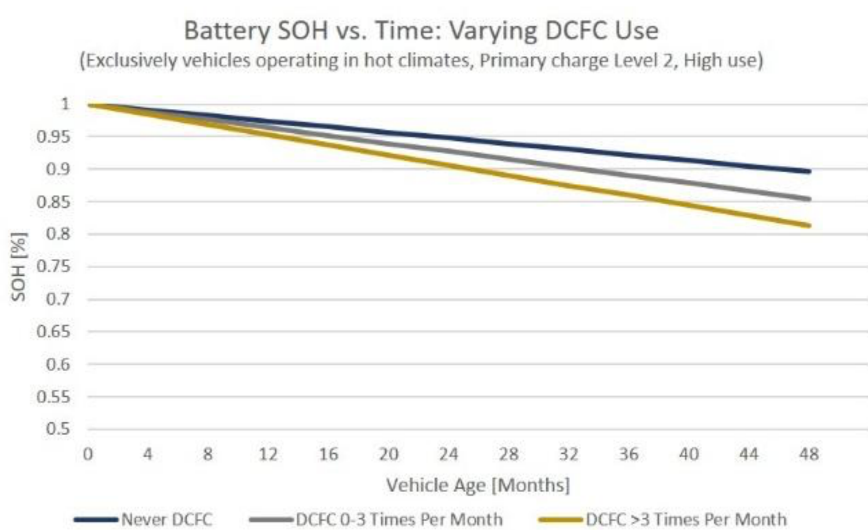


Figure. 6: Observed relationship between battery degradation and use of DCFC [29]

Based on the case studies, the following should be adopted for maximizing EV battery life:

- Limit the use of fast charging and prefer charging using AC Level 2
- Avoid operating in very hot environments while charging
- Maintain battery SOC between 20% and 80% while operating

- Avoid letting the vehicles sit with battery either fully charged or in a depleted state

Geotab's ongoing analysis, telematics tools, and supporting industry reports provide strong evidence that EV batteries are durable, practical for high-use applications, and cost-effective over the long term, dispelling common myths regarding their reliability and replacement needs [29].

This evidence demonstrates how telematics transforms EV battery management into a data-driven strategy, allowing fleets to extend battery life, reduce costs, and operate more sustainably, making telematics essential for long-term EV adoption.

Cobb County's Electric Vehicle Deployment Program

The EV WATTS (Electric Vehicle Widescale Analysis for Tomorrow's Transportation Solutions) pilot project was initiated in 2019 by the Department of Energy (DOE). Data collected from different types of electric vehicles was collected, validated, cleaned, anonymized, analyzed, and summarized from various EV technologies and applications. Data has been collected across different states that participated under the pilot project between 2019 and 2022. Cobbs Country from Georgia also participated and used telematics data as part of this pilot.

By analyzing data that they generated from 75 vehicles across 3 different departments, the county concluded that 90% of their less-efficient vehicles that operated less than 100 miles in a day were suitable to be replaced by electric vehicles. The operating cost of these less-efficient vehicles was between 60 and 90 cents per mile while the WATTS study highlighted that the operating cost would reduce to 20 cents a mile if operated using electric vehicles. Based on the findings, the county procured 40 electric vehicles and 26 hybrid vehicles for the state department. This resulted in the enhancement of environmental sustainability by reducing the carbon footprint, leading to the reduction of fuel bills by $100,000 and the simultaneous reduction of 342,000 pounds of CO_2 emissions [30][31].

This systematic approach of using telematics data to identify electrification opportunities ensures optimal resource allocation and operational benefit rather than arbitrary vehicle replacement, vying for the use of telematics systems.

