Image credit : Maybach

MOBILITY INDUSTRY INSIDER

Q2 2020 | Pulse

Passenger Wellness

What's inside?

- Cabin sterilization & air filter is one of the prime focus during the pandemic
- Latest research innovation related to cabin air filters against various airborne pollutants
- Startups Tracker update Q2'20

FutureBridge

THEMES AND KEY TAKEAWAYS IN PULSE

COVID-19 has intensified the concerns over health risk monitoring in the mobility industry.

Vehicle interiors often contain multiple occupants in an enclosed space for long periods. What's more, there are abundant frequent touch points in that environment. Therefore, inadequate sterilization of surfaces, and microbes could lead to cross-contamination. OEMs and the suppliers are developing and implementing technologies to tackle vehicle sanitation.

Themes covered in this scope	Key Takeaways
Cabin sterilization & air filter is one of the prime focus after the pandemic ▪ Based on our industry development tracker since last 6 months ▪ Latest Technology in which OEMs and suppliers are working on.	▪ According to Cox Automotive survey, one third of vehicle buyers are more likely to consider air quality features for their next vehicle than before COVID-19. ▪ Various Active and Passive systems related to vehicle sterilization like **Ozone Air Sterilisation**, **UV Radiation**, **Antimicrobial Materials**, **Ionisation system** by **JLR**, **Cerafusion Technology** of **MG Motors**, **Intelligent Air Purification system** by **Geely** are examined
Academic Research related to the Air Filter and health risk associated with various VOCs ▪ Comparison of filtration performance of commercially-available automotive cabin air filters against various airborne pollutants. ▪ Health risk assessment and source apportionment of VOCs inside new vehicle cabins: A case study from Chongqing, China	▪ Careful selection of commercial ACAFs based on performance is essential to protect cabin indoor air quality ▪ The results demonstrated that carpet and seats were the most important source for VOCs inside new vehicle
Startup Update Q2'20 ▪ A snapshot of our startup tracker till Q2'2020 with segmentation by technology, region & commercialization. ▪ Collaboration activity happening in Passenger Wellness ▪ Funding distribution & activities in Passenger wellness ▪ Startup highlight – Edge3 Technologies is focused on AI-based occupant monitoring solution	▪ Of the 35 startups we monitor, USA leads as the major startup hub followed by Israel. 29% of the startup are working for Health Monitoring followed by 23% in Interior Acoustics. ▪ Of the 20 collaborations captured in Passenger Wellness, 11 happened in 2019 and Q2'2020. Most collaborations are relevant to Occupant health monitoring / Safety ▪ In total, 21 startups globally have received funding with respect to passenger

01

Cabin sterilization & air filter in focus during the pandemic

Upcoming Trend

- Cabin sterilization as a standardized feature in all vehicle segments

Players in our coverage

What do we see happening

- Cabin sterilization will become a priority for both buyers and vehicle makers.
- Ozone sterilization and UV radiation are the most commonly used technologies in the sterilization of vehicle with different OEMs trying to add some other technology features to make it work more effectively.
- The ionization system already features in vehicles of JLR and Porsche as optional equipment . With Sterilization as a prime focus, there is a possibility of car makers making it a part of the standard equipment
- Since Sterilization system adds to the cost of a vehicle, OEMs are trying to come up with techniques that can make it cost-effective.

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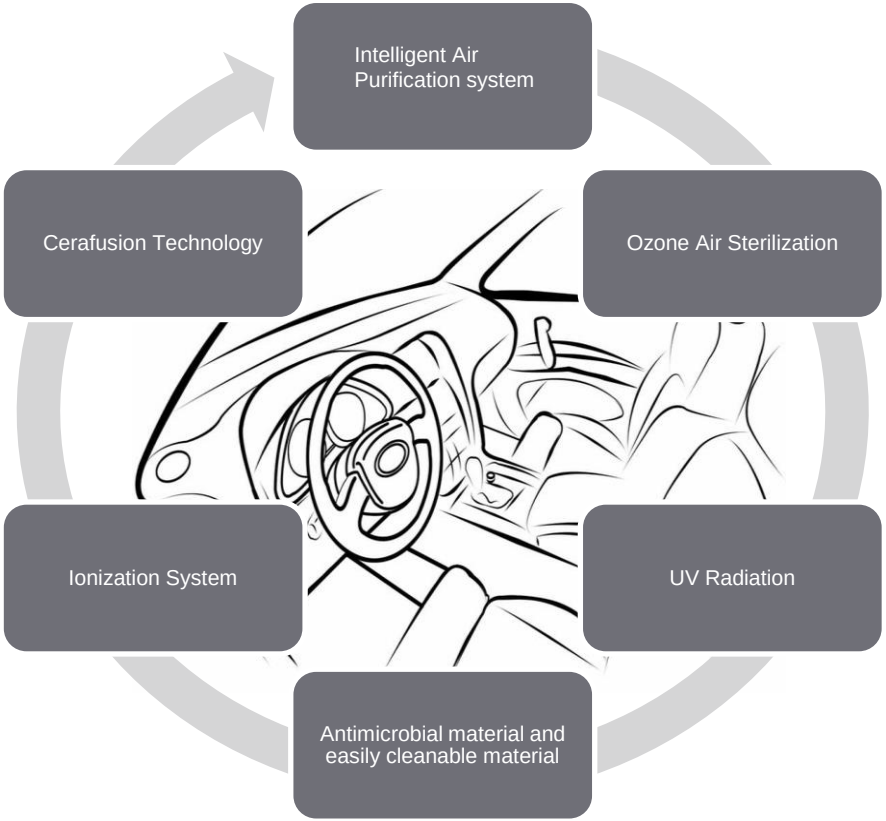
Cabin sterilization & air filter is one of the prime focus after the pandemic

CONTEXT

Virus proofing has grown out to be an important aspect for both the carmakers and vehicle owners. Automakers all over the world are looking for ways to sterilize the vehicle interior after the pandemic broke out.

