WHITE PAPER

TATA CONSULTANCY SERVICES

3C-Enabled Fleet Management: Enhancing Safety, Operational Efficiency, and User Experience

Abstract

In the era of Industry 4.0, emerging digital technologies are transforming the way fleet management companies conduct business. It is imperative that they deliver the right material at the right time along with providing personalized solutions, reducing operation costs, and enhancing safety amid the COVID-19 onslaught. Advanced technologies will help in developing a connected, collaborative, and cognitive fleet ecosystem to collect, analyze, and generate intelligence from data to maximize fleet efficiency and help customers control their logistics costs.

This paper explores the role of internet of things (IoT), artificial intelligence (AI), machine learning (ML), and blockchain to build a connected, collaborative, and cognitive (3C) fleet management system. It also throws light on how a 3C-enabled fleet management solution can help address the current challenges in fleet safety for enhanced compliance, operational efficiency, and user experience.

Building a Cognitive, Collective, and Collaborative Fleet Management System

As technology has evolved over the decades, so has fleet management, which today is underpinned by digital technologies such as artificial intelligence, IoT, digital twin, conversational platforms, augmented and virtual reality, wearable technology, and blockchain. The convergence of these technologies will make fleet management connected, collaborative, and cognitive (3C).

To enable 3C in fleet management, firms need to implement a cloud-based fleet management software (FMS) to perform end-to-end operations over the life cycle of the fleet (see Figures 1 and 2). In fact, demand for cloud-based FMS is projected to expand at a compounded annual growth rate of 11.3% reaching $34 billion in 2025[1].

Figure 1: *Technologies enabling 3C fleet management*

However, building an intelligent fleet management system that equips organizations with valuable insights for autonomous decision-making requires leveraging the right technology such as IoT and AI. Devices mounted on vehicles continuously transmit data that can be collected and shared with other IoT devices or with standard cloud platforms at a predefined interval. This data can be processed to infer intelligence and develop an ingenious system that provides real-time visibility on fleet operations, empowering fleet management systems to identify operational inefficiencies in a connected fleet ecosystem. Such a connected system enhances collaboration among stakeholders such as fleet owners, fleet managers, original equipment manufacturers (OEMs), drivers, shippers,

[1] Markets and Markets; Fleet Management Market by Solution, Service, Deployment Type, Fleet Type, and Region - Global Forecast to 2025; June 2020; Accessed July 13, 2020; https://www.marketsandmarkets.com/Market-Reports/-fleet-management-systems-market-1020.html

government agencies, and financial institutions. While IoT helps build a cohesive system, AI makes the system intelligent by transforming the connected system into a cognitive one with machine learning, reasoning skills, and natural language communication. This helps process complex data types such as sensor data, videos, images, and global positioning system (GPS) data to generate intelligence in real-time. However, here, systems require initial training based on historical patterns and learnings to predict the unseen future. This in turn helps in clear decision-making, mitigating the risk of failure and improving fleet operations productivity by leveraging the following:

