WASTE MANAGEMENT

Forgoing New Pathways: The Next Evolution in the
Waste Management Field

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Growing Challenges And Demands On The Waste Management Forefront

As the global population continues to grow, the waste generation is increasing at an alarming rate. The World Bank projected that the overall waste generation would increase to 3.4 billion metric tons by 2050, and the daily per capita waste generation in high-income countries is projected to increase by 19% by 2050.

The unprecedented pandemic of COVID-19 further accelerated this growth. There has sharp increase in household waste generation in many cities contributed by increasing online shopping, home renovations, and people spending more time at home. The municipal waste collection services have been heavily scrutinized by the public and are under constant stress. The reality, however, is that they face significant resource shortage which undermine their ability to cope with growing demands.

Projected Waste Generation in North America

(Chart: y-axis "Millions of Tonnes/Year" from 0 to 400; x-axis "Year" showing 2016 ≈ 290, 2030 ≈ 340, 2050 ≈ 395)
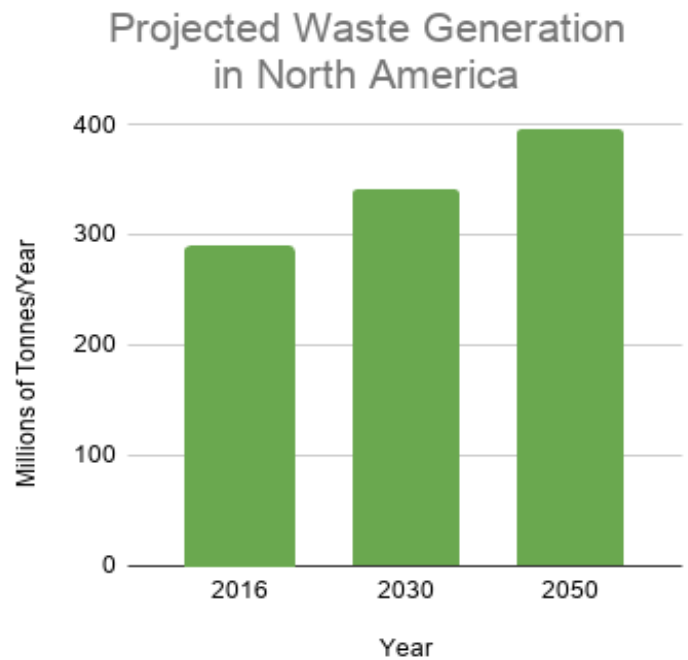
Technologies That Will Transform Our Cities

In addressing these challenges, the government turned the eyes on adapting emerging technologies and advanced data analytics systems to revolutionize how the city is managed. The digital transformation powered by the smart sensor, IoT (Internet of Things), artificial intelligence, and machine learning will enable a new and exciting future. A future that is smarter, safer, more sustainable, more efficient, and more cost-effective in every operational aspect when it comes to community and city management.

Waste management is an important experimental field to put all these innovations into real-world testing and see how they will digitalize and transform the waste collection services. By building an integrated cloud-based data management platform that connects every piece of waste management infrastructures, tools, vehicles, and equipment, there is a great opportunity to improve existing waste collection strategy and develop new algorithms that center on fleet efficiency and utilization improvement.

Governments across the globe have recognized the increasing importance of transitioning into a greener and safer society. The pollution, road accident injuries and deaths were costing the society billions of dollars every year, and it's simply untenable to let this trend continue. The new smart data management solutions take on this challenge and use cameras, recording devices, and advanced sensors to monitor fleet emissions and secure safe operations of vehicles. With the future evolution in the electric and autonomous vehicle field, a completely zero-emission, automated operation fleet is well within reach.

Why Waste Management Industries
Are Falling Behind On Digital Transformation

Though the technologies are quickly progressing and evolving in many other fields, the technology adopted by the waste management industry, especially those carried by municipal waste collection services, hasn't kept up with the evolving trend. The lack of digitalization of waste management assets made it difficult for the central management team to monitor and manage municipal assets and resources.

Absences of Bin Connectivity

The garbage bin, one of the most common waste disposal assets, hasn't changed too much in the past decades and is long overdue for a redesign. The existing bin design has been criticized for lack of digital connectivity with the central system and an absence of smart sensors that measure the bin status, fill level, locations, temperatures, and many other crucial metrics.

