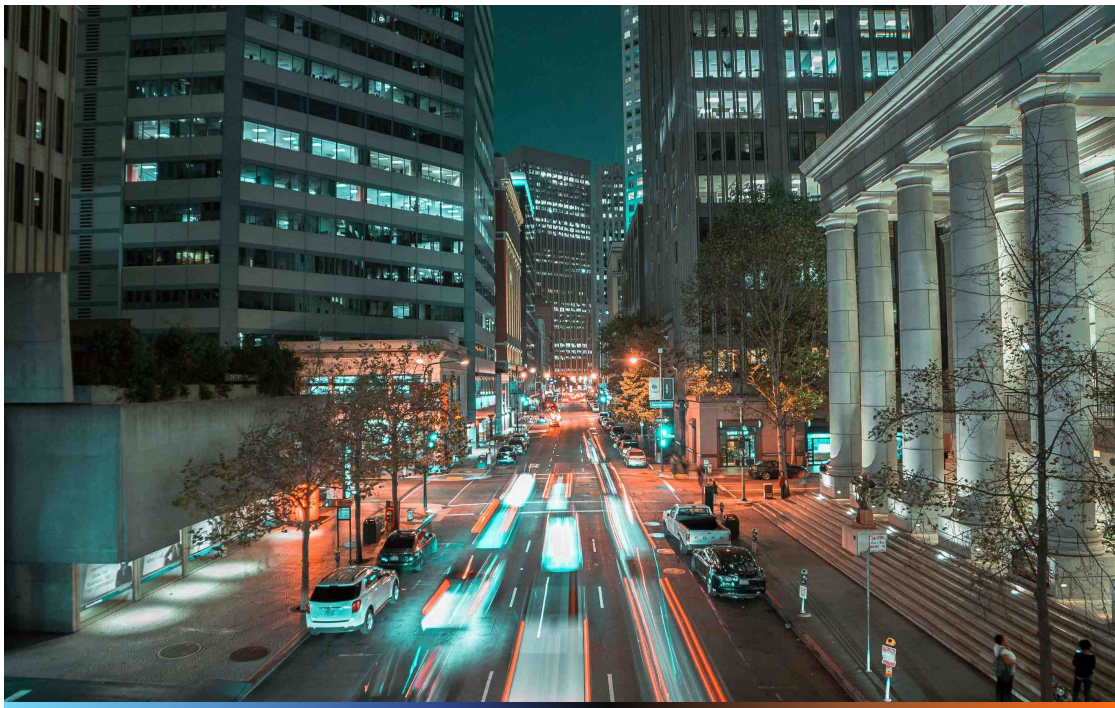# BIOMETRIC AUTHENTICATION

AND THE NEXT GENERATION OF CONNECTED VEHICLES

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Trusted Vision AI

April 2023

Foreword **by Marc Amblard**

Founder & Managing Director, Orsay Consulting

The mobility space is undergoing its most profound transformation since the automobile was born about 125 years ago. Several quasi-simultaneous megatrends are driving this revolution, namely electrification, assisted and autonomous driving, the software-defined vehicle and associated data-based services, as well as new and shared mobility solutions. These megatrends are enabled by a series of underlying technologies such as AI, high performance and edge computing, cloud services, 5G or innovative sensing solutions.

As a result, vehicles — in particular new, battery electric ones — are increasingly structured like servers on wheels offering massive, abstracted processing power and vast software stacks. New electronic architectures combined with an array of sensing modalities enable a wide range of new services and features. This is especially the case for cameras which are fast becoming ubiquitous outside and inside vehicles.

For instance, a camera will be needed inside the cabin for soon-to-be standard driver monitoring systems — and potentially for child detection. It will not be a differentiator among OEMs.

However, once this camera is in place, an array of software layers can be added to deliver additional value and thus revenue, many of which require the driver to be identified. This opens the door to new features such as occupant-specific settings, e-payment for e-commerce or tolls, and much more. In fledgling robotaxis, in-cabin cameras will be used to assess occupants' positioning and behavior, identify a forgotten object, etc.

In addition, cameras are increasingly common on the outside of vehicles for driver assistance solutions. Here again, the same sensing hardware can be leveraged with the addition of face recognition to enable features such as keyless / smartphone-less entry or the setting of driver preferences.

There is no doubt that the deployment of face recognition combined with shared cameras will create a wide array of new services and features that will benefit vehicle users, manufacturers and varied third parties.