According to Cox Automotive survey, one-third of the vehicle buyers are more likely to consider air quality features for their next vehicle than before COVID-19.

Technologies used for cabin Sterilization



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Developments

OEMs

- Hyundai is planning to use ultraviolet (UV) light globes to sterilize the interiors of its cars. Hyundai Motor Group is exploring the idea of using UV light to disinfect automobile interiors by using the humble dome light to fight against the spread of disease.

- JLR's has declared all its new vehicle launched in SA will have an option of Cabin ionization system. It improves the air quality by reducing allergens, airborne bacteria, and associated odors, the system electrically charges air particles, ionizes them and removes pollutants and other harmful particles

- Chinese carmaker Geely has come up with an air filtration system that can eventually prevent bacteria and other viruses from entering the car. Geely has come up with an air filtration system that can eventually prevent bacteria and other viruses from entering the car.

- MG Motor has partnered with Medklinn for natural sterilization of Cabin Air and surface of the car. MG Motors will use Medklinn patented cabin sterilization technology in their Hector and ZS EV model

Developments

Supplier and Aftermarket Players

- ATS ELGi has announced the launch of their new range of vehicle sterilization solutions. The ozone air sterilizer uses ozone to eliminate bacteria, viruses, molds, allergens, odors, and harmful pollutants like volatile organic compounds ensuring a safe and clean in-vehicle environment.

- Seoul Viosys and Sensor Electronic Technology, Inc. have announced they are successful in achieving 99.9% of sterilization against COVID-19 in 30 seconds. It will be mass produced by using compound semiconductor Violed Technology.

- UFI Filters Group launched an air filter that can combat viruses and bacteria in vehicles. UFI's SOFIMA D-FEND antiviral high-efficient cabin air filter was proposed by its research and development team in China and will be used in cars for the Chinese market.

- Valeo's disinfectant solution ClimSpray disinfects a vehicle's interior in 15 minutes. The product not only prevents the spread of infectious microbe at the source but also releases a pleasant fragrance. It can be used on both plastic and rubber and does not leave any traces or stains behind.

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Ozone Air Sterilization

Technology –
The ozone air sterilizer uses ozone to remove bacteria, viruses, molds, allergens, odors, and harmful pollutants like volatile organic compounds confirming a safe and clean in-vehicle environment.

Working –
The ozone air sterilizer uses 12V DC via the vehicle battery to transform natural air or normal O2 molecules into ozone, abolishing the need for additional chemicals or disinfectants which might be harmful or leave behind a residue. This ozone helps in eliminating bacteria, viruses, molds, allergens, odors, and other harmful pollutants.

Advantage –
- Kills viruses and bacteria
- Prevents bad odor
- Improves family health
- Compact & portable design

Players working on it –

ATS ELGI THINK LONG RUN™ FARADAY OZONE MAGNA

UV Radiation

Technology –
UV radiation has been in use to kill microorganisms such as bacteria and fungi and also neutralize viruses – and has been in use in hospitals, train stations, and art galleries.

Working –
UV light will be used as a cars interior dome light and would be ideal for sterilizing touch points such as seats, floor mats, dashboard, and steering wheels simultaneous. Further UV rays will be used as a catalyst to reduce cabin CO2 and kill germs floating inside a car. This technology could form a part of future air conditioning systems.

There are different types of UV light UV-A, UV-B, and UV-C. UV – C is the light that is used for purifying air and water and for inactivating microbes. UV- C light in the range of 260 - 285-nanometer wavelength range are most relevant for current disinfection technologies, but the ray is harmful to the human skin.

Players working on it –

Yanfeng Global Automotive Interiors HYUNDAI JAGUAR LAND ROVER SAIC

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Antimicrobial material

Technology –

These antimicrobial materials damage the protein, cell membrane, DNA, and internal systems of a microbe, causing it to die. An “antimicrobial” surface could have a damaging effect against a range of organisms ranging from beneficial to harmful ones and could include mammalian cells and cell types associated with diseases such as bacteria, viruses, protozoans, and fungi.

Working –

Most antimicrobial material technologies are additives or coatings which contain metals known to be biocidal. For example, copper and silver are natural antimicrobial materials that have intrinsic properties to destroy a wide range of microorganisms. Some natural polymers, such as chitosan, heparin, and e-polylysine can also inhibit the growth of disease-causing microorganisms. Research shows that graphene also offers opportunities as new antimicrobial material. Another way of creating antimicrobial properties is by embedding nano-structures in fabrics and other surfaces that inhibit microbes from living and breeding on the surface.

Players working on it –

FCA FIAT CHRYSLER AUTOMOBILES

Ford

Ionization System

Technology –

It helps in improving air quality by reducing allergens, airborne bacteria, and associated odors, the system electrically charges air particles, ionizes them, and removes pollutants and other harmful particles.

Working –

The system uses a condenser inside the vehicle to collect moisture from the air. These water molecules are then electrically charged, or ionized, to trap contaminants such as allergens and bacteria when dispersed through the climate control system. The benefit of using a moisture based-system means the contaminants are better secured, making them less likely to escape the filter media. Without the ionization process, these particles would flow freely throughout the car's cabin, even though the cabin pre-filters fitted to most vehicles.

Players working on it –

JAGUAR LAND ROVER

PORSCHE

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Cerafusion Technology

Technology –

Cerafusion Technology creates active oxygen. Active oxygen eliminates 99.9% of all allergens, bad smells, bacteria, viruses, mold, and other toxic substances in the air and on surfaces.

