

**H1st vision,
the concept car designed by Software République:
a human-centred vision of mobility for tomorrow**



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INTRODUCTION

An open innovation ecosystem created by six large companies (Atos, Dassault Systèmes, Orange, Renault Group, STMicroelectronics and Thales), Software République has set itself clear objectives to help create a European ecosystem for sustainable, sovereign and safe mobility. Its roadmap sets out the ambition of launching 10 new services and products, incubating 50 or more startups, and offering services in more than 50 geographies around the world by 2025.

Created only two years ago, Software République is staging the world premiere of a collaborative concept at the Viva Technology 2023 exhibition. It incorporates functional and innovative technologies which illustrate its human-centred visions of the mobility of the future. Its name is H1st vision (Human First vision).

It's a revolution in mobility, bringing together 20 concrete, operational innovations.

This physical vehicle doubles up as a virtual replica, a virtual twin in a digital universe where systems that are currently independent (infrastructure, energy, public services, users of different categories) communicate. This makes it possible to model, visualise and simulate the different use cases that could arise in the real world. Thanks to its interconnection with its environment, H1st vision is in constant dialogue with digital and physical ecosystems. A true experience beyond automotive mobility, H1st vision is not just a concept car: it is a tangible vision of tomorrow's mobility experience.

The 20 innovations in this technology demonstrator are centred on people. They are all operational: they take care of the driver, their passengers and other road users.

H1st vision for example features:

- all-new and secure biometric access control
- a one-of-a-kind sound experience inside
- optimised vehicle range and charging
- a driver and vehicle health monitor and assistant
- predictive alerts to protect occupants and other people on the road, using predictive alerts

H1st vision is packed with the expertise of Software République's members, which are all major players, and promising startups selected for their unique contributions. It was developed by a team of 100 people in a record six months. With this functional virtual and real concept, Software République is demonstrating the relevance of the open innovation model for incubating true industrial projects that are helping to make Europe a prominent hub for the mobility of the future.



"The H1st vision concept car is a connected, physical and virtual object that demonstrates both a robust method for collaboration between the partners and how the technologies of Dassault Systèmes, Orange, ST Microelectronics, Renault Group and Thales complement each other to build the mobility of the future".

Eric Feunteun, Chief Operating Officer, Software République

20 on-board innovations

The H1st vision concept brings together groundbreaking mobility technology centred on occupant safety and well-being as well as the environment.

When you approach the vehicle, postural then facial recognition software kicks in to allow access to the passenger compartment then enable ignition. An avatar projected onto the window then on the centre console welcomes the user and assists them with all the available features. The immersive audio system designed with Jean-Michel Jarre envelops users in a cocoon, and its combination with an innovative microphone spatialises sound emission and reception in each seat. H1st vision also has an in-car payment interface and a smart parking assistant. To make mobility sustainable, silicon carbide parts are used in the critical systems powering electric vehicles and in the charging stations, significantly increasing efficiency. Powerbox charging stations work both ways (V2G, Vehicle to Grid), so the car can also support the grid or help power your home during consumption spikes. An array of physical and virtual sensors watch over the health of the occupants and, in the event of an incident, H1st vision can place a mobile or satellite call to emergency services. The state of wear of key vehicle components such as the battery or tyres is also monitored. H1st vision can even generate its own health certificate. The virtual twin in a digital city shows the car's extended connection to its environment (city 4.0, other people using the road, other infrastructure, etc.) to spot potential hazards, keep people safe if they are vulnerable and optimise rescue vehicle traffic flows.

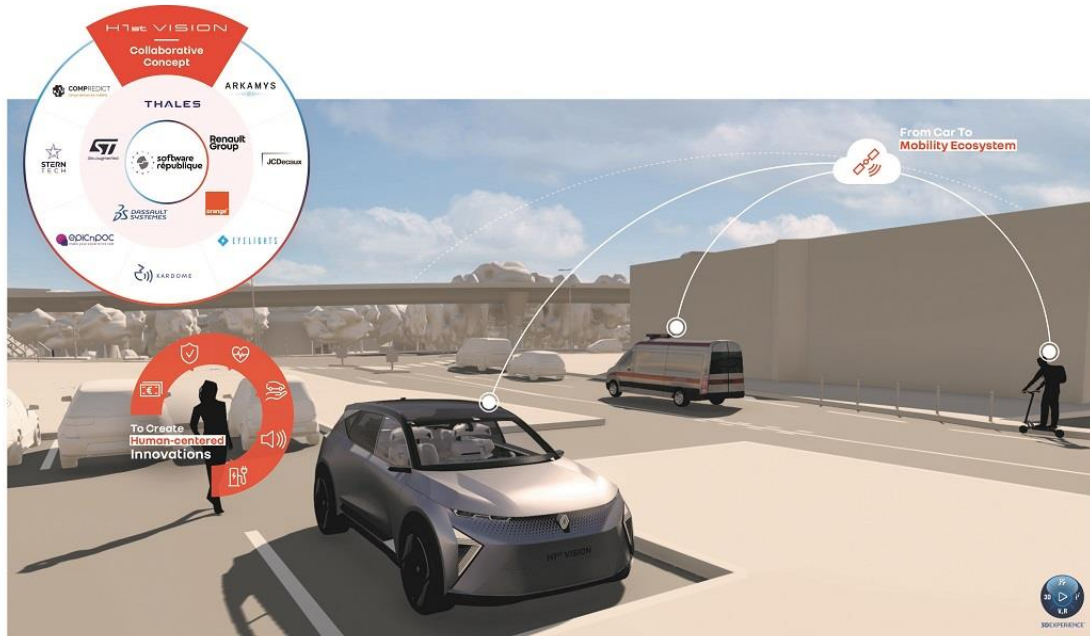
The H1st vision method by Software République

After two years of cooperation between the six founding members (Atos, Dassault Systèmes, Orange, Renault Group, STMicroelectronics and Thales), the robust governance put in place, together with a detailed understanding of each partner's technologies, have made it possible to implement 20 technologies in a unique concept in record time (six months).