Marc Amblard

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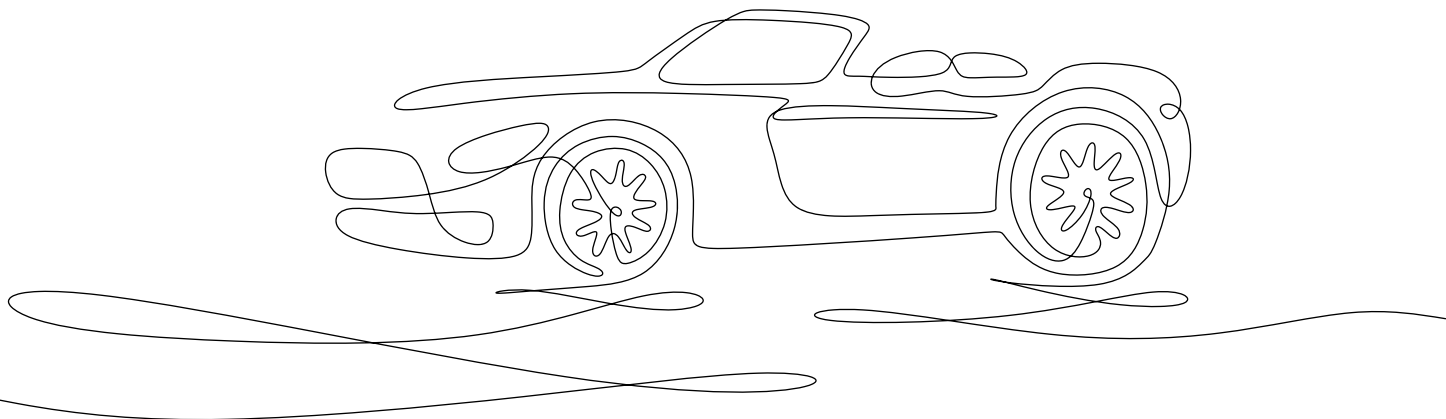Prepare for the Mobility Revolution
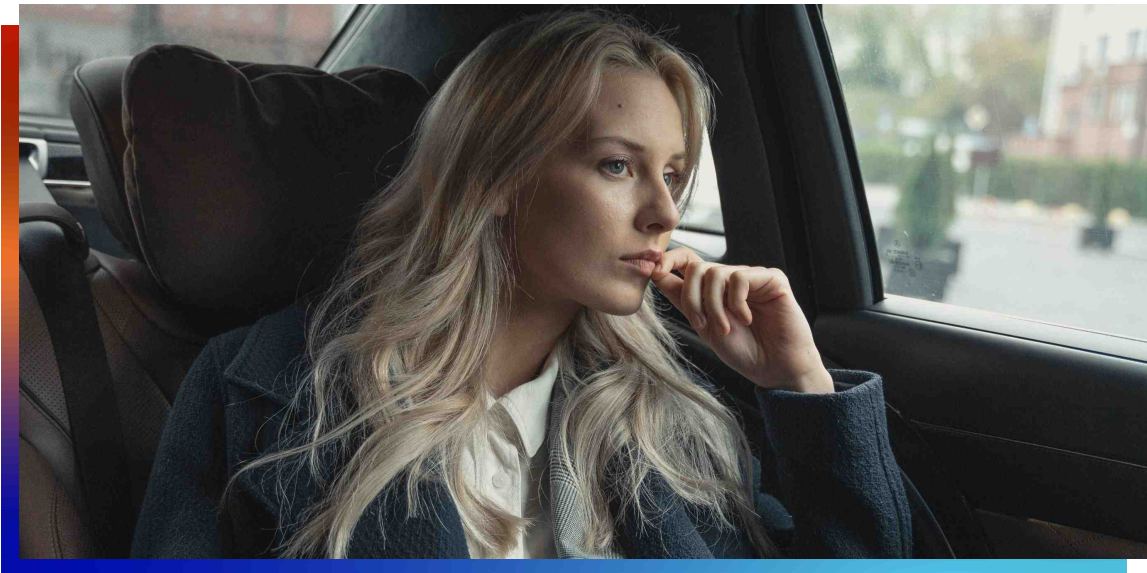
Introduction

Car makers are continuously trying to find ways to meet consumer demand in making safer, easier, and more enjoyable driver experiences in future-forward connected vehicles. New technology advances are helping manufacturers to build seamless and intuitive solutions to help drivers have safer and more enjoyable journeys while being focused on what matters the most.