Madrid Municipal Fleet CO2 Impact Analysis

Madrid along with Stockholm, Munich, Ruse and Turku formed a consortium that undertook the ECCENTRIC project to come up with innovative ideas in terms of sustainable mobility. As part of the program, Madrid municipal council wanted to study

- The environmental performance of electric vehicles
- How charging grids could be optimally utilized

A set of 19 light-duty vehicles in Madrid were fitted with GEOTAB GO devices to undertake the study. The GEOTAB devices captured the following information as part of this study:

- Distance traveled
- Daily range of EVs
- Daily electrical energy consumed
- Average energy consumption of each vehicle

Thanks to the study and the insights from usage of telematics data, Madrid City Council reduced their carbon footprint by 60%, equating to 1 ton per month, on a fleet of 19 vehicles that were part of the study. Today, Madrid City Council employs a 100% electric fleet. [32][33].

This case study demonstrates how telematics systems can be used to optimize EV fleet performance for sustainability objectives.

Across these diverse case studies, from a private UK grocery service to a Spanish municipal fleet, a clear and compelling pattern emerges. The systematic implementation of telematics consistently yields substantial improvements in key operational metrics:

Case Study & Location	Fleet Profile	Telematics Solution	Key Challenges Addressed	Quantifiable Outcomes
Milk & More, UK	500+ EVs	Geotab + LEVL	Real-time performance tracking, driver behavior, charging management	19% EV range increase; 21% fewer speeding incidents

SIRO, Ireland	54 vehicles (80% EV)	Geotab via Nevo	Optimal charging management, safety, route efficiency	76% fewer speeding events; improved energy efficiency; 6% reduction in DC charging overstays; 27% CO_2 reduction
Geotab Battery Study, Global	10,000 EVs	Geotab	Battery longevity and operational insights	Reduced annual battery degradation from 2.3% to 1.8%; identified best practices for SoC, charging methods, and temperature management
Cobb County, USA	75 EVs across municipal departments	DOE EV WATTS	Identify under-utilized vehicles for EV replacement	90% of low-mileage vehicles replaced with EVs; $100k operational savings; 342,000 lbs CO_2 reduced
Madrid City Council, Spain	19 light-duty vehicles	Geotab GO	Environmental performance tracking, charging optimization	60% carbon footprint reduction; informed transition to 100% electric municipal fleet

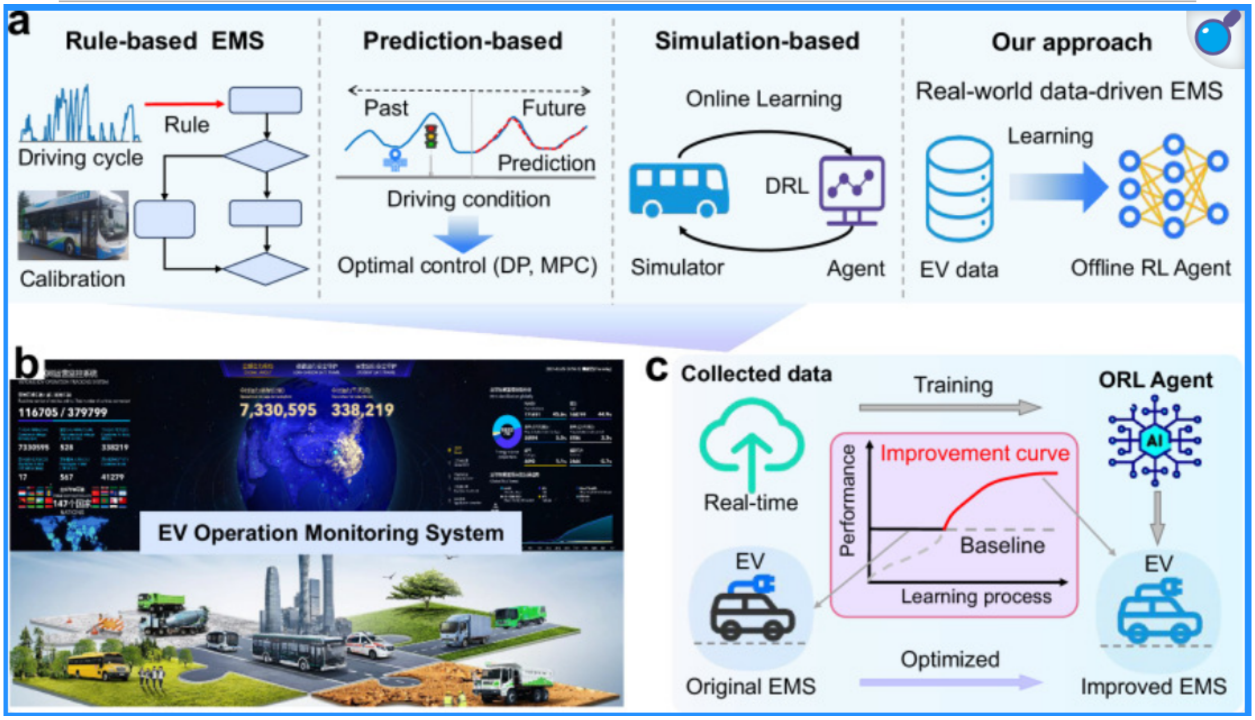
This collective evidence provides proof that the use of telematics is not a marginal improvement but a foundational tool for modern EV fleet management.