It is unique in that it brings together the technologies of the founding members and other players, including seven startups and a partner : Arkamys, Compredict, Epicnpoc, Eyelights, Kardome, Stern Tech and JCDecaux.

The concept is also unique in that it combines a physical object with its digital twin, connected to both the object and its environment.

A HUMAN-FIRST EXPERIENCE



Under its futuristic body, the H1st vision concept car is a human-centred technology demonstrator. It is interconnected, and designed for simpler, smoother and safer electric mobility.

Technology that revolves around the user

H1st vision is as advanced as it is simple and intuitive to use. This is because the user experience, rather than technical sophistication, was one of the main factors directing innovation.



[Device-free car access and the Software République Avatar] Simple, intuitive access

Device-free car access technology is a simple and swift way to unlock the vehicle – without any hardware! You don't need to hold your smartphone in your hand or carry your card or key in your pocket, the access control mechanism is ironclad, and the experience is effortless and seamless.

You open H1st vision remotely using two cutting-edge authentication technologies. Users create a profile on a tablet beforehand. Their data (name, height, a photo of their face and a video of them walking) is encoded and stored in an ultra-secure virtual container integrated into the car, the Digital ID Wallet.

The vehicle recognises the registered driver and passengers approaching on either side, based on their posture (using cameras on the wing mirrors), when they are up to six metres away. Then it recognises their face up to three metres away (a camera on the centre pillar between the two doors switches on once the posture camera has checked their gait).

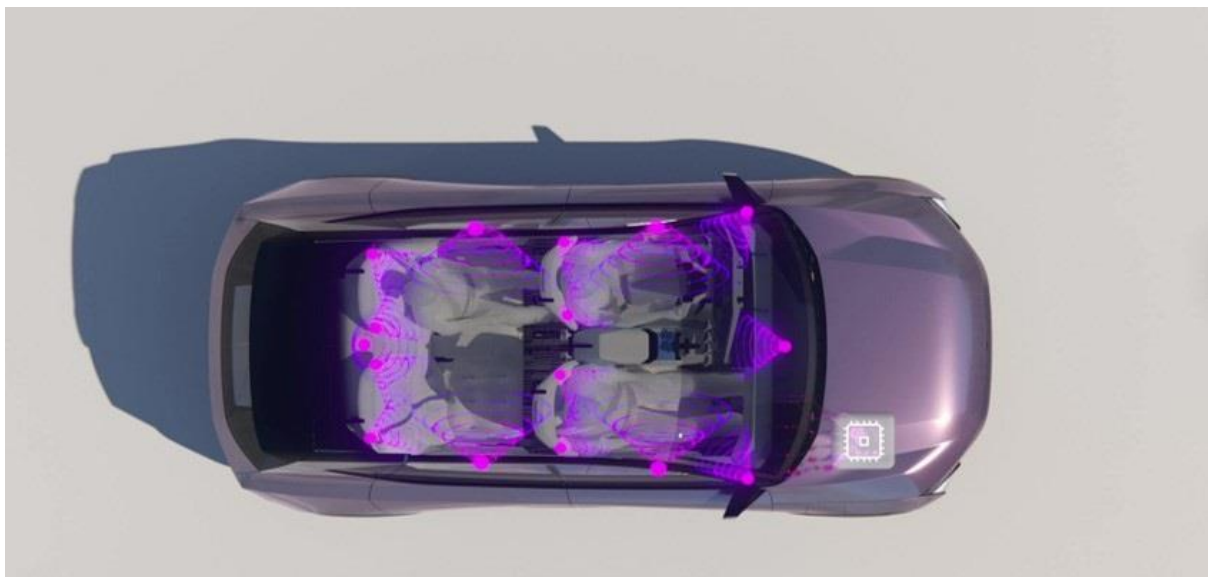
These two authentication technologies complement each other and green-light the users using a maximum-security protocol. A projector built into the front headrest displays Software République's avatar on the rear window, greets the user by name and asks them if they want to step in.

All the user has to do is say "Yes" and the door opens. Then the avatar is displayed on the dashboard screen. The camera in the windshield mirror identifies the driver and any passengers accessing the vehicle, and enables ignition based on the credentials in their profile. The driver or passenger seat automatically moves back or forth to the right position for the person the car has identified.

This novel authentication system helps to simplify car rental, sharing, pooling and driving licence checks.

Technologies used:

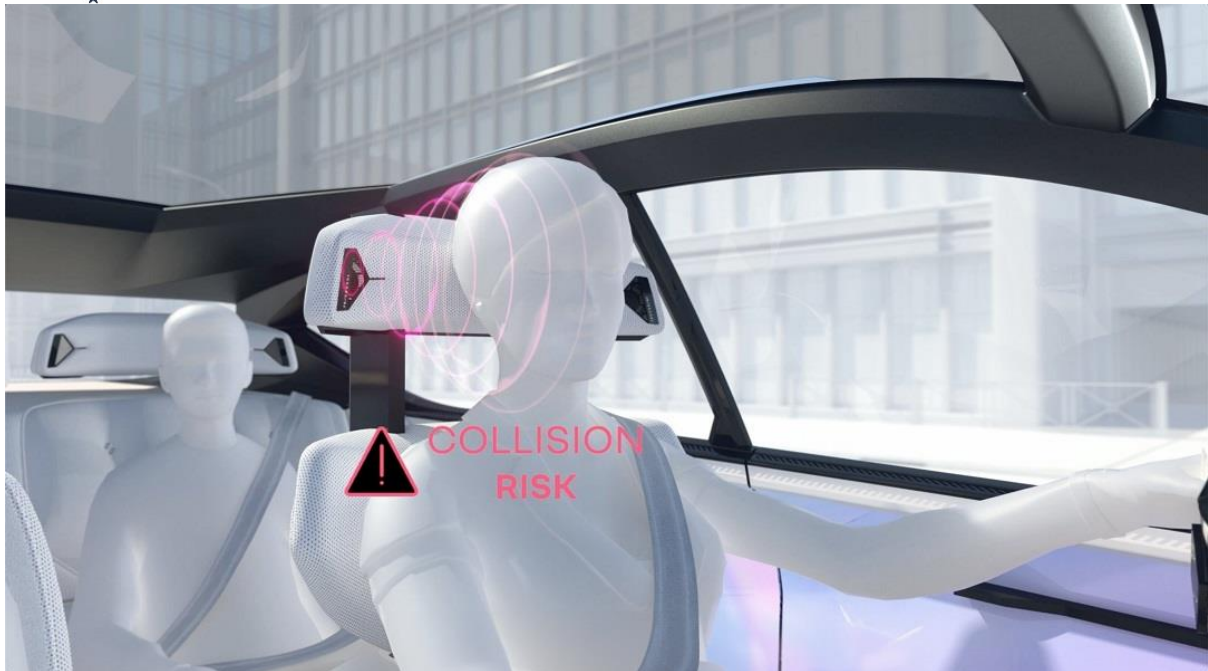
- Facial and gait recognition system: Thales
- Digital driving licence: Thales
- Cybersecurity: Thales
- Orchestrator: Thales
- MEMS microphone (voice recognition): STMicroelectronics
- CMOS (high dynamic range) image sensor: STMicroelectronics
- Microcontroller with integrated cryptographic accelerator: STMicroelectronics
- Window projection: EyeLights
- Door opener and seat position adjuster: Renault Group