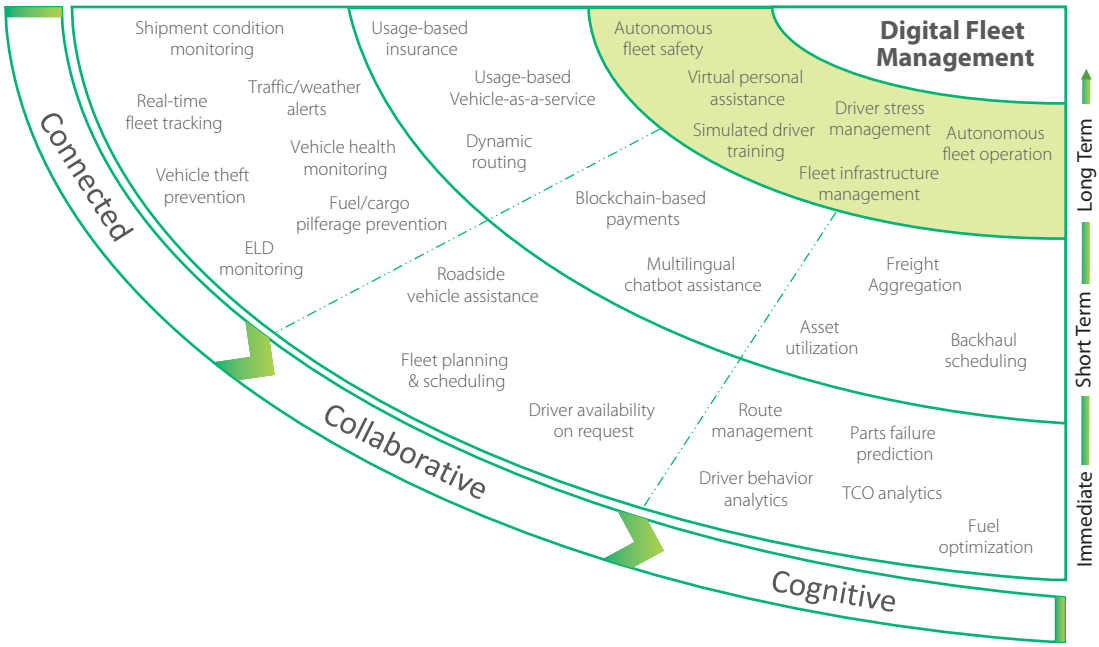

Figure 2: *Connected, collaborative, and cognitive (3C) fleet management*

- **Embrace Autonomous Safety for Enhanced Compliance**

  In the COVID-19 era, safe fleet operations are one of the highest priorities. In fact, in the US, over 160,000 large truck collisions occurred during 2019, resulting in 3% fatalities[2]. At the same time, with the US Federal Motor Carrier Safety Administration (FMCSA) relaxing the electronic logging device (ELD) regulations, drivers are driving for longer hours to ensure continuity of the supply chain, resulting in fatigue[3]. 3C-enabled fleet management minimizes the risk of incidents by tracking the driver's condition and monitoring stress levels in real-time. For example, heart rate sensors installed in hand clip devices can relay data about the driver's body state and external ambient conditions. Similarly, eyelid/retina movements and facial expressions can be observed from wearable glasses and cameras. In addition, a cognitive system can analyze a driver's

[2] *Federal Motor Carrier Safety Administration; Analysis and Information: Crash Statistics; https://ai.fmcsa.dot.gov-/CrashStatistics/*

[3] *Federal Motor Carrier Safety Administration; US Department of Transportation Issues National Emergency Declaration for Commercial Vehicles Delivering Relief in Response to the Coronavirus Outbreak; March 13, 2020; https://www.fmcsa.dot.gov/newsroom/us-department-transporta-tion-issues-national-emergency-declaration-commercial-vehicles*

condition using real-time data, correlating it with historical driving patterns to predict possible accidents and trigger safety alerts or help the driver apply vehicle brakes indigenously when required.

The fleet management system also manages warehouse operations and safety compliance inside a yard. According to the latest data available with the US Bureau of Labor Statistics[4], between 2011 and 2017, more than 75 fatal injuries and more than 7,500 non-fatal incidents, including with forklifts, happen inside the factory. Connected forklift fleets enabled with IoT sensors, actuators, cameras, and radars connect the entire warehouse ecosystem, and help in the identification and prevention of accidents due to hidden/unseen objects. For instance, a cognitive system allows forklifts to detect any possible hazards, and make decisions on their own to regulate speed and avoid fatal and non-fatal injuries. To ensure compliance with COVID-19 safety measures, companies can also leverage FMS for contactless operations, from the time the vehicle enters the plant to when it exits, keeping track of the driver's movements and their touchpoints to trace any possible transmission of the virus.

- **Leverage Voice-Enabled Fleet Operations**

  In the COVID-19 scenario, logistical constraints are changing rapidly, with real-time, accurate information playing a pivotal role in seamless fleet operations. In the current scenario, fleet managers need to navigate through different and often disparate systems and dashboards to get information on dispatches, drivers, and vehicles. A virtual personal assistant such as Alexa, linked to a 3C-enabled fleet management ecosystem can significantly maximize the fleet manager's ability to collect information and improve user experience. Fleet managers can simply ask a series of questions and get information about dispatches, injuries, violations of safety, operational costs and revenue, daily driver turnover, vehicle maintenance status, and more. Virtual assistants are not only equipped to provide information, but can also assist the fleet manager in executing numerous tasks. For instance, Alexa can inform fleet managers about a road accident, helping them avoid the congested route, and share this information with the health, safety, and environment (HSE) department and other stakeholders for further investigation.

- **Increase Uptime and Reduce Idle Time**

  3C-enabled fleet management is constantly improving fleet operational efficiency throughout the fleet life cycle across onboarding, operations, and retirement. A blockchain-based connected network can leverage the carrier's data from a

[4] US Bureau of Labor Statistics; Occupational Injuries, Illnesses, and Fatalities Involving Forklifts; June 2019; https://www.bls.gov/iif/oshwc/cfoi/forklifts-2017.htm

decentralized network to assist associated members in verifying every record. This helps fleet operators onboard a carrier immediately, access the network, and assign load to minimize delay in shipments. In addition, smart contracts maintained in the blockchain help in automatic and faster payments as soon as the delivery is completed, thus reducing the lead time and delays associated with manual invoicing and billing.