Working –

Connected through the USB, it delivers a continuous flow of active oxygen to fill the vehicle interior, eliminating bacteria, viruses, mold, odors, allergens, and pollutants found in the air and surface like seats, carpet, and dashboards. It produced O3 and O- molecules, O3 gets attached to the harmful pollutants and destroys them at the molecular level, on the other hand, O-, the negatively charged oxygen atom will cluster harmful airborne particles causing them to fall on the surface.

Players working on it –

MG

medklinn®

Intelligent Air Purification System

Technology –

Intelligent Air Purification System (IAPS) can automatically filter out harmful particulates from the vehicles' internal air environment. The system is certified to filter out 95% of the small particle.

Working –

The intelligent Air Purification System works in combination with the HVAC system, helps in isolating harmful bacteria and microorganisms. The new air filtration system which is certified to filter out 95% at the 0.3 micron level of a small particle. The anti-bacterial layer utilizes a nano-silver ion sterilization technology, while the anti-bacterial coating uses natural plant polyphenols to zap allergens.

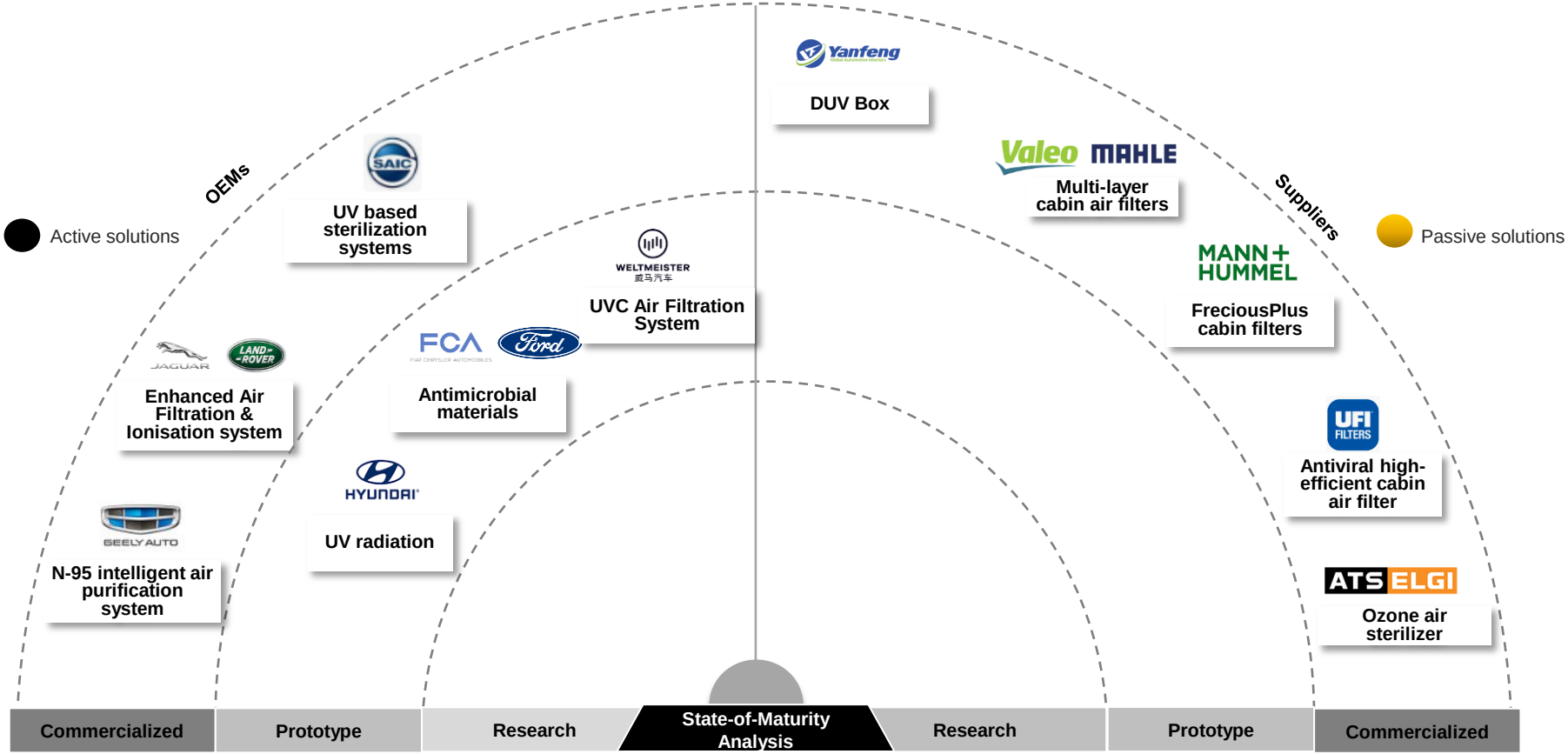
The new IAPS system has an advanced new active carbon chemical filter that can effectively absorb harmful gases such as formaldehyde as they enter the vehicle and is also able to filter out bad odor and harmful pollutants after detected by the automatic system. The system is also equipped with a negative ion generator that can sterilize and deodorize in vehicle pollutants and aim to remove in airborne viruses, bacteria, fungi, and molds, etc, achieving the same level of the air filter as an N95 respiration system.