[Immersive sound experience] A unique sound experience designed with Jean-Michel Jarre

The H1st vision concept car is a true sound cocoon: its hi-fi system features 16 loudspeakers (a woofer in each door + a tweeter in each front door + two surround tweeters in each of the four headrests + a central channel + a subwoofer). This innovative audio system has been enhanced by Arkamys' expertise in signal processing and has been fine-tuned with Jean-Michel Jarre to deliver an outstanding immersive sound experience, which you can enjoy with two of the artist's tracks.

In addition to the quality of the sound output, this system enables flawless positioning of sound transmission and reception.



[Driver private alert] A localised audible alert

Spatialised sound enhances on-board safety. For example, one of the two tweeters in his headrest (the one on the side where a hazard could occur) will audibly alert the driver of an approaching emergency vehicle.



[Personalised call privacy] Private phone conversations

Sound emission and reception are spatialised inside H1st vision. The Kardome software system can identify the person speaking and locate them in the passenger compartment. That way, it can route sound to the speakers in that passenger's headrest (there are two

tweeters per seat). Each passenger, in other words, has their own personal sound space, for example to make a phone call.

The possible extensions of these features include immersive musical creations – for instance the two tracks by Jean-Michel Jarre sampled especially for the H1st vision concept car.

Technologies used:

- Integration into the car: Renault Group
- Sound spatialisation and architecture: Arkamys
- User identification and locating software: Kardome
- Power amplifiers (AB and D classes): STMicroelectronics

Simpler mobility

The H1st vision concept car is designed to simplify everyday mobility in general – and electric mobility in particular. The technologies on board can for instance locate, book and pay for a parking space remotely.



[Park & charge real-time access] Intelligent parking and charging

By pinpointing available parking spaces and charging stations using intelligent sensors coupled with data from connected vehicles and mobility service operators, H1st vision offers users a choice of three services depending on their needs:

- Closest: the spot nearest their final destination, for example a home terminal using the Plug Inn application
- Fastest: a spot near public or other modes of transport. Multimodal travel reduces carbon footprints and may help to ease congestion. To facilitate the user's journey,

H1st vision for example includes self-service bicycle rental stations operated by partners near public car parks

- The most economical: for instance a V2G-compatible charging point (see page 11)

Technologies used:

- Connected vehicle data and data on available charging stations: Mobilize
- Plug Inn app (a French peer-to-peer EV charging community): Renault
- Smart parking space sensors: Orange
- Module combining Narrowband IoT (NB-IoT) cellular communication and localisation by satellite (GNSS): STMicroelectronics
- Self-service bicycle rental service: JCDecaux



[In-car payment] Payment on-board

Park and charge services can be booked remotely and paid for in advance via a chatbot (a single interoperable enhanced messaging interface).

This interface is standard and universal. Service providers can have actual conversations with the vehicle's user through the enhanced messaging service.

The secure system in the car releases payment and displays a receipt on the dashboard. So you can for example pay to charge your battery without stepping out of the car.

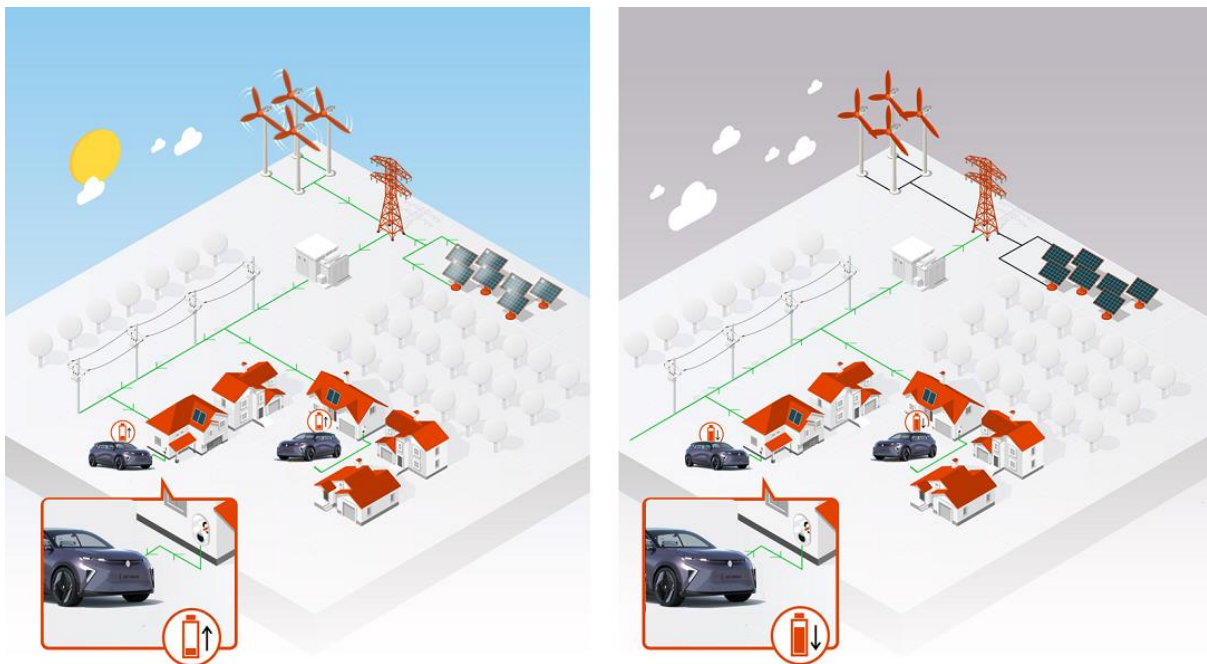
Payment is secured via Mobilize Wallet, a quick and safe service that can be used instead of several credit cards, tags and apps.