Fast, touchless face recognition-powered biometric authentication has changed the way people interact with mobile devices since Apple first launched Face ID in 2017. Now, as vehicles are integrating the connected intelligence previously only associated with smartphones and tablets, face recognition-powered biometric authentication is a natural next step, with the potential to revolutionize Human Machine Interfaces in connected vehicles. With its ability to accurately and quickly identify individuals, face recognition can provide a wide range of benefits for drivers, passengers, and car manufacturers.

In this white paper, we'll explore the current state of connected vehicles and face recognition technology, discuss why the time is right in terms of technology, need, and consumer readiness, and outline some of the key use cases for biometric authentication in the automotive industry.

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The Time is Right

Consumer Familiarity with Biometric Authentication

By virtue of its ability to seamlessly allow access or enable services, biometric authentication can uniquely provide tremendous opportunities for the automotive industry to build frictionless driver and passenger experiences. Consumers are now broadly exposed to the security and convenience benefits of biometric authentication from a growing number of applications. Here, we will explore these applications to build intuition for how the same technology could be deployed in the next generation of vehicles.

Smartphone authentication

While Apple Touch ID was the first major move away from using PINs and passwords in smartphones, Apple's Face ID made biometrics truly ubiquitous on smartphones. The key was going touchless: Users unlock their iPhone, access services, and make payments by simply looking at the device. This provides a substantially more convenient and secure way to access the device, compared to traditional methods such as a passcode or even fingerprint.

Digital identity verification

Over the past three years, and accelerated by the global pandemic and a need to provide remote, trusted services, digital identity verification has dramatically grown. In this case, financial services, gig economy, government services and institutions use selfie-based face recognition to confirm the identity of customers when they access their accounts online or perform transactions. This provides a fast and secure method to positively confirm identity and eliminates the need for customers to remember and enter long and complex passwords or retain specific identity documents. Whereas smartphone authentication typically occurs on the device itself, digital identity verification typically uses the smartphone camera to enable a trusted identity check on a backend service.

Air travel

Face recognition technology is now broadly used in consumer air travel to facilitate check-in, security screening, immigration, and boarding processes. From solutions like Global Entry in the United States to Automated Border Control in the EU, airports and airlines are using face recognition to confirm the identity of passengers and match them with their travel information, eliminating the need for passengers to present a physical ID or boarding pass, reducing queue lengths. This makes the process faster and more convenient for passengers, and it also enhances security by replacing manual review with highly accurate automated identity checks.

Technology Readiness

The emergence of biometric authentication in smartphones, digital identity, air travel, and other applications is no coincidence: after years and even decades of promise, modern face recognition is fast, accurate, consistent, and intuitive thanks to a convergence of recent technological advances across industries.


01

Seamless technology

Due to recent advances in AI and deep learning, improved imaging systems, and compute platforms, face recognition has become incredibly fast and tolerant of extreme angles, occlusions of the face, and variable ambient light conditions. The most advanced face recognition systems can now enable truly frictionless and highly intuitive experiences that make the technology and authentication process feel almost invisible to the user.

02

High accuracy

The same recent advances in AI have dramatically impacted accuracy, including performance across demographic groups and various environmental conditions. Paravision's face recognition was first ranked #1 in the world by NIST FRVT in 2019. Since then, Paravision's technology has demonstrated a greater than 95% decrease in error rates. This allows for biometric authentication to be deployed in a way that wasn't possible just a few years ago.
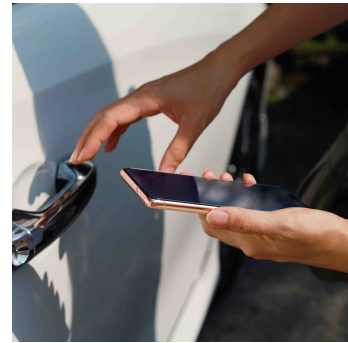
03

Cloud to Edge

New AI compression technologies and hardware acceleration are enabling the optimization of face recognition across platforms including mobile, edge, and cloud deployments, making experiences using a converged identity over multiple touch points possible. For example, users can enroll with a selfie, store their data and enable matching on cloud systems, and save their registration to their vehicles for rapid, in-car authentication.

Intuitive, accurate, and modular: the combination of these features position face recognition for direction integration and immediate benefits in the automotive space.

