Fraunhofer IVI

Institute Magazine

United into the future

Research on intelligent mobility and infrastructure

»Our research in the fields of transportation, infrastructure, energy, and civil security has never been more relevant than it is today.«

Prof. Dr. Sanaz Mostaghim,
Fraunhofer IVI Director

Preface

Welcome to the new edition of the institute magazine!

It is my great pleasure to write this editorial as this is the first issue with me as director of the institute. I can hardly believe that I have already been part of the Fraunhofer IVI family for a year. After a six-month handover phase with Professor Matthias Klingner, who retired at the end of 2024, I was able to effectively start in my new role as institute director on January 1, 2025. Since then, we have already launched several new initiatives together with the management team to make our institute even stronger and offer intelligent solutions to industry.

The past year brought several challenges for key infrastructure systems in Saxony, Germany, and throughout Europe: from the collapse of the Carola Bridge in Dresden to traffic accidents and rail delays, threats to our public security at Christmas markets and other major events, and the effects of climate change, such as flooding in Germany, Spain, and Italy. These examples alone show that our research at Fraunhofer IVI in the fields of transportation, infrastructure, energy, and civil security has never been more relevant to politics, society, and science than it is today.

While transportation is traditionally seen as having negative impact on the climate, we aim to use our technological solutions to show that it is possible to enable personal mobility while remaining energy efficient. Whether through automation, electrification, or optimization, our goal is to make our planet a safer and better place for everyone, especially for future generations.

With its unique position in the science and innovation system, the Fraunhofer-Gesellschaft has always been a reliable partner to industry in Germany, Europe, and beyond. Building on this foundation, I am pleased to report very good results for the past year and, above all, stable income from industry despite a slight decline. The fact that we continue to operate successfully according to the proven Fraunhofer model demonstrates that our institute is very well positioned in the face of profound global changes.

With this magazine, we invite you to explore our research activities and highlights of the past year. Immerse yourself and be fascinated by the topics and people at the institute who work with great energy and passion to meet the challenges facing our society and the economy.

I would like to thank everyone at Fraunhofer IVI for their dedication, hard work, and the warm welcome at the institute.

Prof. Dr. Sanaz Mostaghim
Fraunhofer IVI Director

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Fraunhofer IVI

About us

At the institute's locations in Dresden and Ingolstadt, the research scientists at Fraunhofer IVI develop technologies and concepts in the fields of mobility, energy, and security – from pioneering pre-competitive research to practical applications. The institute cooperates closely with Technische Universität Dresden, Otto von Guericke University of Magdeburg, and Technische Hochschule Ingolstadt.

For 25 years, the institute has been developing innovations for the intelligent planning, coordination and control of mobility and is shaping the digital transformation in public transport with reliable information and assistance systems, platform solutions for mobility data and services, and electronic ticketing.

Projects in the field of autonomous systems, including delivery and heavy-duty transport and agriculture, are becoming increasingly important. Research and development work on e-mobility include innovative charging technologies and solutions for remote battery diagnosis. The Fraunhofer Application Center »Connected Mobility and Infrastructure« in Ingolstadt focuses primarily on issues related to automated driving and flying.

Facilities and equipment

In addition to high-performance laboratory equipment, innovative test platforms and vehicles as well as state-of-the-art IT structures, the institute's research infrastructure also includes a technical center with a vehicle hall and adjacent test track.

More detailed information can be found directly on the department pages (p. 13 to 18).

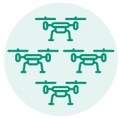
Research fields

Intelligent transport and mobility systems
- Mobility services and data
- Ticketing and fares
- Transport planning

Civil security
- Planning and operational command
- Infrastructure management
- Risk assessment

Vehicle and road safety
- Functional safety
- Accident data analytics
- Traffic psychology

E-mobility
- Battery system development and recycling
- Charging technologies
- Electric buses and commercial vehicles
- Fuel cells/hydrogen technology



Intelligent cooperative systems
- Autonomous driving and cooperative driving maneuvers
- Swarm technology
- Autonomous aerial systems

Vehicle and propulsion technology
- Propulsion engineering
- Multi-axle steering and lane guidance
- Mobile work machines
- Thermal management systems

Process data analytics
- Transportation ecology
- Logistics
- Digital business processes

Strategy process

With a clear focus on applied technology transfer to industry, Fraunhofer plays a special role within the German research landscape. This unique selling point forms the basis for its strong position in the research and development market. In order to remain competitive in the long term and provide innovative impetus to industry, it is necessary to identify new fields of application, continuously develop the existing R&D portfolio, and recognize future market potential at an early stage.

To support the institutes in systematically fulfilling this requirement, structured strategy processes are carried out at regular intervals. At the end of 2025, Fraunhofer IVI will undergo its regular strategy audit. The change in institute management provides a special opportunity to use this broad-based process to sharpen the institute's scientific profile and focus it specifically on future challenges and opportunities in the fields of intelligent transportation and infrastructure.

Dr. Martin Ufert and Sebastian Pretzsch, Fraunhofer IVI strategy officers.