Technologies used:

- Open messaging platform enabling booking and payment via chatbot: Orange
- Application programming interfaces (APIs)/Software development kits (SDKs) for service providers: Orange
- Mobilize Wallet: Mobilize

Optimising energy

H1st vision takes care of its occupants and the environment. Its V2G compatibility means it can be charged smartly at Powerbox stations and return electricity to the grid when needed. Its battery chemistry is state-of-the-art for improved range and charging.



[V2G] Vehicle to grid: intelligent two-way charging

The H1st vision concept car has built-in two-way charging technology – G2V or V2G – so you can even use your car to power your home during consumption spikes. This smart energy management system liaises with its ecosystem and helps to manage costs during consumption spikes and to optimise use of renewable energies when the electricity supply contract so provides. Electric vehicles, in other words, double up as solutions to decarbonise the power grid.

This innovation will be implemented in the next generation of Renault vehicles.

Technologies used:

- 4G telecommunication: Orange
- [Vehicle charging system and Mobilize digital ecosystem](#): Renault Group
- Microprocessor, microcontroller with crypto coprocessor, powerline communication component, metrology device: STMicroelectronics
- Cybersecurity: Thales

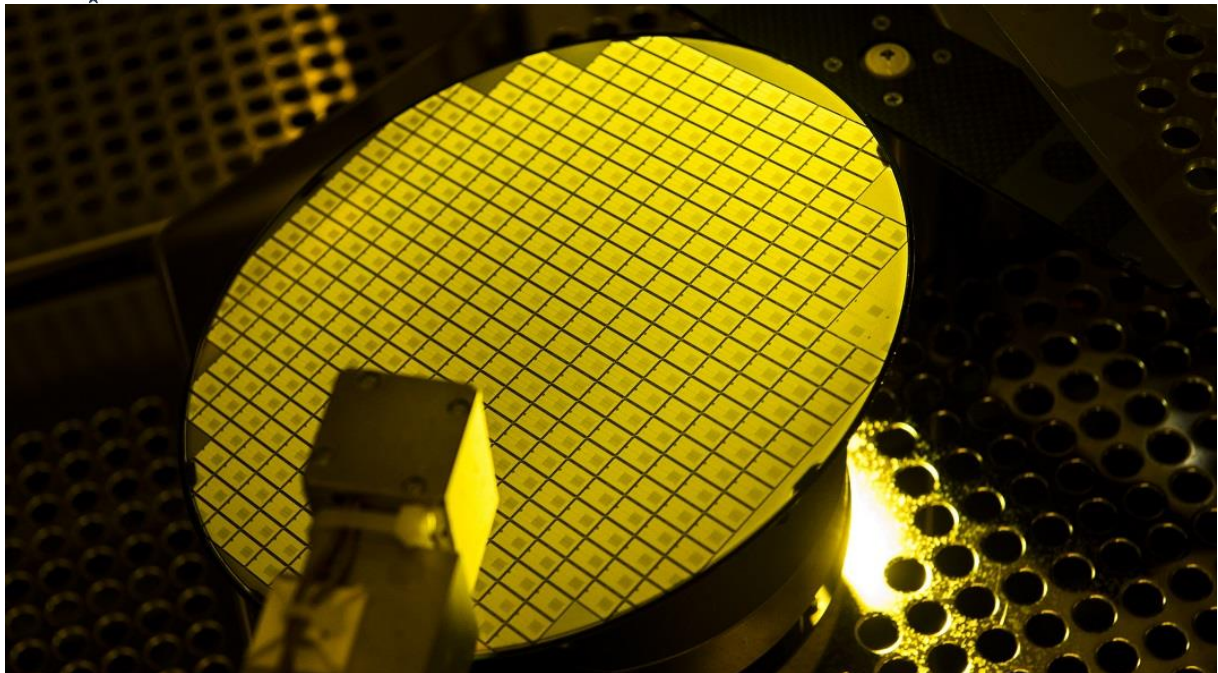


[Mobilize PowerBox] A smart two-way secure charging station made in France

Mobilize PowerBox encompasses a range of smart, connected and secured 7, 11 or 22 kWh AC charging stations. These chargers include V2G technology and will be marketed by Mobilize Power Solutions in particular. You can use an app to operate them remotely.

Technologies used:

- Microprocessors, microcontroller with crypto coprocessor, powerline communication component, metrology device: STMicroelectronics
- Cybersecurity, data protection and connectivity module: Thales
- Digital tools (platform and app): Renault Group
- Telecommunication: Orange



[STMicroelectronics silicon carbide] For more efficient electric mobility

Silicon carbide components are used in the critical systems powering electric vehicles – i.e. the inverters, in-car chargers and DC-DC converters. And they significantly increase efficiency at charging stations. Compared with traditional silicon equivalents, these components:

- Increase vehicle range or reduce battery size
- Lighten vehicles
- Lengthen battery life by easing pressure on it
- Considerably shorten charging time (50% less energy loss)

This innovation will be implemented in the next generation of Renault vehicles.

[Virtual twin] Mobility interconnected in an ecosystem linking the virtual and real worlds

For the first time worldwide, the H1st vision concept car blends into an ecosystem encompassing the vehicle and its virtual twin, interacting with each other in their real or virtual environment – with the driver and passengers but also all the mobility systems including other vehicles, alternative transport options, smart road infrastructure, connected car parks and charging stations, etc.