Players working on it –

吉利汽车 GEELY AUTO

Maturity Diagram: Cabin sterilization Technologies

Many of the suppliers are providing retrofit systems for cabin sterilization and air filtration which could lead to higher commercialization of products



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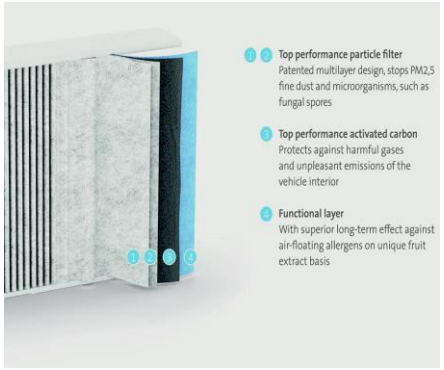
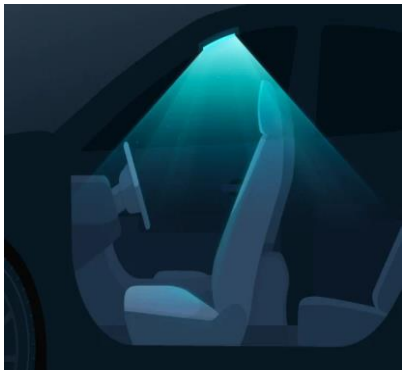
FutureBridge on Cabin Sterilization

- The pandemic has made carmakers to take a different approach for disinfecting and delivery of cars. The potential buyer can take solo test drives, contactless delivery of the cars, providing the worker with protective measures.
- Not only the carmakers[1], different governmental and health care agencies have also issued guidelines to reduce the risk of the pandemic from spreading. Centre for Disease Control has offered guidance to drivers of ride-share, food-delivery, and non-emergency vehicles on cleaning and disinfecting vehicles during the pandemic.
- Most common household disinfectants are effective in cars, but some are not ideal for use on a vehicle like bleach, hydrogen peroxide, benzene, thinners, or other harsh and abrasive cleaners. These chemical products can damage the vehicle's upholstery and interior surfaces.
- N95 filter in the HVAC system helps in removing 95% of particles and contaminants larger than 0.3 microns. It also helps in removing 98% of PM2.5 dust particulates. It also effectively filters smoke particulates, dust, bacteria, and other pollutants.
- HEPA filters are widely used in HVAC system of moderns cars, that provides filtration efficiency of 99.97% at 0.3 microns. This efficiency provides ultimate protection in trapping allergens, dust and other particulates that can enter the vehicle and provides the cleanest air possible.
- Both N95 and HEPA filters help in circulating cleaner air in the cars, but an additional layer of the disinfected system is needed to make the vehicle germ free.

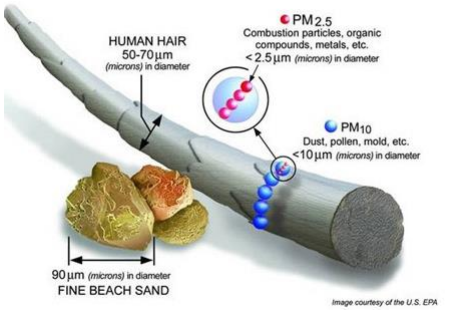
JLR's Ionization system



Geely's Intelligent air Purification System



Hyundai's UV radiation system



02 Quarterly review of early-stage research

Highlights from Academic Research in Q2' 2020

Comparison of filtration performance of commercially available automotive cabin air filters against various airborne pollutants

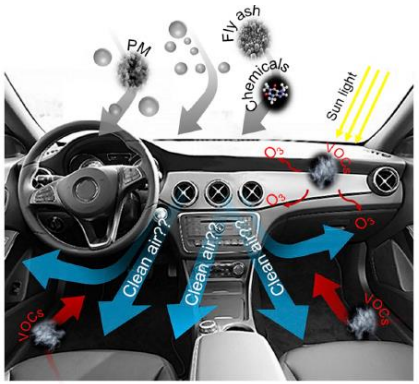
(Science Direct, Aug 2019, Ki Joon Heo, Jung Woo Noha, Byung Uk Lee, Yeonsang Kim, Jae Hee Jung)

Background

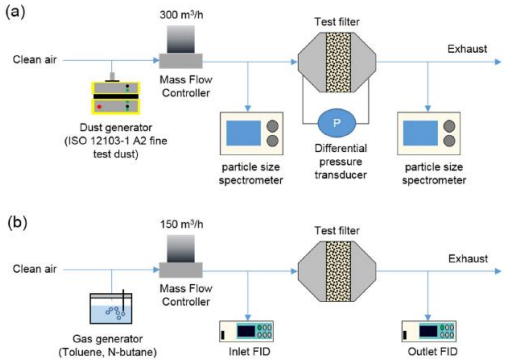
- Controlling air pollutants in the automobile cabin environment has become increasingly important owing to the health risks of exposure to high concentrations of harmful air pollutants.
- To protect daily commuters and drivers against the harmful effects of air pollution, modern automobiles are commonly equipped with automotive cabin air filters (ACAFs).
- Thus, understanding the filtration performance of ACAFs is essential for assessing cabin indoor air quality.

Key Insights

- Commercial automotive cabin air filters (ACAFs) were evaluated and compared in terms of filtration and removal performance.
- Eleven of the 15 ACAFs tested satisfied the standard guidelines for PM filtration performance.
- Only one ACAF satisfied the standard guidelines for gas removal performance of both n-butane and toluene.
- The filtration performance of ACAFs varied depending on the type of filter (OEM or after-market filter).
- Careful selection of commercial ACAFs based on performance is essential to protect cabin indoor air quality.



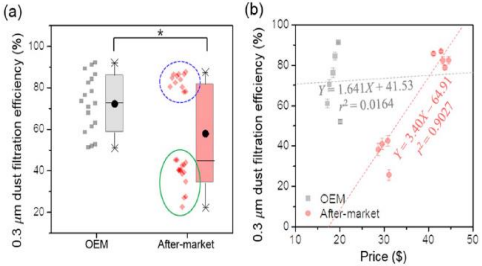
Schematic diagram illustrates that the automotive cabin air filter removes harmful airborne pollutants and purifies cabin indoor air.



Schematic diagram of the experimental setup used in the filtration test. (a) PM filtration performance test set-up and (b) gas removal performance test setup

FutureBridge Analysis

Disruptiveness	High
Feasibility	High
Timeframe / Maturity	Near Future
Areas Covered	Cabin indoor air quality, air filter



Filtration performance according to manufacturer type.