Recent Automotive Industry Technology Advancements

In addition to the rapid advance of core technology, face recognition can build on a variety of policies, technologies, experiences that have recently become common in the automotive industry. In particular, face recognition software can directly overlay commonly deployed technologies such as Driver Monitoring Systems and surrounding cameras, making it easy to implement without significant hardware changes. There are several consumer trends in the automotive industry that are shaping the way cars are designed and built, and the kinds of technology solutions car manufacturers are utilizing.
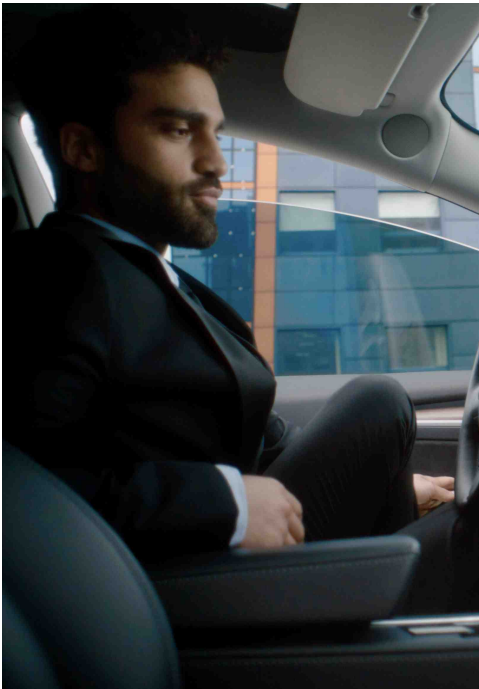
Driver monitoring systems (DMS)

DMS monitor the driver's behavior and alertness while driving. These systems use cameras, sensors, and other technologies to track the driver's eye movements, head position, and other biometric data to detect signs of fatigue, distraction, or other unsafe driving behaviors. DMS can help to improve safety on the road by detecting and alerting drivers to potential hazards, helping reduce the number of accidents caused by driver error, and ultimately saving lives. The link to driver authentication is simple: Cameras are already positioned well for DMS that can be multi-purposed for authentication. The same imaging system and compute platform can be applied to face recognition-based biometric authentication.

Importantly, DMS and related technologies are being heavily promoted through policies such as **Euro NCAP** and **Vision Zero**, which aim to eliminate traffic fatalities and severe injuries.

https://visionzeronetwork.org/about/what-is-vision-zero/

Cameras everywhere

Beyond the DMS systems discussed above, cameras are emerging everywhere inside and outside of vehicles, addressing a wide range of applications from Advanced Driver Assistance Systems (ADAS) to dome cameras to check on back-seat occupants to stitched 360-degree cameras that augment or replace rear-view mirrors and shoulder checks.

In addition to driver authentication, these cameras could readily be applied for a number of applications, as discussed in the use case discussion below.

Software-defined vehicles

Many people consider the move to electrification as a defining characteristic of next-generation vehicles, but this is complemented by a less-obvious trend: The move to software defined vehicles. Whereas prior generation cars had highly distributed computing that was essentially static and not-upgradable, modern cars are defined by a much smaller number of domain controllers that are powerful, feature-rich and easily upgradable. Technologies such as Android Automotive[1] bring modern, smartphone-like operating systems to connected vehicles. This sets the stage for a variety of connected apps and services, just as a consumer might see on their smartphone.
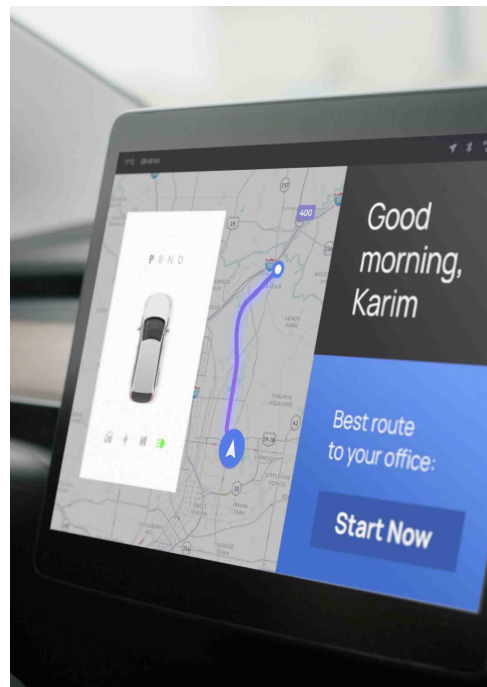
[1] https://en.wikipedia.org/wiki/Android_Automotive

The Use Cases are Compelling

Responding to Consumer Trends in Automotive

Face recognition-based biometric authentication can help to address common expectations from a consumer population that has become familiar with the benefits of biometrics in other use cases, such as smartphone access. Meanwhile, the modern OS and infotainment approach in vehicles has rendered them "smartphones on wheels" in many ways, and the expectation set carries from the smartphone in a consumer's pocket to the one in their garage.