Virtual twins have become essential in groundbreaking innovation. They have revolutionised working methods by making it possible to design, simulate, test and optimise new products, services, processes, materials and experiences much faster, and on a much larger scale, before manufacturing them.

H1st vision's virtual twin was used to simulate many innovations including security alerts associated with V2X (Vehicle-to-Everything) technology and carpooling passenger access. It enabled all partners to visualise and understand the impact of every decision they weighed while designing the various breakthroughs and optimising their system's operation. Thanks to it, all partners involved in the H1st vision project were also able to “talk” with one another in the cloud, in real time, and share a comprehensive, up-to-date database.

H1st vision also treats users to a new kind of experience by connecting the virtual and physical worlds. In its digital environment, the virtual twin enables visualisation of H1st vision in real time all the time. This permanent link enables you to control the vehicle physically, for an enhanced and optimised mobility experience.

Technologies used:

- 3DExperience platform, and Catia and 3DExcite applications: Dassault Systèmes
- Biometric data processing and analysis system: Thales
- V2X platform and data: Orange
- BOWL platform with virtual-physical link: Epicnpoc

BETTER PROTECTING THE DRIVER AND OTHERS

Health and safety are top priorities for everyone. The technology developed by an open innovation ecosystem such as Software République can play the role of guardian angel. The H1st vision concept car is packed with pioneering technology to make mobility safer for the people in it and everyone else on the road.

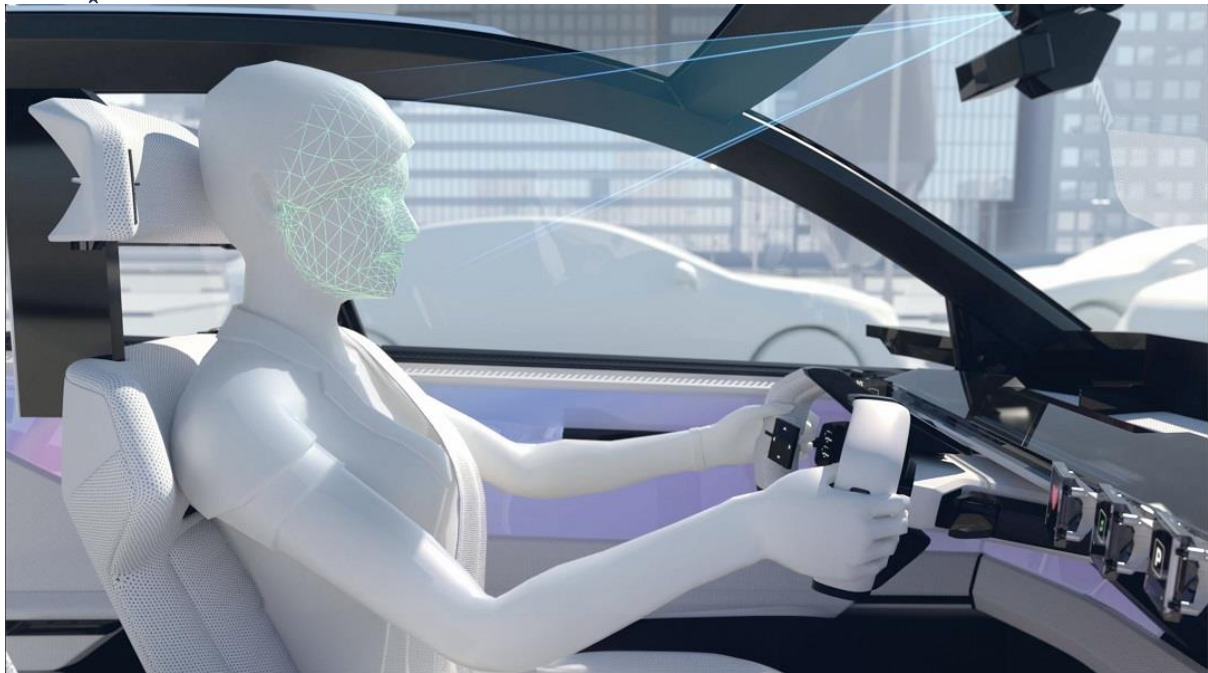
The driver's health

H1st vision is pioneering a new active safety system: monitoring the driver's health and providing assistance. The technology goes beyond the ADASs in modern cars: it enables medical care as well.



[Health monitoring assistant] Your car watches over you

Sensors in H1st vision concept's steering wheel unintrusively monitor the driver's heartbeat, any changes in it and its pattern. Another sensor, in the seatbelt this time, analyses their breathing rate. This information about the driver's health is displayed on the dashboard. Over time, the system checks the driver's data at any point in time against its "usual" profile. Following analysis, H1st vision concept informs the occupant of their health status. The Avatar makes suggestions (to adjust temperature or light inside the vehicle, for instance) or offers other advice that may help them feel better. For example, the avatar may prompt a passenger to do a breathing exercise.



[E-mood assistant] Your car gets to know you

The in-car camera and the microphone under the windshield mirror discern the driver's mood by analysing their voice and facial expressions. The avatar's look, the colour of the onboard strip and the screen adjust accordingly.

If the e-mood technology detects that the driver is irritated or stressed, it will suggest a breathing exercise to help them relax.

Technologies used:

- Mood analysis software: Stern Tech
- Inertial module MEMS in the steering wheel to monitor the heart's electrical signals and accelerometer in the seatbelt to monitor the heartbeat, operation amplifiers, microcontroller with Bluetooth connectivity and power components: STMicroelectronics



[Real-time health assistant and satellite communication] Satellite emergency call assistant

H1st vision's health monitoring assistant analyses the driver's health data. Thanks to its algorithms and user's health track record, it can potentially step in before the driver is unfit to drive and suggest that he or she take a break. During the break, the health data can be sent to a medical assistance service, with the driver's consent, and the system can set up a videoconference for a live conversation with a medical professional. The H1st vision concept car can also place a satellite call from a dead zone (an area with no mobile network coverage) using the shark fin antenna on the roof, to alert emergency services if someone in the car is unwell. Concurrently, it flashes its front and rear lights.