The shortfall in the technological features made the bin assets management an extremely resource-intensive task that requires human labors to conduct manual field checks to confirm the conditions and status of bins scattered across the city.

Inefficiency in Operations

The insufficiency in data collection from the bins also adversely impacts how the system plans out and programs waste collection trucks' routes. The program automatically assumes that vehicles need to stop at all bin locations and generate and assign routes to fleet vehicles to ensure that all bins will be serviced.

However, in a real-world scenario, not all bins require services for several reasons, such as a low bin fill level. This results in an unnecessary waste of resources and increased operational fuel costs since drivers were spending extra time and extra mileage to service bins that do not require it.

Vandalism of Public Assets

Garbage bins and recycling containers may attract vandals, criminals, and thieves, which they might vandalize, destroy, burn, or move the bins. This creates enormous challenges for waste collection truck drivers as they might need to devote extra time looking for bins that have been misplaced. These situations significantly slow down the waste collection process and reduce the overall efficiency of the fleet operations. The loss of public assets also means that cities need to spend extra money to replace and recover broken or missing bins, creating additional financial burdens.

Lack of Clarity in Driver Information Interface

Waste collection drivers also face a lack of assisting technologies to help them make informed decisions. Drivers deserved to have a user interface that clearly illustrates their upcoming tasks, planned routes, and bin information. The highly interactive and informative mobile user interface will help drivers streamline work progress and facilitate real-time inventory updates. Another highly anticipated request from many drivers is better navigation and route optimization, which factors in live traffic conditions, road imitations, and construction updates. An efficient fleet management solution works the best by always putting vehicles on the fastest, safest, and most cost-effective routes.

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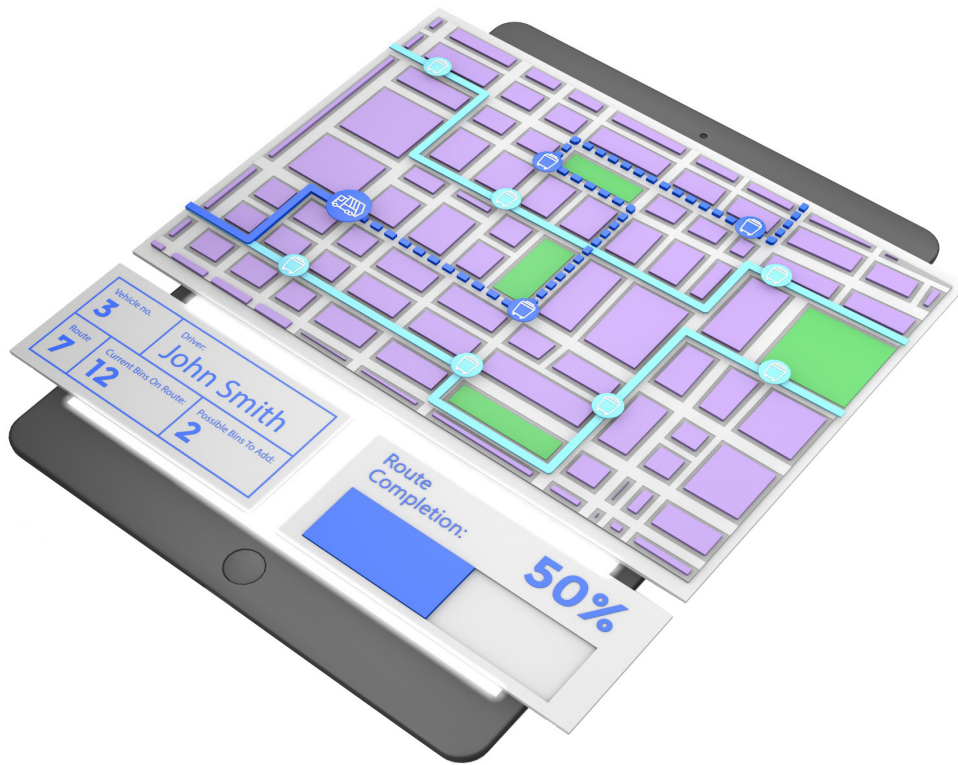
Hidden Safety Risks

Fleet safety and employee safety are always the top priority for any fleet managers and governmental organizations. Current waste collection drivers are confronted with situations that they cannot obtain a clear and full view of their vehicles' surroundings when making stops or operating vehicle equipment. This could be a serious hidden danger for equipment operators and vehicles or pedestrians passing by. Considering that many of the garbage collection work was happening overnight and conducted in a relatively dark environment, a 360-degree monitoring solution can provide vehicle operators and drivers with the confidence, visibility and assurance that they need.