Deep dive into Reinforced Learning

A. Charging Management

One of the areas where reinforced learning framework is being leveraged is charging management. By using telematics systems in electric vehicles, billions of datapoints have already been generated and stored. A significant amount of research work has now been initiated to harness the power of this data captured under different operational environments by use of reinforced learning agents.

The initial approach adopted to train the agent was through offline reinforced learning as historical operational data was already available. Today, with a base framework in place, reinforced learning for charging management is through sequential and dynamic decision-making problems of agents that can gradually by utilizing experiences acquired from their repeated interactions with the environment.



The Markov Decision Process has been used for reinforced learning models and its improvement is based on a rewards function [34][35].

In the case of charging management:

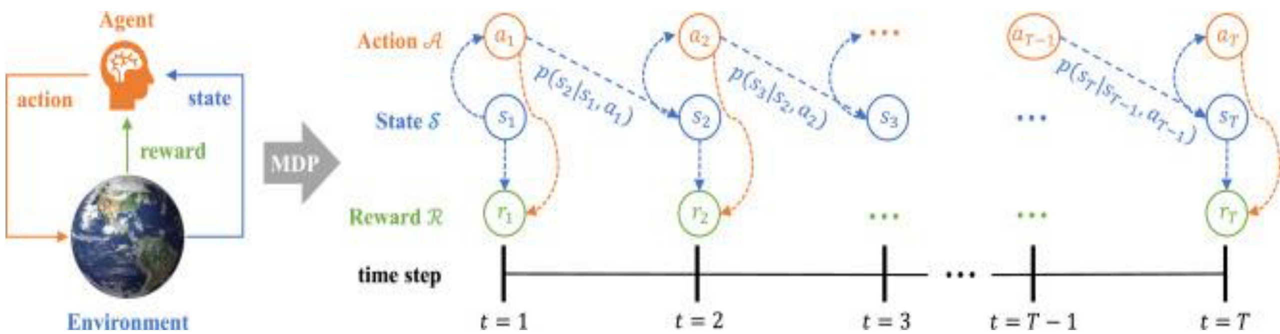
- The agent is the electric vehicle which ultimately is the decision-maker and decides on the specific charging station that needs to be selected by the EV, the time when the EV needs to reach the charging station and the amount of charge that the EV needs to energize to.

- The environment is defined as the energy management system model of the EV battery that can generate a new state.

- The state is the description of the environment. In our example, this would consist of parameters that include current state of the battery (SoC), temperature of the battery cells and the cost of charge available at various charging points.

- The action is the decision taken by the agent. In our example, this would include deciding on the time when the charging needs to happen, degree to which charging needs to happen and the appropriate charging station that needs to be used for charging purposes.

- After the agent takes a decision, a reward (either positive or negative) is given to the agent based on the outcome of the decision taken. If the agent's decision leads to the greatest savings, it is positively rewarded, and the decision is deemed suitable for reinforced learning.