Group and Alliance membership

Fraunhofer ICT Group

Prof. Dr. Sanaz Mostaghim | sanaz.mostaghim@ivi.fraunhofer.de

www.iuk.fraunhofer.de/en.html

Fraunhofer Big Data and Artificial Intelligence Alliance

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www.bigdata-ai.fraunhofer.de/en.html

Fraunhofer Transport Alliance

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Fraunhofer Energy Alliance

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Fraunhofer Battery Alliance

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Cooperation

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Organization Chart

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		Data Systems and Travel Assistance | Sebastian Pretzsch *Ticketing and Fares* | Dr. Torsten Gründel
	Vehicle Systems	Dr. Frank Steinert | Phone +49 351 4640-846 frank.steinert@ivi.fraunhofer.de
		Vehicle Engineering | Dr. Marcel Markgraf *Charging Infrastructure* | Dr. Sven Klausner *Monitoring and Control Strategies* | Dr. Martin Ufert
	Traffic Safety and Vehicle Automation	Prof. Dr. Thoralf Knote | Phone +49 351 4640-628 thoralf.knote@ivi.fraunhofer.de
		Vehicle Control and Sensor Systems | Dr. Felix Keppler *Vehicle and Road Safety* | Maria Pohle
	Strategy and Optimization	Dr. Kamen Danowski | Phone +49 351 4640-660 kamen.danowski@ivi.fraunhofer.de
		Digital Business Processes | André Rauschert *Disposition* | Dr. Kamen Danowski *Logistics* | Denise Holfeld
	Intelligent Cooperative Systems	*Cooperative Systems* | Dr. Thomas Otto *Swarm Technology* | Dr. Christoph Steup
Application Center	Connected Mobility and Infrastructure	Prof. Dr. Gordon Elger | Phone +49 841 9348-2840 gordon.elger@ivi.fraunhofer.de
		Autonomous Aerial Systems | Henri Meeß *Intelligent Infrastructure Systems* | Prof. Dr. Gordon Elger

Advisory Board

Chairman

Nils Schmidt,
Head of Yunex Traffic Germany

Members

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Scientific Director, Institute of Safety in Future Mobility (ISAFE),
Technische Hochschule Ingolstadt (THI)

Prof. Dr.-Ing. Marcus Geimer (since 2025),
Director, Division Mobile Machines (Mobima),
Karlsruhe Institute of Technology (KIT)

Dr. Babett Gläser (until 2024),
Head of Research Department, Saxon State Ministry for Science, Culture and Tourism (SMWK)

Mario Herber,
Senior Chief Superintendent, Head of Department »Central Services« Dresden Police Department

MinR Hans-Peter Hiepe, retired (until 2024),
Head of Division »Innovation support; Structual strengthening«,
Federal Ministry for Education and Research (BMBF)

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Director Innovation Center,
Sensor-Technik Wiedemann (STW) GmbH

Peter Merz (since 2025),
Vice President, Head of Nokia Standards,
Nokia Solutions & Networks GmbH & Co. KG

Katja Müller,
Head of HR Transformation,
Lausitz Energie Bergbau AG (LEAG)

Sonja Penzel,
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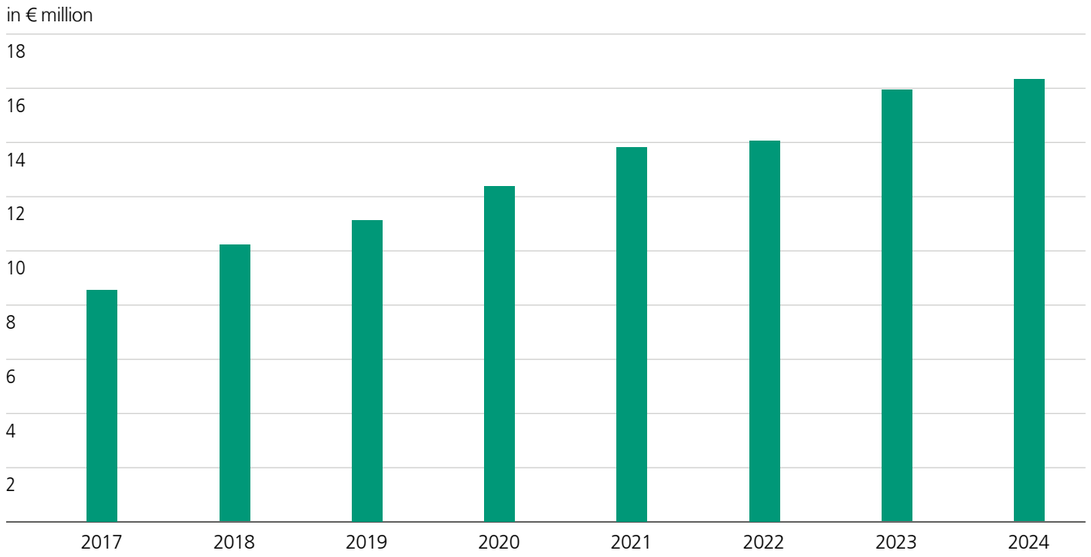
Head of Strategy and Steering Group R&D China,
Volkswagen Group China

Lars Seiffert,
Board of Operations and Human Resources,
Dresdner Verkehrsbetriebe (DVB) AG

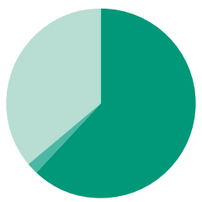
Facts and Figures

Economic development 2024

Financial development

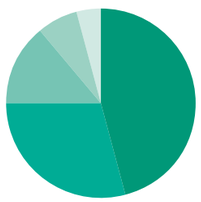


Staff



Employees	158
Trainees	5
Student assistants	92

Operating Budget



Public sector	46 %
Industrial revenues	29 %
Basic financing	14 %
EU	7 %
Miscellaneous	4 %

Academic output

- Publications
- Teaching engagements
- Final theses
- Public body membership
- Patents and certification
- Trademarks

All details on the institute's academic output:

25 Years of Fraunhofer IVI

Last year, the institute celebrated its 25th anniversary – an occasion not only to look back, but also to take stock. A lot has happened since Fraunhofer IVI was founded in 1999: The number of employees has grown from 35 to over 160, and industrial revenue has more than quadrupled. The following dashboard provides exciting insights into various key figures from our institute's quarter-century of research.