Seamless user experience

Seamless experiences are crucial to the driving experience. Drivers want to be able to interact with their cars in new ways, such as controlling the car's settings, receiving real-time traffic updates, and unlocking the car without fumbling with buttons and knobs, or using passwords and keys. Seamless experiences also improve the overall safety of the car, allowing drivers to stay alert and focus on the road and their surroundings, keeping them and their passengers safe. Meanwhile, delivering seamless experiences brings valuable benefits to car manufacturers, as they can significantly improve user satisfaction and engagement, and can lead to increased customer loyalty and retention.

Personalization

Consumers also expect their cars to be more personalized and tailored to their individual preferences. A sophisticated approach to personalization can significantly increase the perceived value of the car and make it more appealing to buyers. Personalization allows car buyers to:

- Adjust the car to their preferred driving position and make it more comfortable to drive.
- Customize the car's infotainment system and entertainment options, allowing drivers to access their favorite apps and music.
- Turn on any available advanced safety features and other technologies according to preference. This can include everything from lane departure warnings, automatic braking, and blind-spot monitoring, to advanced driver-assistance systems (ADAS) and autonomous driving capabilities.

In-car payments

In-car payments are a feature that allows drivers to make purchases directly from their car's infotainment system, using their car's connected capabilities. This can include refueling or vehicle charging, paying for parking, and making other types of payments while on the go. In-car payments are important for buyers because they provide a convenient way to make payments without having to stop and take out their wallet or phone. This can save time and make the overall driving experience more efficient. With the right authentication technology, in-car payments can also provide a more secure way to verify identities and conduct payments quickly.

Unlocking a Range of Applications

01 Vehicle access
By using facial recognition to confirm the identity of the driver, car doors can automatically open as authenticated drivers or passengers approach the car, eliminating the need for traditional keys or fobs, while improving the security. Cameras are already being located on the "B Pillar," a natural location to enable vehicle access.

02 Ignition
DMS cameras are already optimally suited to enable vehicle ignition. By using face recognition to confirm the identity of the person behind the wheel, cars can ensure that only authorized drivers are able to start the vehicle. This can provide added security and peace of mind for car owners, as well as prevent theft and unauthorized use of the vehicle.

03 Personalization
By recognizing the faces of the passengers and adjusting settings such as seat position, temperature, and entertainment options accordingly, cars can provide a more comfortable and personalized experience for everyone on board. DMS cameras and dome cameras can enable personalization for the driver and occupants alike.

04 Payments
Facial recognition can be used to make payments for fuel, parking, and other services, without the need for a physical card or cash. Just as with ignition, the DMS camera location is a great fit for payment authentication.
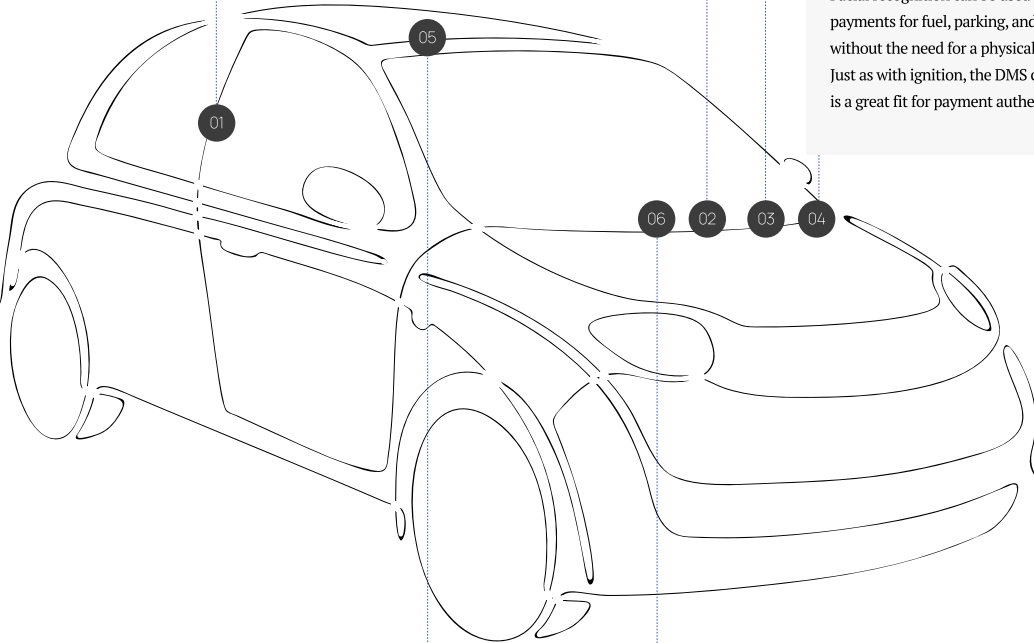
05 Driverless ride-sharing
Ride-sharing companies have already started piloting autonomous rides. Face recognition can be used to verify the passenger before allowing access to an autonomous vehicle, preventing unauthorized users from accessing the ride. By using the same dome camera that can enable occupant safety checks, face recognition can also help in monitoring the passengers throughout the ride, sending alerts for identity-linked occupant safety issues of any kind.