The driver fatigue and distracted driving behavior could undermine the fleet safety record and result in severe road accidents causing injuries or deaths. The urban road networks and traffic conditions are notoriously known for their complexity and difficulties for driving. Operating large waste collection vehicles among the heavy traffic and narrow roads require extra attention and carefulness from drivers. However, it's essential to recognize that even the most skillful drivers could make mistakes that put others and themselves in danger. An extra layer of safety protection is required to safeguard the driver's safety and help improve community safety for all, and technology plays a prominent role in the process.

Respond to Customer Complaints

Though in most cases, vehicle operators don't make direct contact with residents and consumers, waste collection is a vital public service that puts public satisfaction in mind. Waste collection operators often encounter situations where residents complain about why their garbage bin wasn't getting cleared. It's difficult for fleet managers to determine who is at fault without image and video evidence in situations like this. This could hurt the government or brand reputation and cause a lack of trust in waste collection services from communities.

New Opportunities Emerged From The Pandemic

The COVID-19 pandemic has significantly changed our lives, but it also brings new opportunities and pushes for changes and innovations in many industries. For the waste management field, the increases in household waste and hazardous waste have presented new challenges for waste management organizations.

The increased use of PPE (Personal Protective Equipment) and increased quantities of biomedical waste have posed a new crisis for the waste management industry as infectious waste contamination raised growing public concerns. Serving as an essential service during the pandemic, waste collection service has played a more significant role in meeting people's increasing needs. On the other side, protecting vehicle operators and reducing their potential exposure to the virus is crucial. That's why the government needs innovative technologies to assist the waste collection fleet in utilizing the fewest possible resources to complete tasks efficiently.

## Innovations That Will Revolutionize The Waste Management Field

Digitalized Bins and Containers

Many of the technologies that could help with the waste management fleet operation have already emerged in the telematics field. The sensing technology powers the digitalization of waste management infrastructures that allows smarter assets management across the system. The updated garbage bin is packed with advanced sensors and telecommunication devices that allow for easier and simpler management and monitoring from anywhere. The smart sensors utilized ultrasound echnology to measure and detect the bin fill levels and transmit all the data via the IoT (Internet of Things) such as GPRS, Narrowband-IoT, LoRa, and Sigfox, to the central management cloud-based platform.

The whole data transmission process is fast and encrypted to protect data from cyberattacks. From there, controllers and drivers can access data and check the bin information in real-time and make informed operational decisions. These data also help with route optimization and allow drivers to skip bins that aren't full or don't require services.

By analyzing these data, fleet managers can also adjust waste collection frequency, vehicle types, numbers of drivers needed, and other resource allocation problems. These smart sensors are also weather-resistant, shockproof, and highly durable, which means it can be installed on any bins or containers in any condition. Cities could reduce the waste collection costs by 30% and lower the carbon footprint by 60% by eliminating unnecessary bin waste collections and digitalizing the resource management process.