Highlights from Academic Research in Q2' 2020

Health risk assessment and source apportionment of VOCs inside new vehicle cabins: A case study from Chongqing, China

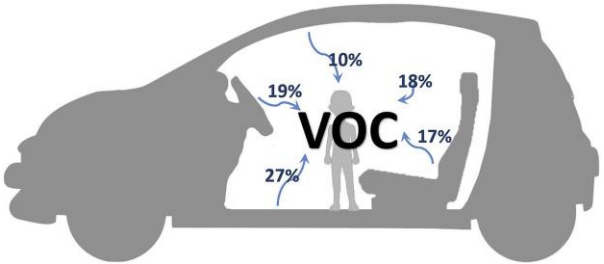
(Science Direct, Sep 2019, Bo Lianga, Xiang Yua, Haipeng Mia, Di Liua, Qingqing Huanga, Mi Tianb)

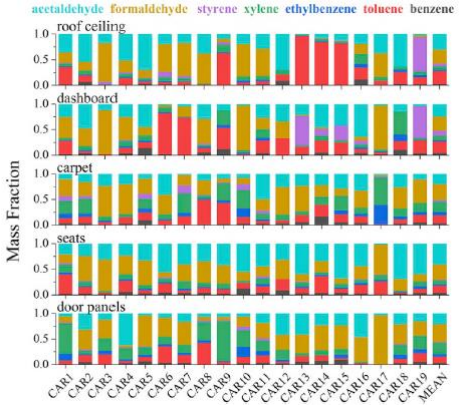
Background

- Vehicle cabin is a relatively confined environment in which driver/passengers are exposed to volatile organic compounds (VOCs), which may lead to adverse effects on human health.
- In this study, airborne VOCs inside new vehicle cabins were measured to evaluate the human health risk and to identify the dominant source.
- To identify the dominant source of in-vehicle VOCs, nineteen sets of interior parts (including roof ceiling, dashboard, carpets, seats, and door panels) corresponding to nineteen targeted vehicles, respectively, were measured to get the source profiles.

Key Insights

- In-cabin VOCs for new vehicles were measured to evaluate the human health risk and to identify the dominant source.
- The in-cabin VOCs levels in the present study were all below the Chinese limitations, but they may still cause potential health risks.
- CMB results demonstrated that carpet and seats were the most important source for VOCs inside new vehicle.
- Formaldehyde and acetaldehyde, the main causes of potential human health risks, were mainly from carpet and seats.



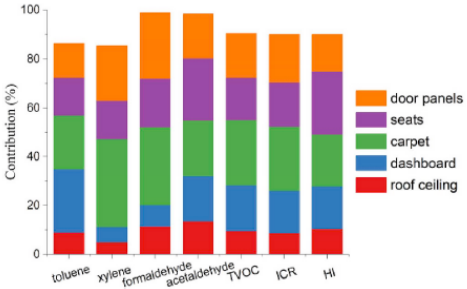


VOCs Source apportionment CMB Health risk assessment New vehicle

FutureBridge Analysis

Disruptiveness	High
Feasibility	High
Timeframe / Maturity	Near Future
Areas Covered	VOCs in vehicle

VOCs source profiles



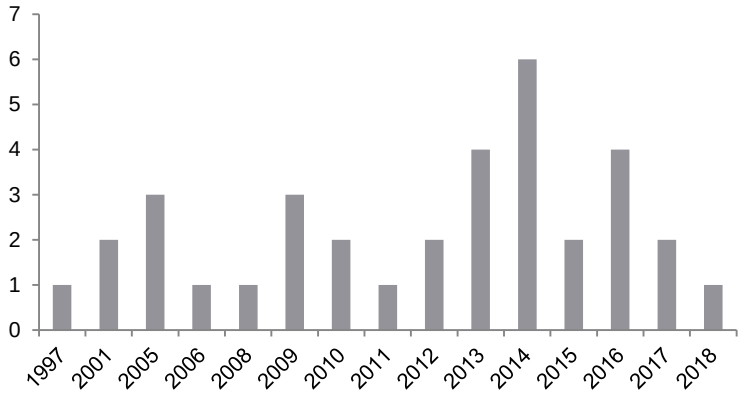
Average source contributions to individual and total VOCs inside vehicle cabins.

03 Startups Tracker update Q2’20

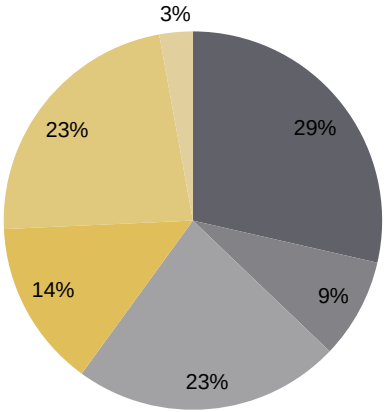
Startup Tracker summary Q2'20 : For more information access our Startup Tracker

Of the 35 startups we monitor, USA leads as the major startup hub followed by Israel. 29% of the startup are working for Health Monitoring followed by 23% in Interior Acoustics

Founding year of new startups

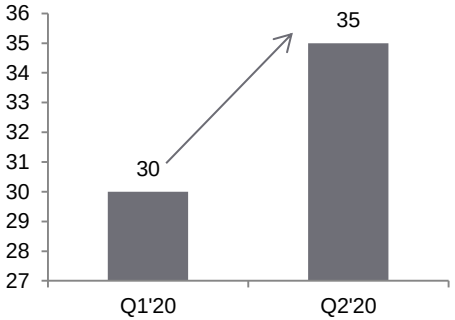


Startups by Technology

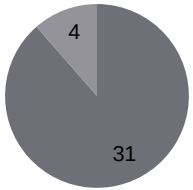


- Health Monitoring
- Humidity and Air Quality Control
- Interior Acoustics
- Interior Lighting
- Seating
- Suspension System