Budget

1999 **€ 1.9 m**

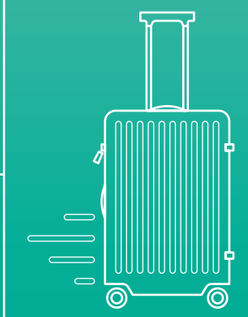
2024 **€ 21.7 m**

Staff

35 1999

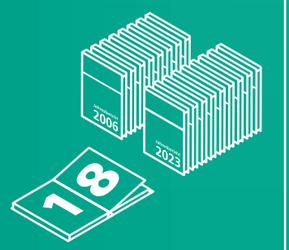
163 2024

Business trips



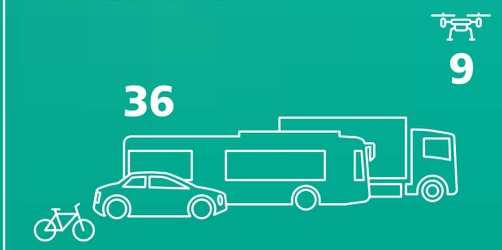
14 440

Annual reports



18

Test vehicles and drones



36 **9**

Industrial revenue

1999 **€ 0.8 m**

2024 **€ 5.4 m**

Partners & customers

> 425

EU projects

Interview

Six Questions for Prof. Dr. Sanaz Mostaghim

Innovative mobility, smart infrastructure, promising prospects: With solutions for vehicle engineering applications, intelligent transport systems, and civil security, researchers at Fraunhofer IVI achieve high effectiveness across industries and sectors. Since June 1, 2024, the new institute director, Professor Sanaz Mostaghim, has been adding further forward-looking expertise to the institute's portfolio. The renowned expert in artificial intelligence has been a university professor at the Chair of Computational Intelligence at the Faculty of Computer Science at Otto von Guericke University Magdeburg (OVGU) since 2014. Her research focuses in particular on multi-criteria optimization, decision-making and evolutionary algorithms, as well as collective intelligence and swarm robotics.

Prof. Mostaghim, let us look back on your first six months as the new institute director. What are your first impressions of Fraunhofer IVI and of Dresden as a location?

My first day at Fraunhofer IVI was a highlight, everyone welcomed me warmly, and I felt at home from the very first moment. I am truly excited about my scientific work at the institute and strongly believe that our research plays an important and pioneering role in our society. The topics addressed by Fraunhofer IVI, which revolve around the development of key technologies for transportation and infrastructure systems, are at the core of innovative scientific research and large-scale industrial projects that are vital for a better future for everyone. We are committed to developing new technologies for a better life for ourselves and future generations, and I am very excited to see that our projects will have a large impact on the innovations of the next few decades.

As chairholder of the »Chair of Computational Intelligence« at Otto von Guericke University Magdeburg, your main activities so far used to be in university-based fundamental research. What was the special appeal for you in taking over the management of a Fraunhofer institute with a strong focus on applied research?

The philosophy of Joseph von Fraunhofer – »researcher, inventor and entrepreneur« is actually the guiding principle of my own research, which I have developed over the last two decades. I strongly believe that good theoretical work can only be successful if we can apply it in practice. At the University of Magdeburg, I work on theoretical foundations, simulations, and hardware implementations in my SwarmLab, which I established back in 2014. At Fraunhofer IVI, I now have a larger platform to pursue industrial applications at greater scale. This was a vision that can now become reality.

You have succeeded Prof. Matthias Klingner, whose work shaped the institute for over 20 years. What topics will you focus on in your research and what new priorities would you like to set at the institute?

As transportation and mobility are at the heart of new revolutionary topics in the era of digitalization and climate change, I see great potential for visionary topics towards which I intend to guide our research. Fraunhofer IVI already has an excellent status in terms of management and project acquisition. The essential elements such as organizational structure, research groups, funding profile, personnel structures and infrastructure are ideally positioned. While maintaining and continuing the successful status quo, we will set new research priorities, increase our scientific research impact, and establish new collaborations. I also strive for a transparent management structure to enrich the institute's culture and create a diverse, inclusive and international working life for all.

I have felt at home at Fraunhofer IVI from the very first moment.«

Prof. Dr. Sanaz Mostaghim,
Fraunhofer IVI Director

What are the goals you have set for Fraunhofer IVI in 2025?

I have a long list of goals for this year. We already started the strategy process in January, which will accompany us throughout the year. We have also established a new research group on swarm technologies to expand our research portfolio. This is generously funded by the Fraunhofer Attract program. Also, we will intensify our cooperation with TUD and OVGU. We will fill a new head of department position, which will be combined with a professorship at TUD. In addition, I aim to increase our visibility by identifying new platforms for exchange with our national and international partners. I am very pleased that we have taken the first step in the collaboration between the institute and the University of Magdeburg, and that the first PhD student from Fraunhofer IVI enrolled at OVGU. We will also look for opportunities to increase diversity and enable better participation. This year's strategy process will enable us to identify further potential, which we will implement step by step.

So far, what is your impression of the institute spirit and the personal interactions between colleagues?

Open-minded, competent, professional.

In addition to your position at the institute and your professorship at OVGU, you are a member of a variety of public bodies, including the Digitalization Council of Saxony-Anhalt. How could synergies with Fraunhofer IVI arise in the future?