Another crucial advancement of the bin design is the introduction of digital bin identification tags and stickers. Accessibility to public assets information is necessary for both the public and the assets managers. In a connected city concept, the government relies more on the public effort to assist with asset management. A QR (Quick Response) code will be displayed on the bin, and the public can scan the code through a smartphone's camera and access bin information.
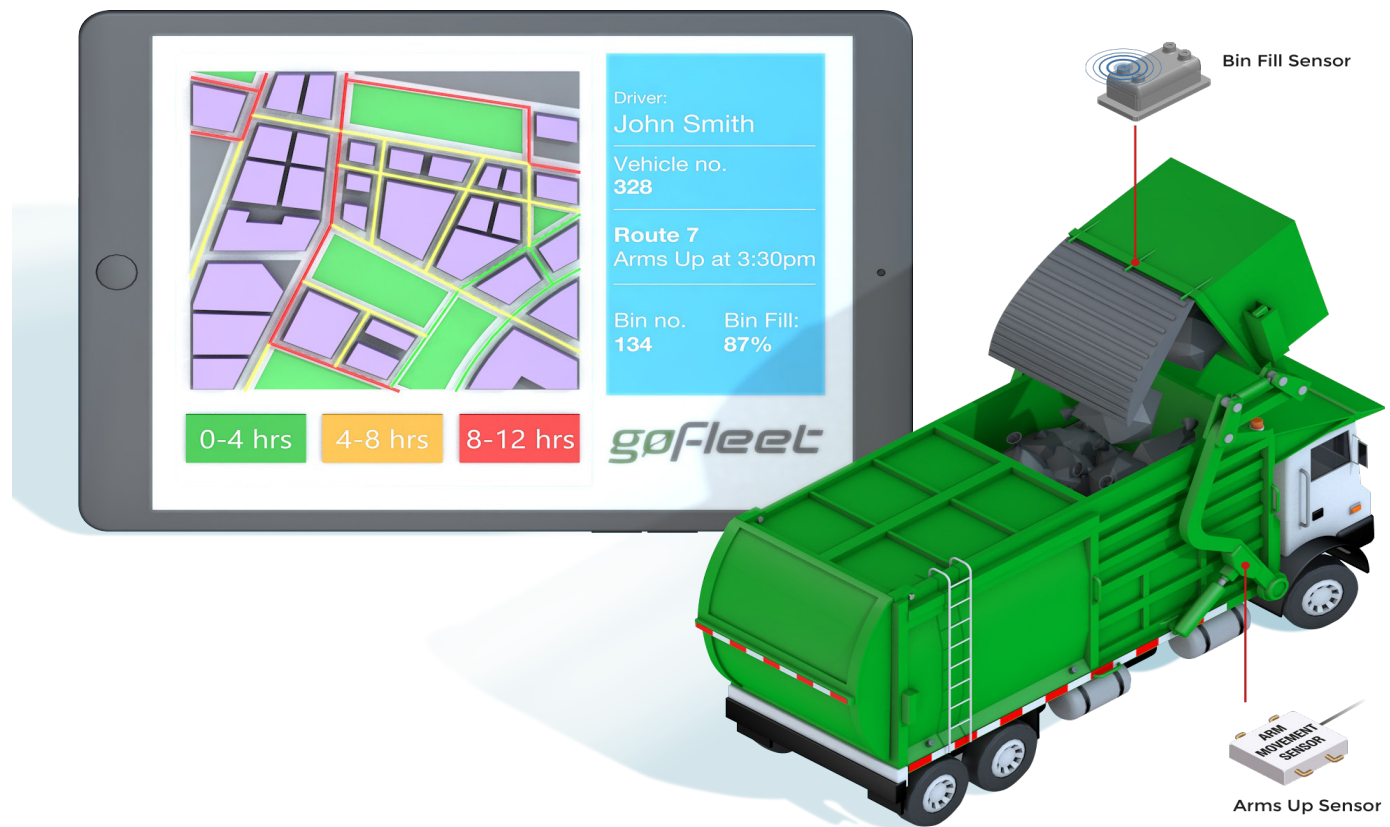
The public also can help report any physical damages or malfunctions of the bin or report any excess garbage situation with just a scan of the code. The community report functionality, combined with smart sensing technologies, provides the ultimate real-time monitoring and tracking solutions to waste assets management. The RFID (Radio Frequency Identification) tag, a second tag attached to the bin, simplifies and digitalizes the waste collection process for vehicle operators and fleet managers. By scanning the tag via a specialized RFID reader, operators can instantly access all the bin details such as owners, identification numbers, designated locations, and collection schedules. Operators can update any of the information if they discover an error or flag any problem, such as a bin being misplaced in the wrong location to the fleet manager.

Restricting and reducing the authorized use of bins is proven to help improve fleet efficiency. Thanks to the unique code and tag affixed on the bin, waste collection operators can quickly identify bins owners and only collect waste from bins registered on the system. This will ensure that waste collectors will not serve customers who do not have a service contract with companies or cities. Because every step of the operation is digitalized and recorded in the cloud-based management database, fleet managers and vehicle operators can confront customers' complaints more confidently by quickly checking service records to identify who should be accountable for the issues.

Onboard Vehicle Sensors

The onboard vehicle sensors and telematics devices create even more opportunities for fleet managers and cities to collect live data and facilitate efficient and accurate vehicle tracking and safe operations. For the fleet manager, monitoring and tracking all the vehicles' status and location in real-time is essential when responding to an emergency, accident, or unexpected events.