In summary, telematics data and reinforced learning can significantly improve efficiency and sustainability. RL-based energy management can maximize each charge cycle's benefit. Such RL-based improvements in decision making across multiple sub-systems unlocks new capabilities for EV fleets.

B. Route Optimization to enable last mile delivery

Last mile deliveries refer to the delivery of the order from the last distribution center to the consumer's doorstep. In urban cities with dense population, dense traffic and limited space, the last mile connectivity ends up being the most challenging part of the supply chain ecosystem. Studies show that last-mile delivery can constitute up to 53% of total shipping costs, owing to the need for speed, accuracy, and flexibility in urban environments.

Today, innovative strategies are being employed using AI and EV technologies. AI-powered tools are being used in optimizing routes, predicting energy consumption, and enabling real-time EV fleet management. Sensors are being placed in strategic locations, such as areas with high vehicle density, to study the real-time urban traffic flow. This form of real-time granular traffic data is being fed into routing algorithms.

ECO Logistica, a logistic company in Lisbon, has redefined their operational framework for last mile delivery. They use large vans for bulk transporting to the City Consolidation

Center (CCC) and then utilize small EVs and drones for efficient delivery to their destination.

AI is employed, which tracks the real-time traffic situation within the urban center, monitors the SoC for the vehicle, keeps the availability of charging stations in context, and then chalks out the delivery route. Continuous feedback mechanism followed with AI-driven adjustments contribute towards improvements in last mile delivery. So far, the company has witnessed a 15-20% reduction in delivery times, a 10-25% savings in energy utilization and up to a 40% decrease in greenhouse gas emissions.

The findings confirm that the synergy between EVs and AI provides a robust and scalable model for achieving sustainable last-mile logistics, therefore supporting broader urban mobility and climate objectives [36].

Challenges and Limitations

A. Data Privacy and Security Concerns

Researchers have identified that automakers have been collecting significant amounts of personal data outside the purview of vehicle operation by using front-facing cameras and sensors. Drivers have been monitored even when they are off duty. Based on a study conducted by Mozilla Foundation, 84% of the automakers ended up sharing or selling this personal data [37][39].

Given that EVs are connected digitally, there is always the risk of being hacked. In an incident reported in Wired magazine in 2015, a jeep’s air conditioning, radio and windscreen wipers were remotely accessed, and the vehicle’s transmission was cut off. The situation was later remedied through a software patch, but the concern still remains as long as the EV is connected to the internet [38].

B. Technology Integrations and Interoperability

As newer technologies make their way, the success of the rollout relies heavily on the integration with the legacy systems. These may not be compatible with the latest telematics solutions and therefore would need upgrades or replacements. This incurs additional costs and time overruns for the implementation of newer technologies [40].

C. Economic Considerations

The cost of implementing telematics systems consists of telematics hardware, its installation fees, monthly subscription fees, integration cost, and the training cost, to name a few. The cost of telematics depends on the provider, features subscribed for, size of the fleet, and so forth. Advanced functionalities such as real-time vehicle tracking, driver behavior monitoring, and vehicle diagnostics may incur higher costs. However, the potential for cost reductions through benefits such as energy savings, expedited deliveries, and reduced downtime of electric vehicles due to proactive maintenance more than compensates for the investment in telematics. Many small logistics companies have yet to capitalize on the power of telematics due to upfront costs. [41][42].

Recommendations and Future Directions

A. Cost-Effective Sensor Architecture Implementation

Based on analysis of available technologies and various telematics and fleet-management solution providers, this research recommends a multi-tiered sensor architecture that considers both capability and cost-effectiveness. The proposed E/E architecture below integrates sensing modalities while also maintaining economic viability for fleet operators.

Priority Tier	Components	Cost Range (depending on telematics company)	Primary Benefits
Essential	OBD II interface, GPS tracking, basic accelerometer	$50-150 per vehicle	Location, basic diagnostics
Standard	Essential + Enhanced OBD II, TPMS, temperature monitoring	$150-300 per vehicle	Comprehensive monitoring
Advanced	Standard + AI dashcams, advanced IMU, environmental sensors	$300-600 per vehicle	Predictive capabilities
Premium	Advanced + Multi-sensor fusion, edge computing, 5G connectivity	$600-1000+ per vehicle	Optimization in real-time

[41][42].