Similarly, the fleet management system continuously collects a large amount of data from the vehicles, cargo, and external stakeholder systems to predict any operational failure. For instance, it can connect to government systems to gather the latest information on coronavirus hotspots and use this information for fleet planning to minimize the driver's exposure to the virus. In another scenario, sensors can capture degrading moving parts such as any damages and oil level drops to predict parts failure and schedule predictive maintenance for vehicles. However, this scenario can become complex with increasing use of autonomous trucks in the future, as they use multiple sensors and the failure of any sensor could be extremely hazardous while the truck is on the road. It is, therefore, crucial to conduct frequent sensor checks apart from regular and predictive maintenance. A cognitive system can consider such constraints and plan systematic sensor checks at partnered service centers. This will help reduce idle time and increase a truck's uptime.

Overcoming Key Challenges for Successful Digital Fleet Management

The connected fleet ecosystem encompasses a colossal network of connected devices which becomes increasingly complex with the use of a wide variety of device makes and models. These devices continuously collaborate to create a thriving fleet ecosystem. For companies to realize the full potential of fleet management systems, it is crucial to overcome key challenges (see Figure 3) including the following:

Ensuring data security and data flow: In a connected fleet ecosystem, devices are connected using multiple frequencies and any conflict in the transmission frequency impacts communication across the ecosystem, resulting in crucial data loss. This requires building trust and ownership of data in the ecosystem to overcome potential entry points for data hacking and business insights leakage.

Synchronizing data: Standardizing data collection templates rapidly synchronizes assorted data and processes it on the go for real-time decision-making.

Improving device management: Currently, installed wireless devices need frequent battery recharging or replacement and any delay in power backup disconnects the system. This requires better device management to keep track of device onboarding and maintenance for increased uptime.

Training the system: Improving system intelligence using the right data set and time frame helps train the system in a precise manner ensuring greater processing accuracy, before it is applied to live conditions.

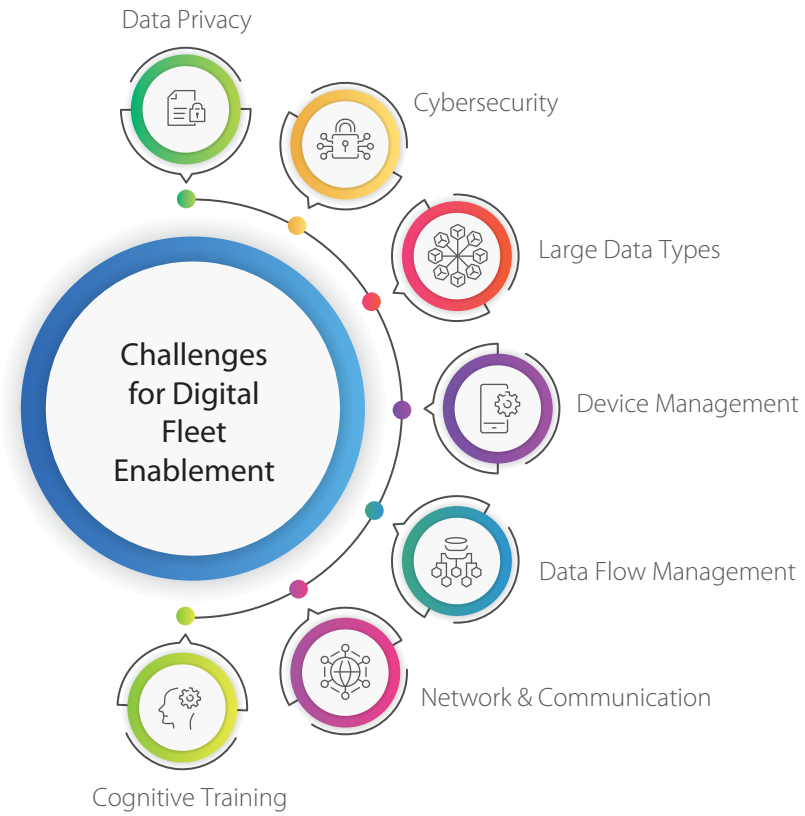

Figure 3: *Managing key challenges for successful fleet management*

Driving Innovation with Digital Fleet Management

The increasing adoption of new-age technologies such as IoT, AI, ML, and blockchain is transforming fleet management into an agile function that can continuously learn from a dynamic ecosystem and interact with humans alike. A 3C-enabled fleet management system not only helps fleet management companies take advantage of technology but also ensures data privacy, security, and seamless data communication. With a change in business strategy, transformed cultural mindset, continuous product innovations, and improved infrastructure, organizations can embrace the full potential of digital fleet management solutions while ensuring superior fleet operations, healthy working conditions, and enhanced user experience.

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