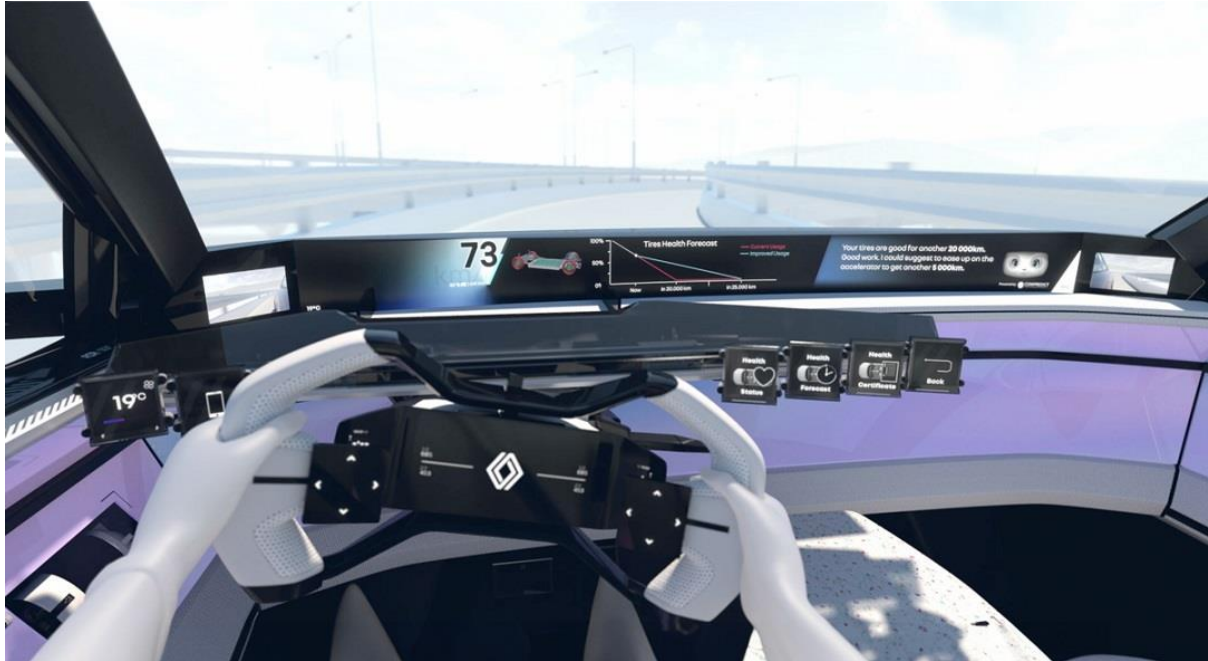
H1st vision can also place a call in areas covered by the terrestrial cellular network. Its multi-connectivity, in other words, provides seamless service everywhere.

A smart flashing beacon can also be fitted onto the roof to automatically send the vehicle's position of the road traffic supervision centre over the cellular network.

Technologies used:

- Inertial module MEMS in the steering wheel to monitor the heart's electrical signals and accelerometer in the seatbelt to monitor the heartbeat, operation amplifiers, microcontroller with Bluetooth connectivity and power components: STMicroelectronics
- Integration into the car: Renault Group
- Satellite calls: Thales and Orange
- Module combining Narrowband IoT (NB-IoT) connectivity and localisation by satellite: STMicroelectronics

The innovation-packed H1st vision uses its technology to give drivers greater peace of mind regarding the state of operation and wear of its key components. This is reassuring for current owners, as well as future owners if the car changes hands.



[Predictive Car health monitoring] Vehicle condition monitoring

The H1st vision concept includes all-new virtual sensors, which can assess wear in the vehicle's key components (battery, brakes, tyres, gearbox, chassis, suspension, etc.) in real time.

Complementing the physical sensors already fitted into today's vehicles, the virtual sensors provide information enabling extremely detailed analysis.

By accurately monitoring the state of wear of the vehicle's key components, the H1st vision concept generates:

- “health status”, a general snapshot of the vehicle's health, available anytime;
- “health forecast”, an estimate of the number of kilometres the vehicle can drive before it needs servicing (based on sensor readings, not one-size-fits-all maintenance contracts), and advice to extend wearing-part life.



[Car health NFT certificate] Vehicle health certificate

The H1st vision concept car can generate its own “health certificate”. This document is an NFT* available on all digital devices (for instance a smartphone). It attests to the car’s health and contains all the related records (number of owners, status of the battery and other key components, number of check-ups, certificates issued by the garages that serviced the vehicle, etc.). It also includes the list of past technical inspections and, most importantly, tells you when the next inspection is due.

The health certificate uses blockchain technology, which is tamper-proof. The fact that its authenticity is guaranteed is reassuring for future owners or rental professionals and increases the car’s residual value.

Technologies used:

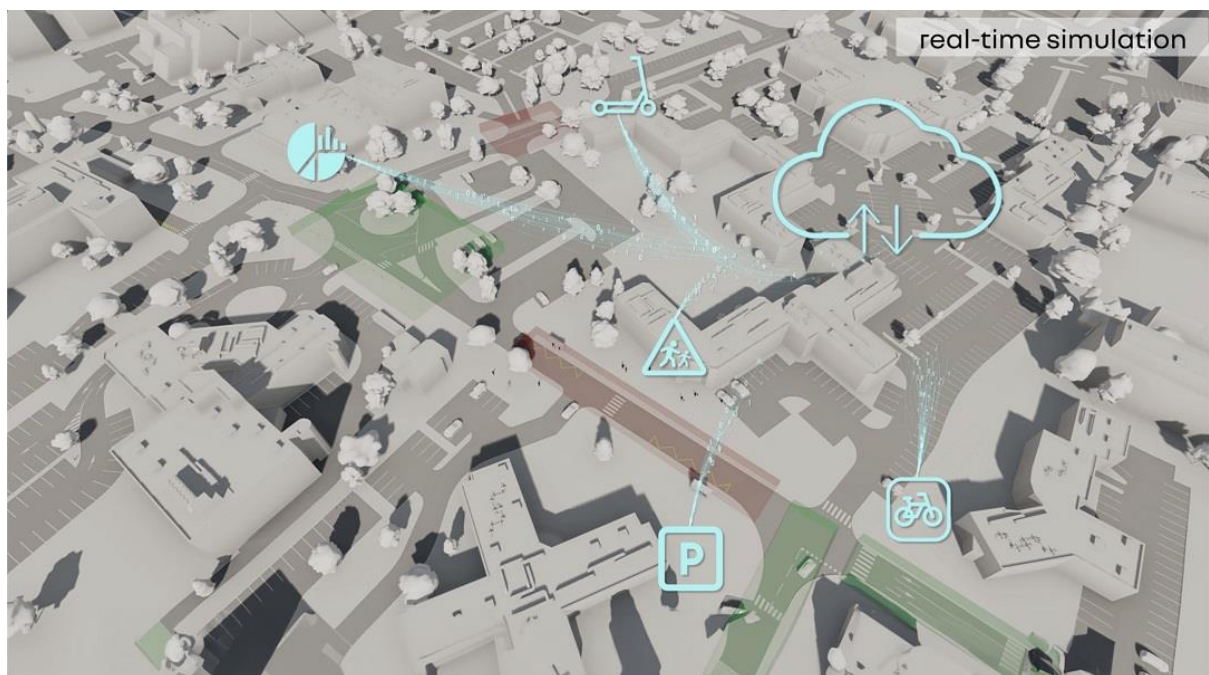
- Virtual sensors and monitoring based on machine-learning and deep-learning technologies: Compredict
- The car’s past data and expert insight: Renault Group
- NFT/Smart contract: Renaissance
- Live Identity Wallet and blockchain: Orange
- Virtual twin/3DExperience platform: Dassault Systèmes

* Non-fungible token: a unique digital certificate of ownership, which cannot be copied, replaced, or subdivided.

For safer roads

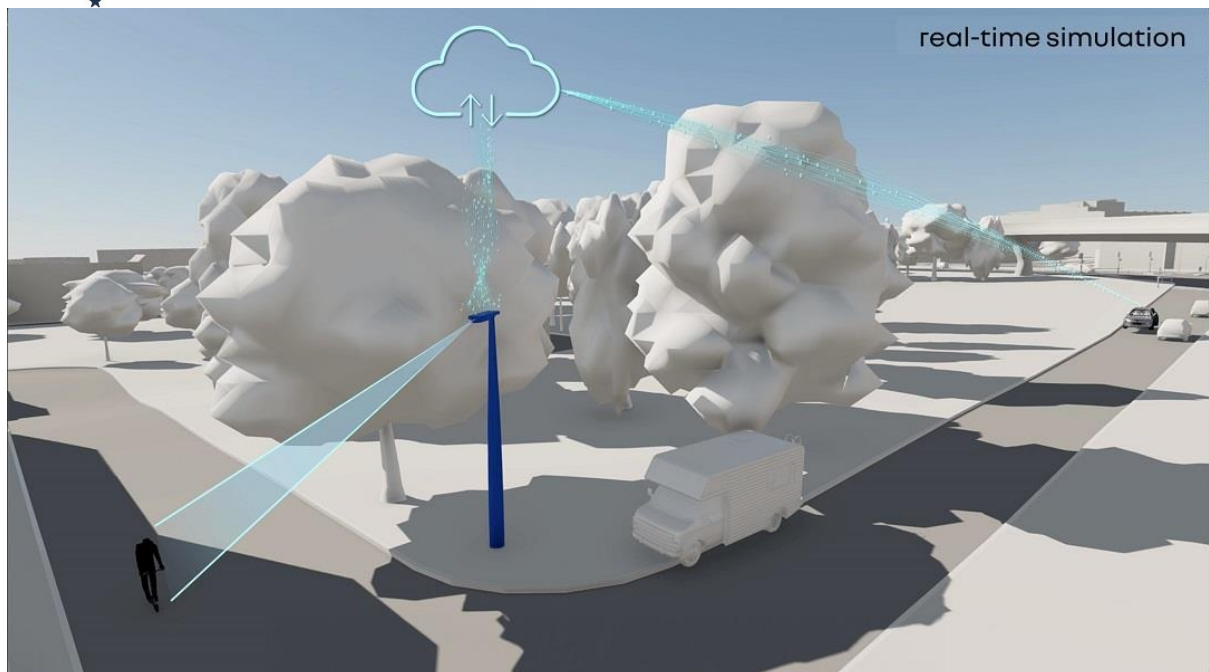
The interconnected H1st vision concept car constantly processes data it obtains in real time from the entire connected ecosystem as well as archived data. Its software platform collects, shares and analyses information from the 4.0 city and road networks, as well as from other vehicles and road users, weather data, etc. The aim is to improve safety in and around the vehicle, in particular through predictive systems.

A simulation of this technology is available via the H1st vision concept car's virtual twin "in" a virtualisation of a real city.