The vehicle onboard GPS tracking device offers real-time vehicles' locations updates with minimal lagging. Faster updates mean that fleet managers can always stay on top of critical alerts and improve dispatching efficiency. The onboard GPS tracking device also acts as a vehicle diagnostic tool when connecting with other sensors. Engine health and temperatures, fuel usage, odometer reading, equipment status are vital metrics that fleet managers and drivers should always keep an eye on.

The GPS tracking device is a powerful tool that displays all these readings in one place, allowing drivers and fleet managers to easily view and track these metrics. The system will send alerts to drivers and managers if it detects an abnormality in reading or equipment failures, so fleet managers could respond and investigate the issues and conduct appropriate maintenance work early to prevent vehicle breakdowns during operations. The system also serves as an electronic logging and recording device that track HOS (Hours of Service), vehicle performance to send data to the central cloud-based storage platform, which fleet managers can retrieve and review these data from the database anytime.

Cameras and Recording Technologies

The camera and recording technologies have been around for decades, but to cope with future demands and more complex challenges, it must be smarter and more connected than ever. Smart camera and recording technologies could leverage fleet safety to an entirely new height by offering drivers a clearer understanding of their surroundings. This proves to be especially important for the waste management field as drivers need to frequently operate vehicles' heavy machinery and equipment in all kinds of complex environments. Monitoring the operations of arms, loaders, hopper, compactor, and ancillary equipment in real-time provides operator confidence and assurance that all the equipment pieces are functioning normally, and there are no safety risks that are identifiable. It's a necessary tool in protecting workers' safety and prevent pedestrians and cyclists passing by from injuries.

The in-dumpster cameras focused on measuring and assessing dumpster contents and identify contaminants. The evolution in artificial intelligence technology has a huge implication in perfecting the smart camera's functionality. The dumpster cameras can now collect images and analyze the dumpster contents through artificial intelligence and alert drivers or fleet managers if contaminants are detected. The system also measures and quantifies the contamination level and converts it into a score that tells fleet managers and drivers how serious it is. Empowered with the camera system's high connectivity, the city could access the generated data through cloud-based technologies to track down the contamination sources and inform clients of the problems. Further targeted educational coaching and policy enforcement activities could be carried out by the city to reduce waste contamination rates across the city.

Road Safety Tools

The road safety is at the heart of every fleet's operations, and the waste collection fleet makes no exception. Road injuries and fatalities are preventable, and every road user has the responsibility to stay vigilant to protect each other from injuries. Any road accident will seriously disrupt the fleet operations and bring unnecessary costs for businesses and corporations. However, it is important to consider that any drivers could make mistakes, and that's why camera technologies play a supportive and life-saving role in protecting everyone's safety and preventing collisions. The collision avoidance system includes a forward-facing smart camera set up that uses artificial intelligence and machine learning technology to alert drivers prior to the collision. It can also detect stationary and moving pedestrians and cyclists within a 30-metre range and alert drivers in critical situations where a collision is imminent. The lane departure warning features warn drivers when they are about to cross the lane boundary without signaling to prevent side collision.

Distracted driving is another major cause leading to road collisions and accidents. In the past, fleet managers often encountered problems where there is no way to track and measure drivers' driving behaviors and performances. With driver distraction cameras and a performance scoring platform, fleet managers can monitor drivers' behaviors, identify potential safety risks, and reward drivers with good driving habits.

The driver distraction camera also serves as an extra layer of safety protection for drivers, as drivers will receive a visual and audible alert if they take eyes off the roads. The driver's scoring system assigns a score to each driver based on their driving performance, such as the numbers of hard brakes, speeding, or hard acceleration. By being able to access the data, fleet managers are enabled to identify high-risk drivers in the fleet and develop personalized training programs to coach them to improve.

Data Collection, Storage, And Management

One of the key parts of any fleet management is data collection, management, and storage. As growing numbers of cities are eyeing on digitalizing city operations and building a more connected smart city, data is a valuable asset that enables city officials to make more informed and data-driven decisions that benefit communities.