In view of the significant impact of Fraunhofer IVI's work on regional, federal and state levels, I see it as my task to actively highlight the institute's contributions in all these structures. We have already begun collaborating with other organizations. For example, we intend to intensify our collaboration with the state of Saxony-Anhalt. In March 2025, the State Secretary visited us here at the institute in Dresden as part of this initiative. In our first meeting, we identified five projects for future collaboration. So it seems that things are progressing well. I am especially committed to bringing together my many years of committee experience with the institute's well-established networks for professional exchange.

Mobility and Digital Services

Range of services

- Design and development of data spaces and platforms for traffic and mobility data; corresponding use cases
- Analysis, definition and preparation of approvals regarding operating areas for autonomous driving in public transport
- Applications for technical supervision and monitoring of autonomous vehicle fleets in public transport
- Fare calculation tools for traditional, electronic and mobile ticketing
- Fare-specific programming language including development and testing tools
- Fare modeling and simulation

Tools and equipment

Mobility data space testing environment, control center for vehicle fleets in autonomous public transport, database of driving and disruption failure scenarios for (automated) public transport, simulation environment for autonomous vehicles in public transport

Complex transportation systems are becoming increasingly digital and interconnected. With the help of information and communication technologies, it is possible to improve traffic coordination, establish new mobility services and involve passengers and other road users more actively. For 25 years, Fraunhofer IVI has been developing robust and practical solutions in the field of mobility including the required digital services. In this context, the institute has maintained close cooperation with a wide range of stakeholders, such as transport companies and associations, partners from industry, and public institutions.

The two working groups »Data Systems and Assistance« and »Ticketing and Fares« have an interdisciplinary profile. The department's successful work is based on in-depth knowledge and extensive experience in the fields of computer science, mathematics, software technologies, information and automation technology, and transportation science, combined with expertise gained from applied projects.

Contact and more information

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Vehicle Systems

Mobility is the key to both economic success and individual quality of life. To safeguard this vital asset of modern industrial society for the long term, the entire transport sector must be made more efficient and climate-friendly.

The department has many years of expertise and experience in the engineering of vehicle drives – this includes complete vehicle design as well as component solutions, innovative and hybrid drives, methods for energy-efficient vehicle operation in both the drive and the auxiliary units, and software solutions for system and component diagnostics and predictive maintenance. The R&D work focuses on commercial and special-purpose vehicles, commercial vehicle fleets, as well as machinery for agriculture, construction and mining. Particular challenges lie in holistic system integration with the aim of reducing weight, volume and costs, as well as in minimizing energy consumption and emissions in both individual vehicles and vehicle fleets.

Contact and more information

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Range of services

- Design and layout of electric and hybrid powertrains
- Functional safety according to ISO 26262
- Development of automation concepts for agricultural machinery
- Fast charging technologies for electric vehicles
- Development of multimodal energy supply concepts
- Modeling, simulation and diagnosis of traction batteries and fuel cell systems
- Vehicle fleet monitoring and corresponding data analysis
- Development of operating strategies for commercial and special-purpose vehicles as well as mobile machinery

Tools and equipment

Test vehicles and innovation platforms for automation in agriculture, test rig for fuel cell systems (from 10/2025), test rigs for battery cell characterization, two electric distributor trucks equipped with high-performance charging system

Traffic Safety and Vehicle Automation

Range of services

- Innovative steering systems for ultra-long road vehicles with multiple steered axles
- Control center for autonomous driving in non-public areas
- Analytics, surveys and development work in the field of vehicle and road safety
- Traffic psychology: Analyses of the experience and behavior of various groups of road users in terms of traffic safety
- Modeling and testing of driving scenarios with the help of motion platforms
- Implementation concepts for electric and hydrogen fuel cell vehicles
- Charging infrastructure for bus and logistics depots

Tools and equipment

Accident data base, AIMATS survey method (driving scenarios), motion platforms for standardized vehicle tests, CERES field robot

Rising costs, the pressure of international competition and staff shortages are forcing many industries, including agriculture and logistics, to seek innovative solutions. The focus in these sectors is on the automation of process flows. Highly automated vehicles are subject to special safety requirements, as they must be able to navigate safely in a wide variety of traffic situations – both on public roads and in non-public areas.

The helyOS® (highly efficient online yard operating system) control tower system was developed to coordinate driving tasks in automation zones. It enables efficient processes across diverse sectors such as logistics, airport operations and agriculture. Driving and test scenarios for vehicle automation are designed based on accident data and traffic observations, covering the entire process chain from scenario creation to implementation on test tracks.

Contact and more information

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Strategy and Optimization

The increasing availability of data and up-to-date information offers public authorities and companies new opportunities to optimize their processes. For this, however, solutions are required that can quickly and effectively process large amounts of data and cope with domain-specific problems.

The department focuses on research topics in civil security and hazard control, business process analysis and infrastructure management. The team develops innovative optimization methods and algorithms, and designs and implements complex systems for practical use. A major objective is providing decision support for the optimized planning and control of resources.

The department's interdisciplinary team, which includes computer scientists, mathematicians, and geoscientists, collaborates very closely with end users.