06 Fleet management
Biometric authentication can help to ensure the safe and proper use of enterprise fleet vehicles. This can help to avoid swapping of keys and questions about safe driving while delivering the same benefits as the consumer applications noted above. In this case, in addition to utilizing camera systems in new vehicles, authentication can be enabled in legacy vehicles with aftermarket windshield-mounted camera systems.

Deployment Considerations

Face recognition technology represents a dramatic set of benefits in the next generation of connected vehicles. However, biometric identity needs to be taken seriously due to policies such as GDPR as well as general best practices for consumer rights and equitable access to technology. When considering biometric authentication in a vehicle, best practices include:

Managing biometric data

1. Enable biometric features with **explicit opt-in and informed consent**.
2. Clearly articulate a **privacy and data retention policy**.
3. Provide **ample alternatives** for users who choose not to opt-in.
4. Provide a clear path to **manage and delete biometric data**.

Ensuring high accuracy

1. Deploy face recognition technology that has been **demonstrated as a leader** - including across demographic groups - by NIST FRVT, the gold-standard benchmark for face recognition accuracy assessment.
2. Different use cases may require different levels of accuracy. For instance, personalization may not demand the same level of accuracy as ignition, access, or payments. But **even for personalization, accuracy is still key**: In particular, lower False Non-Match rates mean better usability and lower frustration. Demographic considerations remain critical, as convenience features need to work equally well for all users regardless of age, gender, ethnicity, race, or skin tone. Even though the risks of non-performance may feel lower, leveraging a technology benchmarked by NIST FRVT provides a superior user experience and ethical foundation.

For more on accuracy and ethics, see paravision.ai/trust
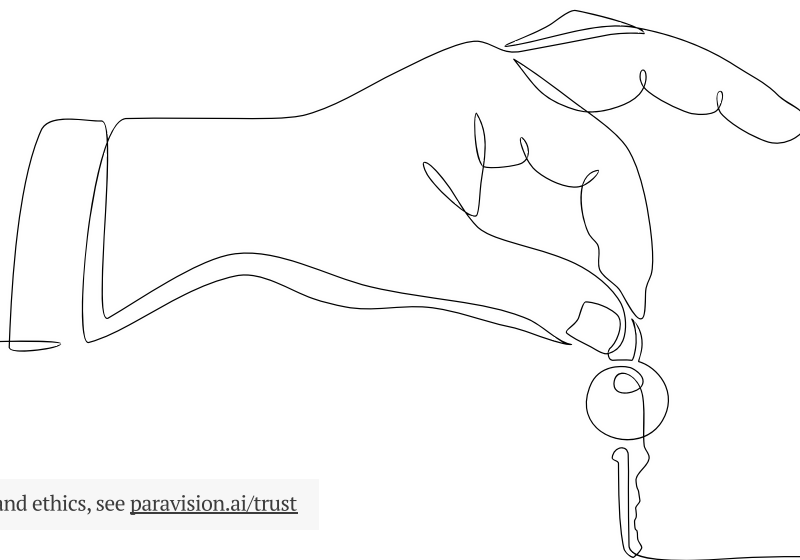
Conclusion

Face recognition technology represents a significant step forward in improving safety, convenience, and feature enhancement in the automotive industry. From driver authentication and access, to in-car personalization and payment, face recognition can provide a wide range of benefits for drivers, passengers, and car manufacturers. The technology is now ready, consumers are ready, and the automotive industry is ready.

If you'd like to learn more about how biometric authentication can improve the security, safety and seamless use of connected vehicles, please book a meeting to chat with the Paravision team.

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For more information or to schedule a demo, please contact us at: info@paravision.ai