Number of Startups added



Companies with commercial products



- The 4 pipeline product which are not yet being commercialized consists of Lighting, NVH solution and sensor for Health Monitoring of Passenger.
- There is no official announcement by the makers for the launch of this product, but we expects it to be in the market by the end of this year or early next year

■ Commercialized Products ■ Pipeline Products

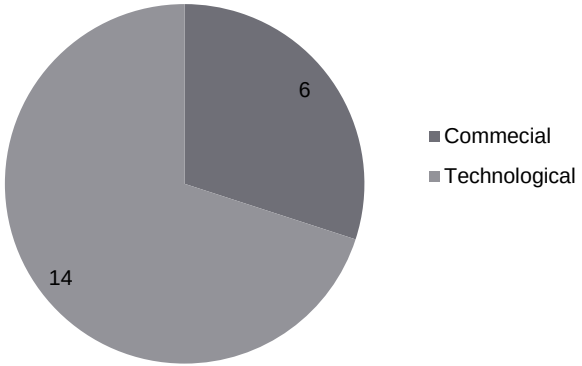
New Startups added Q2'2020

CARUNA ERGONOMIC INDEPENDENCE	Seating
mifold	Seating
EDGE3	Health Monitoring
Re-Fresh 刷新 智能电子	Air Quality Control
IDM 苏州慧闻纳米科技有限公司 IDM Technology Inc.	Air Quality Control

Collaboration Summary of the startups 2009 – Q2’20

Of the 20 collaborations captured in Passenger Wellness, 11 occurred in 2019 and H1’2020

Collaboration by type



- Out of the 20 collaboration, Occupant Heath Monitoring is having most the collaboration, followed by NVH solution and Audio system

Some of the Important collaborations 2019 – Q2’2020

Airlabs — Cabin air filter >> → BARCLAYS

Silentium — Engine Order Cancellation >> → AKM

MDGo (vehicle to medical insight) — Advanced vehicle safety systems >> → HYUNDAI

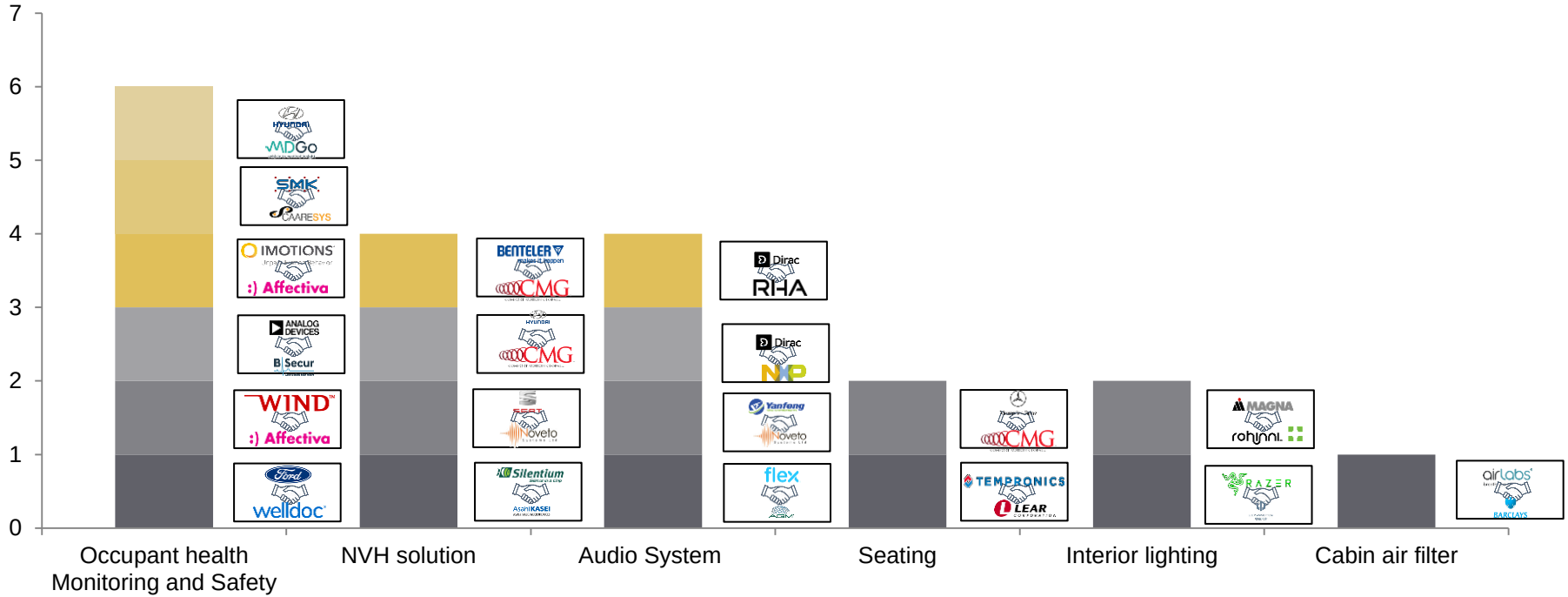
CMG (Comfort Motion Global) — New Motion Seating technology >> → Mercedes-Benz