Contact and more information

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Range of services

- Command, control and communication system for firefighters, rescue services, emergency services and police
- Analytics and decision support systems
- Robust distributed systems using analytics tools from data mining, machine learning and NLP on the basis of big/smart data
- Data-driven process optimization with AI methods
- Integrated optimization of production processes and cargo spaces
- Condition-based maintenance planning

Tools and equipment

Operations command vehicle, high-performance AI cluster with 3,072 CPUs and 64 GPUs, autonomous mobile communication network including cameras

Intelligent Cooperative Systems

Range of services

- C-ITS: Development and testing of system solutions for connected driving in private and public transport
- CCAM: Analysis, development and implementation of connected and automated vehicle fleets using collective and swarm intelligence
- Mobility data analysis and algorithm development for innovative transportation services
- Dynamic object and scenario detection for assisted automated driving
- Optimization of distributed mobility systems and design and implementation of hybrid simulation environments
- Implementation of hybrid cloud systems and C-ITS test bed management for connected infrastructure

Tools and equipment

Dresden test bed, connected automated vehicles, 5G remote control center, infrastructure assistance for automated driving, communications laboratory

Automated and connected mobility solutions are highly complex. Difficult-to-assess traffic situations, multimodal on-demand services in rural areas, or automated fleet solutions using swarm intelligence on highways and in depots – automated mobility services must be able to handle all these situations safely and efficiently.

Through functionally safe infrastructure assistance, resilient connectivity and collaboration, vehicles are enabled to safely navigate complex situations. Algorithms for data analysis and mobility management are used to record traffic-relevant scenarios and evaluate anomalies in the transportation network. With the help of simulation environments, alternative courses of action can be analyzed and evaluated based on this information. Thanks to the integration of swarm intelligence, it is possible to optimize and efficiently control entire mobility systems.

Contact and more information

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Fraunhofer Application Center »Connected Mobility and Infrastructure«

Infrastructure assistance for smart city applications and infrastructure-enabled autonomous driving is currently facing a wide range of challenges. The same is true for the field of autonomous aviation. On the one hand, there is a lack of comprehensive multimodal datasets needed to bring the required technologies to market maturity. On the other hand, AI systems are required to achieve higher levels of reliability and trustworthiness.

The application center designs and implements suitable solutions by combining broad expertise in the development of new, trustworthy AI and sensor systems with expertise in communication technologies, robotics and sensor data fusion. R&D efforts over the past years have established the basis for targeted dataset creation in both domains as well as in-depth reliability analyses.

Contact and more information

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Range of services

- AI systems that detect, track and predict traffic to enable smart city applications and autonomous vehicles
- Collection of datasets using mobile sensor systems for tracking road users
- Traffic optimization via reinforcement learning, AI and quantum-based methods
- Automatic detection and correction of errors in extrinsic and intrinsic sensor calibration
- Reliability analyses
- Functions for autonomous and independent (emergency) landing in unknown terrain without GNSS
- AI and robotics systems for autonomous flight functions such as environment perception and trajectory planning

Tools and equipment

Drone systems up to 25 kg MTOW, AI computing cluster, mobile sensor systems, test beds for autonomous driving, laboratory for testing the reliability of electronics components

2024 – A year of milestones and achievements

Selected highlight projects concluded in the past year

More information

LANDNETZ – Digital applications for the agriculture of the future

The five-year joint research project between TU Dresden, Fraunhofer IVI and the Saxon State Office for Environment, Agriculture and Geology (LfULG) focused on implementing digital technology solutions to optimize agricultural processes. In order to make these more efficient and resource-friendly, various approaches to using 5G and other communication infrastructures were investigated in a model region north of Dresden.

C-ITS-Pilot Dresden – Connected driving in urban areas

Cooperative driving, including the integration and digitalization of vehicles and infrastructure, is considered one of the key puzzle pieces for achieving safe, efficient and sustainable transportation in the wake of the mobility transition. Fraunhofer IVI is the initiator and operator of the Dresden Digital Test Field and lead partner of the C-ITS pilot project in Dresden. The integration of the C-ITS services developed at the institute into future automated driver assistance systems represents another important milestone on the road to autonomous driving.

MEGA-LADEN – Fully automated fast charging system for electric trucks in the megawatt range

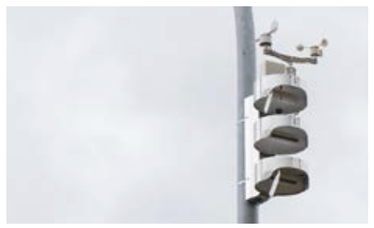
The electrification of heavy-duty transport is a major challenge. The MEGA-LADEN project has developed an automated underfloor contact system for electric commercial vehicles that can transfer power in the megawatt range. This technology easily charges truck batteries during loading and unloading or during breaks, improving comfort and increasing the acceptance of electric mobility in the logistics sector.

IN²Lab – Traffic safety and efficiency in the Ingolstadt Innovation Lab

Over a duration of three and a half years, the IN²Lab project established the »First Mile« test field at Auwaldsee in Ingolstadt and developed a safety system for automated driving functions. Fraunhofer IVI is a key project partner together with the Technische Hochschule Ingolstadt and has contributed significantly to its design, architecture, and specification. The institute is also supporting the expansion of the test field by additional roadside units in the 5GoIng project and its further development into a living lab.

SAFE20 – Control center software for safe autonomous logistics

The project's aim was to develop and implement a comprehensive safety concept that, for the first time, enables fully automated vehicles to operate regularly at depots at speeds of at least 20 km/h in mixed traffic. This is a basic prerequisite for regular operation and thus for the economic breakthrough of autonomous commercial vehicles. The helyOS® software framework was used in the project for integrating the three test vehicles and to ensure the reliable, optimally coordinated planning of driving tasks.



DEUS_SmartAir – Large-scale monitoring of air quality in cities

The DEUS_SmartAir project pursued an approach that involved setting up large-scale measurement networks consisting of inexpensive air quality sensors, generating data from the transport sector in the context of meteorological data, and evaluating this data closely. To this end, almost 100 mobile and 50 stationary sensors were installed in Teltow and Halberstadt. The results from the locations are visualized via a dashboard. Fraunhofer IVI contributed its many years of experience in data screening, modeling, and forecasting to the research project.