Fleet operators should ideally implement essential-tier capabilities across all fleet vehicles, and then selectively deploy higher tiers depending on the operational requirements of the fleet operator.

B. Policy and Regulatory Recommendations

To encourage the widespread adoption of telematics systems for EV fleets, governments and other regulatory bodies could consider implementing incentive programs. Examples could be tax credits, rebates, grants, or reduced regulatory compliance costs for fleets implementing these telematics systems. Although this could result in short-run costs to the regulatory bodies, the overall long-run costs would show a decrease as there would be significant environmental benefits from these implementations. [44].

Standardization efforts should aim to make it easier for different telematics providers and vehicle systems to work together smoothly. Industry groups should create shared data formats and communication rules to make integration simpler and less expensive. [43][45]

C. Advanced AI Implementation

Organizations that seek to implement AI capabilities should follow a structured approach that builds this capability gradually. Starting with basic data collection and visualization, organizations can, over time, implement more sophisticated analytics and algorithms for optimization as data quality and organizational capability matures [21] [35]. This would allow for the AI capabilities to display their maximum efficacy.

An idea of what a sample AI progression roadmap may look like is shown below:

Foundational Phase (Months 1-6) Establish data collection, implement basic analytics dashboards, train staff on data interpretation

Analytics Phase (Months 6-18) Deploy predictive maintenance algorithms, implement route optimization, establish performance benchmarking

Optimization Phase (Months 18-36) Introduce reinforcement learning algorithms for charging optimization, implement multi-objective optimization, develop AI models

Advanced Phase (Months 36+) Deploy federated learning systems, implement real-time adaptive optimization, integrate with smart city infrastructure

D. Future Research

Based off the analysis in this paper, several promising research directions emerge.

Federated learning enables fleet operators to collaboratively improve models without sharing raw telemetry data, thus preserving competitive and regulatory data privacy. Complementarily, edge computing architectures process data closer to the vehicle (onboard or at nearby edge nodes), substantially reducing latency and improving the timeliness of real-time decisions such as anomaly detection and predictive maintenance. [46] [47]

Furthermore, integration with smart city infrastructure represents another significant opportunity. Deploying EV fleets as mobile sensor networks allows for the dynamic mapping of street-level air pollution and traffic congestion. This approach enriches urban planning perspectives and contributes to broader urban sustainability objectives by transforming vehicles into distributed data collectors. [48]

Conclusion

This research paper demonstrates how leveraging operational data from urban transportation electric vehicles represents a transformative opportunity for improved efficiency, environmental sustainability, and operational optimization. Evidence from real-world case studies across various fleet operations – from Milk and More's comprehensive telematics and EV-fleet transformation to the EV WATTS pilot project – provides compelling quantitative validation of the possible benefits that are achievable by systematically utilizing operational data from telematics systems.

The exploration of reinforcement learning applications for charging optimization illustrates how sophisticated AI capabilities are now becoming practical for fleet deployment. This is displayed through the logistics company ECO Logistica, that was able to utilize AI to gain significant benefits such as a reduction in delivery times, energy utilization, and greenhouse gas emissions. However, successful implementation requires a consideration of possible challenges, including data privacy, technology integration, and economic constraints.

Looking to the future, the possible integration of EV fleets with smart city infrastructure and the development of federated learning systems for knowledge sharing will further enhance the importance of data-driven fleet optimization. The economic and environmental benefits from these possible uses ensure that these capabilities will become increasingly important to help better the world we live in.

In the competitive landscape of urban logistics, the use of operational data, telematics, and AI-driven optimization is no longer optional. It is an essential strategy for survival and profitability in the electric age. The future of urban logistics belongs to organizations that recognize operational data as their most valuable strategic asset. For these innovative, implementing the systems necessary to transform that data into a decisive competitive advantage is not just a path to success—it is the very definition of it.

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