Vibracoustic — NVH solutions for EVs >> → BENTELER

Vibracoustic — NVH solutions for EVs >> → HYUNDAI

Collaboration Summary of the startups 2009 – Q2'20

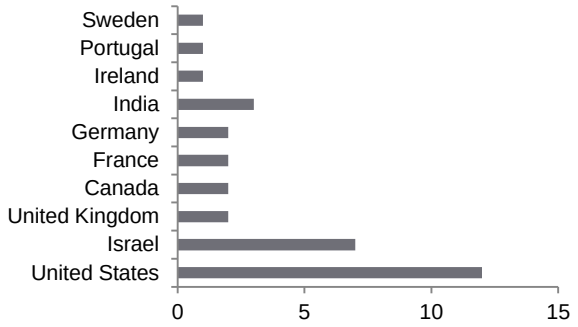
Most of the collaborations are relevant to Occupant health monitoring / Safety



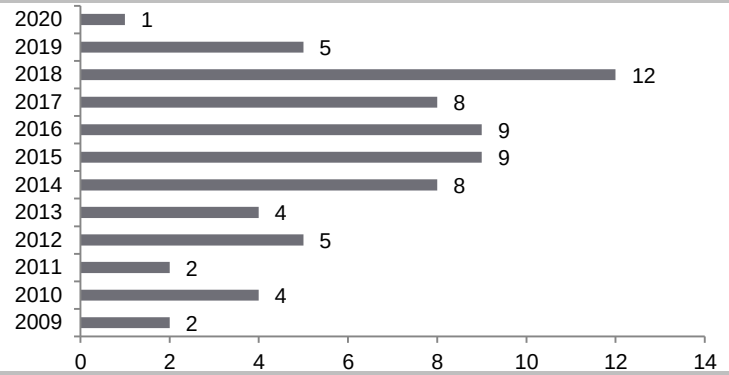
Global funding report: 2009 – Q2'20 (1/2)

In total, 21 startups globally have received funding with respect to passenger wellness.

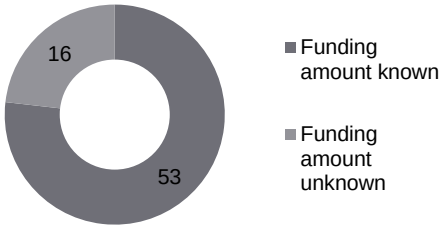
Startups by region



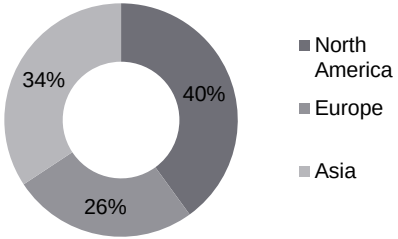
Funding status of startups as per year



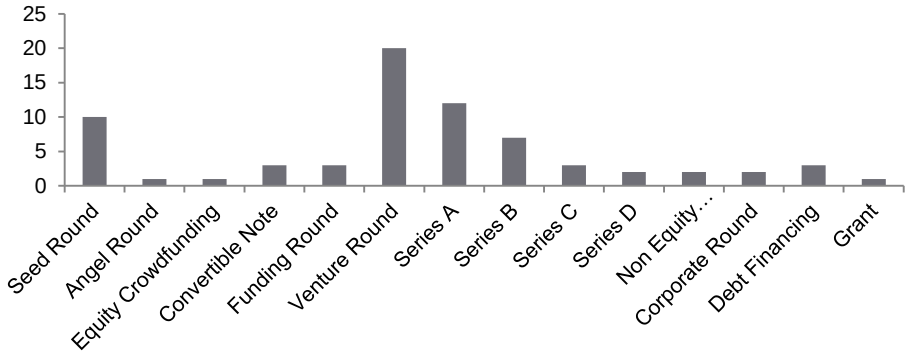
Total known and Unknown transactions



Top 3 continents share (%) of startups



Transactions through type



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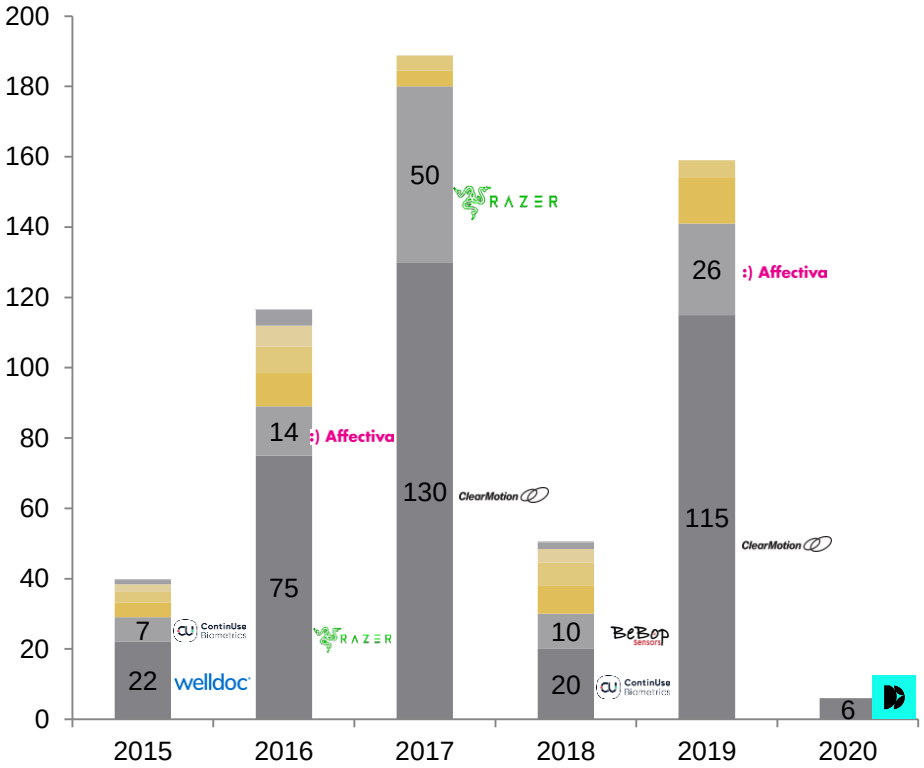
Global funding report: 2015 – Q2’20 (2/2)

In total, 21 startups globally have received funding with respect to passenger wellness.