The waste collection fleet not only provides garbage collection services but also plays an integral role in remote data collection. Every vehicle within the waste collection fleet has the opportunity to become a mobile data collection tool after the installation of smart sensors and telematics communication devices. By measuring and collecting key vehicles and road performance metrics, such as traffic conditions, hard brakes, acceleration speed, idling time, fuel consumption, tire pressures and many more, it's possible to use collected information to identify community accidents hotspots, road potholes, and overall traffic conditions.
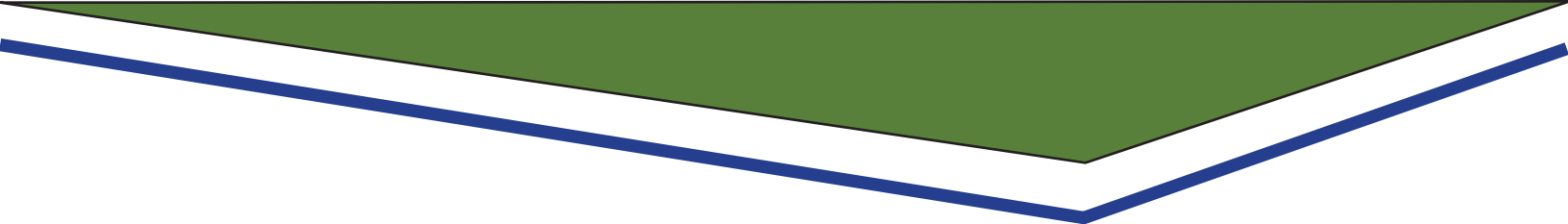
Eyeing The Future Of Waste Management

Building a more connected waste management system is an integral part of advancing the initiative of Smart City. We do not have to look into the future to realize that emerging technologies and innovations are and will continue to profoundly impact the waste management industries' fleet operations. Automation will revolutionize how the city or private businesses collect, sort, recycle, and manage waste.

With the progress made in the autonomous vehicle and robotic arms field, the public can expect to witness a more efficient, precise, and safe waste collection process once these technologies have been adopted. It's also part of the plan to minimize fleets' carbon footprint and step towards a greener and more sustainable fleet operation model. Increasing the degree of automation means a growing need for telematics solutions to connect all the automated machinery and vehicles to the central control platform. Camera and tracking technologies will take a more important role, serving as human "eyes" on the road, to monitor and send real-time updates back to the control center. To fully utilize the automation technology, it requires collaboration with other digitalized waste management infrastructure pieces such as smart bins and containers to create a highly integrated cloud-based waste management system. Telematics is the fastest and simplest tool to build an extensive data transmission network that connects all the assets and allows easy management and control from one place.

The engine powering the whole data transmission and storage process is a cloud-based database and IoT cloud server. Data is one of the most valuable assets for the city and any businesses. By reviewing and analyzing data, cities and businesses can better optimize fleet operations, improve services and products, increase customer satisfaction, and maximize profitability.

Having a well-organized database is also necessary to meet regulatory compliances and standards. Fleet managers can effortlessly pull-out data and history from the database if they are asked to show evidence for inspections or customer complaints.

Telematics offers a complete solution that automatically prepares, stores, and organizes data for cities and businesses in the background without any additional human work. City-wide data and fleet operational data could be beneficial for the municipality in the decision-making stage. Data provides insights into identifying areas for improvement, tracking the effectiveness of execution, and justifying strategic proposals. When sharing these data with the public, the public gains real-time visibility of urban operations and municipal service status. In the future, people will rely on data more than ever to construct efficient and sustainable urban networks. It's all part of the greater objective of building a well-connected Smart City.

Conclusion

The waste management industry will experience growing challenges as the globe sees increasing waste generation and urban population rise. Current waste and resources management methods and strategies are not able to cope with the growing demands. Fortunately, emerging technologies and innovations provide the necessary tools and platform for cities and businesses to advance and rethink the future of waste management systems. Through incorporating the latest telematics technologies, tools, sensors, and equipment, there is a great opportunity to build an efficient and sustainable fleet that can drive cities and businesses to a smarter future.

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We don't just provide another GPS fleet tracking system. We are in the business of providing you a solution. Our fleet consultants work with you to understand your business. We help you implement solutions based on everyday pain areas and industry best practices. Of course it helps having the industry's most powerful and reliable GPS vehicle tracking system, but the real difference is made in our customer service. Let us show you the GoFleet difference.

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