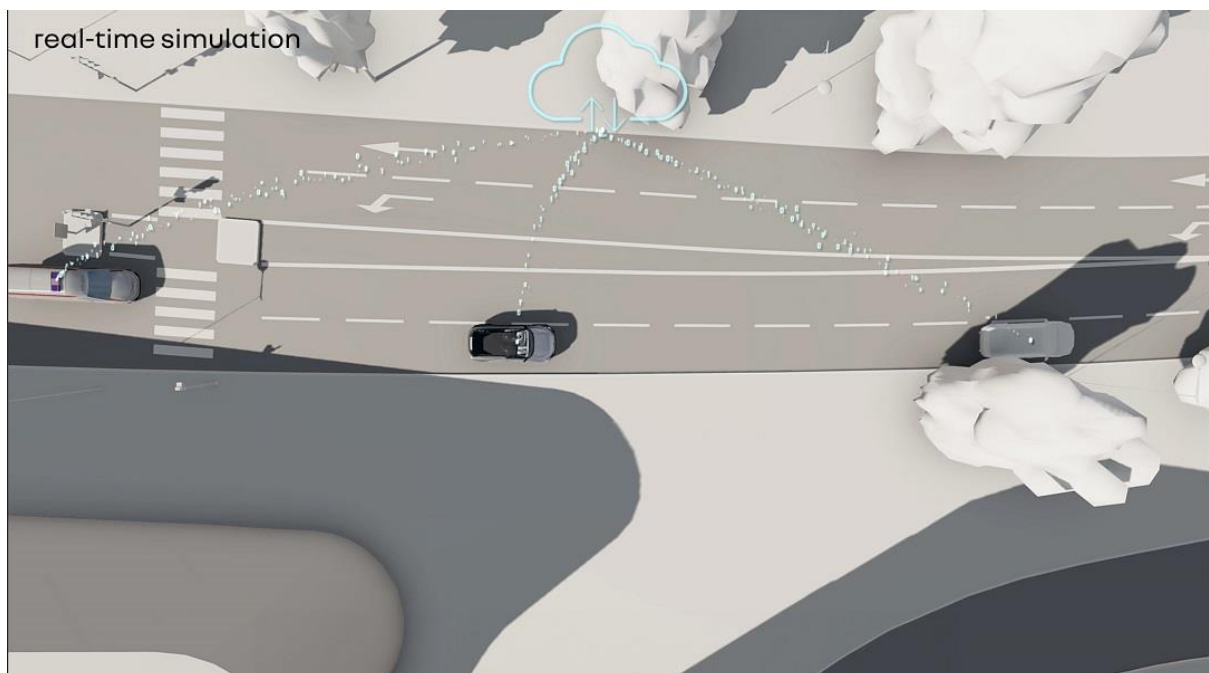
[Predictive risky zone alert] Early warning of accident-prone areas

The H1st vision concept uses accident statistics, the characteristics of the road and its environment (reduced visibility, intersections) to determine the probability of accidents. Capable of anticipating hazards such as accidents or the presence of black ice, it alerts the driver in real time via a display on the dashboard to increase the safety of the occupants and others, and protect the environment.



[Real-time vulnerable road user protection]

The H1st vision concept is hyperconnected to the entire mobility ecosystem. As it is connected in real time to the city, it uses data from infrastructure such as traffic lights and data from people using this infrastructure (for example in other cars, on scooters and on bicycles). The aim is to better protect all users with a system that alerts the driver of imminent danger in a timely manner, even when a vulnerable road user is in a blind spot or in an area with reduced visibility.



[Predictive emergency vehicle alert]

The congestion that builds up around accidents slows down emergency services trying to reach the area. As every minute counts when someone needs first aid or needs to be evacuated, V2X communication technology alerts the drivers of all connected vehicles that are slowing down or standing still that rescue vehicles are approaching. That way, drivers can help make way for the emergency vehicles to get through.

Technologies used:

- 5G connectivity, data and V2X platform: Orange
- Vehicle data and connectivity: Renault Group
- Secure V2V and V2X communication: STMicroelectronics
- Virtual twin: Dassault Systèmes



Cybersecurity: detection and response

Today, most new vehicles are connected. By 2025, nearly 85% of them will be connected in Europe (according to an S&P Global market study). To provide new functionalities and at the same time ensure maximum security, these intelligent cars will have an increased need for cyber-protection as well as risk detection and management. Cybersecurity is not an optional extra for connected and secure mobility. Orange Cyberdefense – the Orange group’s cybersecurity entity –, Renault Group and Thales jointly developed a unique solution to detect and respond rapidly to cyberattacks. This comprehensive solution is based on machine learning and other artificial intelligence technologies.

The complementary technologies from the three companies, integrated end to end, will make it possible to better identify cyberrisks and deal with them in all vehicle components and in the cloud, while meeting the most stringent applicable standards and regulations.



This unique solution shortens the time required to respond to cyberthreats: it detects the type of attack up to eight times faster, to anticipate and prevent risks more effectively. It will be implemented in the next generation of Renault vehicles.

Technologies used:

- 24/7 monitoring and analysis at the Security Operations Centre using IA/ML models:
Orange
- Cyberthreat detection algorithms to build, maintain and improve IA/ML models:
Thales
- Integration into the vehicle architecture: Renault Group

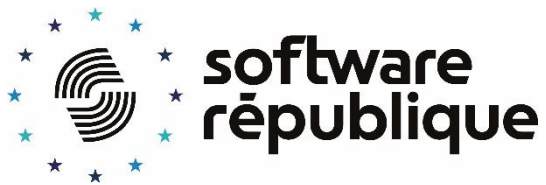


The H1st vision concept car's design

More than a demonstrator on wheels, H1st vision is a real vehicle that can seat four passengers in great comfort. The appealing design is a harmonious blend of smooth surfaces and sharp angles enhanced by a silver paint finish with purple varnish. Slim and stylish, the front and rear lights add a distinct techno vibe to the vehicle's silhouette. And announce all the cutting-edge technology awaiting inside.

The shape of the rhombus runs through the design of H1st vision. The design of the rear lights is inspired by the new Renault logo.

Mirroring the looks of all-electric cars, the front has no air vents or air intakes. As if to deceive the eye, what appears to be a perforated grille is in fact an elegant checkerboard of Plexiglas diamonds through which LEDs emit coloured light. The LEDs also send out an interactive light signal that can alert pedestrians or indicate that the vehicle has come to an emergency stop.

**About Software République:**

The Software République is defined as an open innovation ecosystem dedicated to intelligent, secure, and sustainable mobility. It was created in April 2021 by six founding members: Atos, Dassault Systèmes, Orange, Renault Group, STMicroelectronics and Thales. The Software République builds collective businesses focused on tomorrow's mobility through its unique horizontal collaboration model. The ecosystem stands out for its innovative approach, combining established companies and startups from different backgrounds to bring to market products and services that meet the new challenges of the connected vehicle, the smart city and energy. These projects are based on the complementary expertise of its partners in data analysis, artificial intelligence, cybersecurity, connectivity, and virtual twins, and on the ambition to invent a new model of innovation while keeping people and the environment at the heart of its motivations. Further information can be found at <https://www.softwarerepublique.eu/en/home/> .