Some of the important transactions in 2019=2020

- Clear Motion Inc. has raised a sum of $115 million from lead Investor Franklin Templeton Investments for ‘digital chassis’ that makes car rides smoother >>
- Volvo Cars Tech Fund. Has invested an undisclosed sum in MDGo, for combining real-time data from the vehicle during an accident with medical knowledge. >>
- Dirac has received a funding of $13.2 million from Clun Network Investments for developing the Audio System. >>
- Affectiva has received $26 million of funding from Aptiv PLC, Forward Capital, Motley Fool Ventures and CAC, which brings it total funding to 453 million, to accelerate and scale its perceptive technology in the automotive industry, as well as other areas such as conversational interfaces, social robotics, and market research. >>
- B- Secur has secured a sum $4.84 million from ADV, Kernel Capital for using electrocardiogram (ECG) readings (heart rhythms) for cybersecurity, of vehicle >>
- Swedish audio technology company Dirac Research has raised $6m in funding from new and existing investors. >>

Startup highlight – Edge3 Technologies is focusing on AI-based occupant monitoring solution

Key PATENTS

US20170045950A1

Gesture Recognition Systems

Patent relates to the method and apparatus for performing gesture recognition. The method includes the steps of receiving one or more raw frames from one or more cameras, each of the one or more raw frames representing a time sequence of images, determining one or more regions of the one or more received raw frames that comprise highly textured regions, segmenting the one or more determined highly textured regions in accordance textured features thereof to determine one or more segments

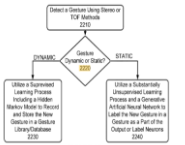


FIGURE 22

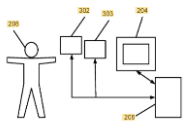


FIGURE 3

US20160103499A1

Systems and methods for distinguishing gestures

Patent relates to gesture control system includes a processor, the processor in communication with a plurality of sensors. he processor is configured to perform the steps of detecting, using the plurality of sensors, a gesture in a volume occupied by a plurality of occupants, analyzing a prior knowledge to associate the gesture with one of the plurality of occupants, and generating an output, the output being determined by the gesture and the one of the plurality of occupants.

PRODUCTS

CLOUDDETECT

A cloud-based fleet analytics platform that identifies distracted driving behaviors

DRIVE

A real-time in-cabin driver monitoring solution that alerts drivers and fleet managers to dangerous driving behaviors

AMBIENTSENSING

The Ambient Sensing Node (ASN) is an AI-powered, low-cost sensor used to identify children left behind in hot cars. ASN detects movements in the vehicle, including minute movements such as heartbeats or breathing.

GAUGE

A dimensioning platform used to automate measurements of parcels and pallets for the transportation and logistics industry.

ACTIVITIES

About

EDGE3 Technologies is a leading supplier of end-to-end Vision AI in-cabin monitoring solutions and products for the automotive, transportation and logistics industries.

Acquisition

May, 2015 | Sensorbit acquired by EDGE3 Technologies

News

July, 2018 | Edge3 technologies launches the cloud detect distracted driving analytics platform.>>

Nov, 2017 | Edge3 technologies receives CES 2018 innovation award >>

Appendix

Sr. No.	Links
1	https://www.startribune.com/coming-soon-a-virus-proof-car/571366072/
2	https://thenewswheel.com/fca-will-add-sterilizing-technology-to-new-vehicles/
3	https://www.petoskeynews.com/news/business/virus-proofing-could-become-popular-feature-in-vehicles-after-coronavirus/article_3695b15c-dd41-585e-967b-61bf5676be7f.html
4	https://www.deccanherald.com/business/business-news/mg-motor-india-ties-up-with-medklinn-for-vehicle-cabin-sterilisation-amid-coronavirus-pandemic-826061.html
5	https://www.post-gazette.com/business/money/2020/05/26/Virus-proofing-could-become-popular-feature-in-vehicles-after-coronavirus/stories/202005260021
6	https://www.autoremarketing.com/technology/company-takes-proactive-approach-disinfecting-vehicles
7	https://www.cbtnews.com/the-profit-in-cabin-air-filters/
8	https://icrowdnewswire.com/2020/06/08/covid-19-impact-on-automotive-in-cabin-air-quality-improvement-solutions-market-forecast-to-2021/
9	http://www.freepatentsonline.com/y2009/0311138.html
10	https://www.prnewswire.com/news-releases/covid-19-impact-on-automotive-in-cabin-air-quality-improvement-solutions-market--exclusive-report-by-marketsandmarkets-301049151.html
11	http://global.geely.com/media-center/news/all-geely-vehicles-to-use-advanced-anti-bacterial-filters-in-2020-models/
12	https://www.sae.org/news/2020/03/coronavirus-cabin-air-filtration
13	https://www.boschautoparts.com/en/auto/filters/hepa-cabin-filters
14	https://www.proton.com/promotions/proton-intelligent-air-purification-system
15	https://usa.nissannews.com/en-US/releases/dos-and-donts-for-disinfecting-your-vehicle#
16	https://www.shine.cn/biz/auto/2003255057/
17	https://www.news18.com/news/auto/understanding-vehicular-pollution-aqi-harmful-effects-and-how-to-reduce-it-2047845.html
18	https://ec.europa.eu/growth/content/electric-and-hybrid-cars-new-rules-noise-emitting-protect-vulnerable-road-users_en
19	https://www.nytimes.com/2018/11/01/business/seats-cars-safety-comfort.html
20	https://icrowdnewswire.com/2020/06/08/covid-19-impact-on-automotive-in-cabin-air-quality-improvement-solutions-market-forecast-to-2021/

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