INCLUDING – A milestone in European security cooperation

Since July 2019, consortium partners from various European countries have been working on the INCLUDING EU project to improve and strengthen security against chemical, biological, radiological, and nuclear (CBRN) substances. To this end, institutions will work even more closely together in the future and security forces will be trained more efficiently. This can now be realized through a software solution that enables resources and expertise to be shared more effectively, thereby generating maximum added value.

SteigtUm! – Electric micromobility for Freiberg

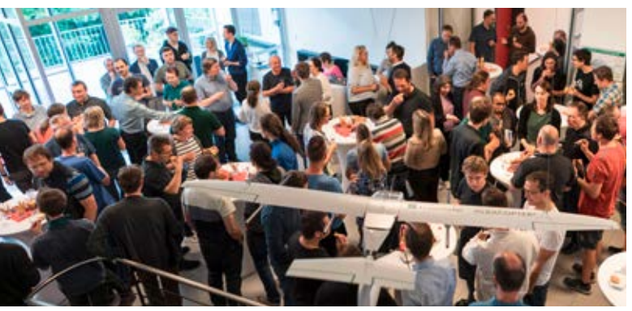
In order to successfully tackle challenges in the field of urban mobility, such as pollution and poor parking conditions, the partners in the SteigtUm! project transformed the city of Freiberg into a living lab. The focus was on developing small electric vehicles suitable for everyday use. These vehicles, combined with an autonomous rental and charging infrastructure with a universal user interface, could offer practical benefits for many people in daily life.

Special events 2024

January 16, 2024 | DISRUPT project kick-off meeting in Ingolstadt
The research project is investigating cooperative environment perception and prediction of road users using infrastructure and vehicle sensors.

January 30 – February 1, 2024 | Fraunhofer IVI at the MOBILITIES FOR EU launch in Madrid
Twenty-nine partners from nine European countries came together to kick off the EU-funded project. Its aim is to jointly create innovative mobility concepts in order to achieve the goals of the European Green Deal by 2030.

February 19, 2024 | Memorandum of understanding with KATECH
Fraunhofer IVI signed a memorandum of understanding for future cooperation with the Korea Automotive Technology Institute (KATECH).



February 27-28, 2024 | C-ITS Forum in Frankfurt am Main
The aim of this specialist event was to further expand cooperation and exchange between key German players in the field of cooperative intelligent transport systems. Around 150 mobility experts from politics, industry, transport companies, and infrastructure operators attended the conference.

March 26, 2024 | Fraunhofer IVI and TU Dresden celebrate successful completion of KIWA project
After three years of research, the KIWA project (Artificial Intelligence for Flood Warning) has been completed.

May 7, 2024 | LAURIN consortium meeting at Fraunhofer IVI
During the consortium meeting, the partners took stock of the current project status and planned the final work. In the BMDV-funded project, automated driving functions are being tested in complex scenarios on the Lausitzring.

June 3, 2024 | Official inauguration of the new institute director
Professor Sanaz Mostaghim has been the new director of Fraunhofer IVI since June 1. The renowned expert in artificial intelligence additionally holds the Chair of Computational Intelligence at Otto von Guericke University Magdeburg.

June 13, 2024 | Network meeting of the UAM initiative
The UAM initiative in Ingolstadt aims to connect different stakeholders in order to generate a new and forward-looking form of airborne mobility in lower airspace.

June 14, 2024 | Dresden Science Night
Fraunhofer IVI presented various current research projects and gave over 600 guests a look behind the scenes of the institute – partly in virtual space, but also up close and personal on the test track.

August 14, 2024 | Visit from the Humboldt Foundation
Around 35 international postdocs and experienced research scientists visited Fraunhofer IVI as part of a study trip to Dresden. They are all scholarship holders of the Humboldt Foundation, which supports exceptionally qualified researchers from all over the world.

August 22, 2024 | Review of AMSEL and Telewerk at the 9th simul+ Future Forum
The event on the topic of future of regional development in Saxony provided an opportunity to present the results of the AMSEL and Telewerk model projects. The living lab in Mittweida impressively demonstrates what life and work in rural areas could look like tomorrow.

September 17, 2024 | Successful conclusion of the Fraunhofer Summer Camp 2024 in Benediktbeuern
This year, numerous students developed innovative ideas as part of a tiny house challenge under the motto of »compact living as a testing ground for sustainable building research.«

October 1, 2024 | C-ROADS roadshow in Dresden
Fraunhofer IVI invited high-ranking guests to the final demonstration of the C-ITS pilot in Dresden where they attended presentations at the institute's own test track and on public roads. The focus was on the collaboration between vehicles and infrastructure.

October 8, 2024 | Project launch for digital and data-based maintenance for rail switch technology
Switches are among the most expensive elements of rail infrastructure in terms of acquisition and maintenance, and are also prone to malfunction. In a DZSF-funded project, Fraunhofer IVI and company partners are developing a concept to improve maintenance, reduce costs, and increase service life.

October 21-22, 2024 | International plenary meeting of the EU-funded EO4EU project at Fraunhofer IVI
The research project aims to improve the accessibility of geodata and develop innovative processing and visualization tools. The project partners met at the institute to discuss the status of their work.

November 20, 2024 | Completion of eHaul project
At their closing event, the eHaul project partners demonstrated that electrified mobility can be an efficient and CO_2-saving alternative in the logistics industry. The project brought forward Europe's first fully automated battery exchange station for heavy commercial vehicles, which can replace batteries in less than ten minutes.

25 research highlights from 25 years of Fraunhofer IVI

1999

OPAL – Multi-criteria optimization in high-voltage networks

2000

Intermobil – Control and information system for traffic and tourist information

2001

Speech recognition systems for timetable information

2002

Obstacle detection and platform safety for rail systems

2003

AutoTram® – Hightech demonstrator for automated lane guidance, new drive systems and operating concepts

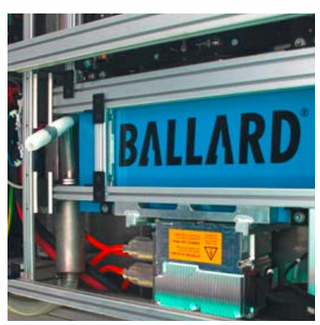
2004

Assessment of the safety of driver assistance systems

2005

HyTra – Mobile hydrogen production and filling station

2006



FELICITAS – Development of fuel cell systems for heavy commercial vehicles

2007

MobiKat® – Modular software for alle levels of operational command

2008

Comprehensive sewage treatment plant control system for Stadtentwässerung Dresden

2009

DefDesc – Digital recording and 3D modeling of vehicle deformation in accident research

2010

Handyticket Deutschland – Software for mobile ticketing in public transport

2011

Octocopter HORUS for recording thermal images and video data

Visionary ideas and a broad spectrum of topics with high public impact have been the basis for the institute's economic success from the start.«

Prof. Dr. Matthias Klingner,
Fraunhofer IVI Director until December, 2024

2018

Automated electric underbody fast charging system for commercial and personal vehicles

2019

autartec® – Technologies for self-sufficient energy and water supply

2020

SE-Netz – Information transmission and coordination of actions in hazardous operations

2021

FAPS – Accident prevention course for school students based on virtual reality

2022

CERES – Electric field robot for the automated execution of tasks in agriculture

2023

FLASH – Driverless, automated Shuttle vehicle for public transport in rural areas

2017

AutoTruck – Electric truck for highly and fully automated driving

2016

TruckTrix® – Automated navigability analytics for heavy-duty goods shipping

2015

VERSATO – Precise locating of freight cars in digital logistics

2012

AutoTram® Extra Grand – Double-articulated, highly maneuverable bus with partially electric operation

2013

NADINE – Smartphone app for real-time navigation and ticketing in public transport

2014

EDDA-Bus – Concept and Infrastructure components for fast-charging buses in public transport

The evolution of Fraunhofer IVI

When the Fraunhofer Institute for Transportation and Infrastructure Systems IVI was founded in 1999, it had already been part of the Fraunhofer-Gesellschaft since 1992 as Process Control Institute (EPS) of the Fraunhofer Institute for Information and Data Processing IITB (now IOSB). The decision to establish an institute for transportation research in Dresden opened up completely new perspectives for the branch office in Karlsruhe.

Initially, the newly founded institute operated as a research branch of Fraunhofer IITB. It was not until October 2013 that the Senate of the Fraunhofer-Gesellschaft decided to grant Fraunhofer IVI the status of an independent Fraunhofer institute. Factors such as its balanced technical orientation, sustainable staff structure, university connection and positive economic development were decisive in this process.

In 2013, the institute added a technical center with a vehicle hall and adjoining test track to its infrastructure.

In a quarter of a century, Fraunhofer IVI has developed into a high-performance institute that enjoys national and international recognition thanks to its expertise. Innovations in the fields of electronic ticketing, intelligent transport systems as well as vehicle and drive engineering have characterized it since its beginnings.

New focal points and areas of application, such as automation, civil defense or vehicle and road safety, were added. As a result, the institute has developed into a strong R&D partner in the fields of mobility, energy and safety.

Academic connections were further strengthened through the establishment of an application center at Technische Hochschule Ingolstadt in December 2019. The challenges of automated and connected driving and flying are a particular focus here.

While Fraunhofer IVI is celebrating its 25th anniversary, the institute building has been a research location since the 1960s. In order to offer employees a pleasant working environment and to meet the requirements of a modern scientific institution, the institute has made investments in recent years primarily in expanding the research infrastructure and modernizing the existing building.

Continuous growth, a balanced budget and stable earnings form a reliable basis for ongoing prosperous economic development. Last but not least, it is also its openness towards developing new research fields for tackling social challenges that puts Fraunhofer IVI in an excellent position for the coming years.

Career with Fraunhofer

Introducing our junior researchers

Left to right: Dr. Felix Keppler, Max Ziermann, Kai Ciesielski and Max Leon Langer.

What motivates young people to become a researcher at Fraunhofer?

After successfully completing their doctoral and master's theses, the institute was able to recruit Felix, Max Leon, Kai, and Max as committed young scientists. In the following interview, they provide insight into their projects and discuss the processes involved in finding their topics as well as the challenges of scientific work and writing.

What inspired you to choose the respective topics for your theses?

Felix My group has extensive expertise in motion planning for individual vehicles. However, in order to operate three trucks simultaneously in mixed traffic at a logistics depot in the SAFE20 project, it was necessary to efficiently coordinate the movements of several vehicles in a very confined space.

Kai The topic arose from a mixture of current trends and feedback from our customers. The team developed a concrete research approach that matched both the customers' needs and my professional profile.

Max Leon The threat of cyberattacks has become a permanent companion for IT and engineering. As a system architect and robotics software developer, I consider this topic essential for the design of future-proof systems.

Max From the outset, it was important to me to have a topic with clear practical relevance. Since I had already worked at Fraunhofer IVI as a student before starting my job, I sort of »slid into« the topic.

What specific challenges did you encounter in the course of conducting your research?

Max For me, defining the scope of the thesis was a major challenge. It took me a long time to put the individual parts together in my head to form a coherent whole. Once I had a clear framework, the rest was much easier.

Kai I encountered minor challenges during the conceptual development and technical integration. However, these were successfully overcome through structured analysis, targeted consultation, and independent solutions.

Felix Due to the rapidly increasing complexity of motion planning in space and time, not every idea could be translated into functioning and quickly calculable algorithms right away. Instead, my imagination was often challenged.

Max Leon I am fascinated by the interdisciplinary influences when looking at such complex systems as agricultural robots. One challenge was to estimate the vehicle-related and agronomic effects of a network-based cyberattack.

What advice would you give to other graduates who are just starting out their careers?

Max Leon Future systems are becoming increasingly complex, which means that collaboration in interdisciplinary teams will be more and more important. No matter how great the topic sounds, I think it has to be a good fit on a personal level – that's what binds employees to an employer. My advice would be to pay attention to that. In summary: For me, Fraunhofer IVI ticks all the boxes.

Max Do not hesitate to take on responsibility and just get involved!

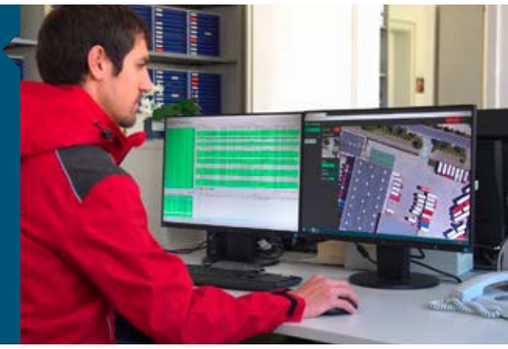
Kai Do not compare yourself too much to others. Follow your own path, be curious, ask questions – and above all, stay true to yourself.

Felix Be curious and get involved in working together on complex tasks. Good cooperation with colleagues and students, and good relationships with alumni and partners can give you a lot in return.

More information

Multi-robot trajectory coordination for complex vehicle combinations | *Dr. Felix Keppler, Dissertation*

In order to operate multiple automated vehicles efficiently in a delimited environment area such as in a logistics depot, their movements must be precisely coordinated. Otherwise, deadlock situations in which vehicles block each other's way can occur, especially at narrow passages and intersections. As part of the dissertation, algorithms for coordinating multiple large vehicles such as trucks with semi-trailers were developed and expanded to robustly handle disruptions.

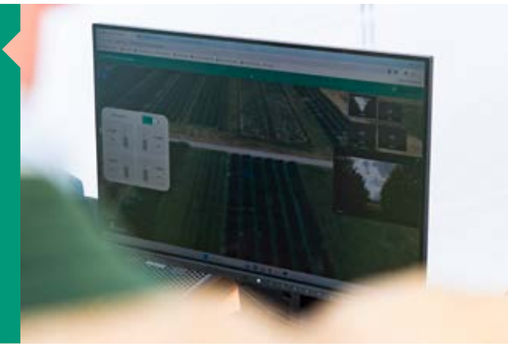


Analysis of options for integrating push-to-talk functionality into a command and control system for authorities and organizations responsible for public safety | *Kai Ciesielski, Master's thesis*

Push-to-talk (PTT) is an established communication method used by fire departments and police forces. The thesis identified requirements for integrating PTT functionality into modern command and control systems such as MobiKat®, evaluated various implementation options, and developed a prototype to assess practical suitability.

Aspects of cybersecurity to be considered when connecting a self-driving agricultural robot to a control system | *Max Leon Langer, Master's thesis*

The growing threat of cyberattacks has implications for the architectures, concepts, and prototypes developed by Fraunhofer IVI. The thesis highlights vulnerabilities, points of attack, and their consequences for robots and processes in the future use of agricultural robots. In addition, a security concept for robots was developed that will serve as a basis for further investigations.



Investigation of methods for the data-driven analysis of operational areas for automated public transport vehicles | *Max Ziermann, Master's thesis*

Before implementing self-driving buses in public transport, it is necessary to compare limitations of the automated driving system with the situation in the planned area of operations. This requires suitable data on the routes within the operating area. The thesis examines publicly available data sources regarding their informative value and data quality for assessing the compatibility of vehicle and operating area.

Supporting talent, promoting innovation

Taking road safety to the next level with TALENTA

With her expertise in human factors and traffic psychology, Nora Strauzenberg has been instrumental in establishing and developing research in the field of traffic safety at Fraunhofer IVI since 2018. As a project manager, she is responsible for the nationwide long-term »Fraunhofer IVI Accident Prevention School« project, among other things.

By participating in the Fraunhofer »TALENTA speed up« career program, Nora aims to successfully complete her dissertation and prepare herself for a management position in a targeted way. Through the TALENTA program, Fraunhofer is showing their strong commitment to attracting, promoting, and retaining more women in applied research. Among other things, the program offers freedom for professional and personal development.

Advancing swarm technologies with support from Fraunhofer Attract

The Fraunhofer Attract funding program offers outstanding external research scientists the opportunity to advance innovative ideas within a Fraunhofer institute in a market-oriented manner by establishing their own research group. Via the Attract program, Dr. Christoph Steup from Otto von Guericke University Magdeburg has joined Fraunhofer IVI.

Based on his many years of experience with robot swarms, Christoph brings his in-depth understanding of the functioning and potential of swarm technologies to the institute's R&D portfolio. As head of the INNOSWARM project, he will spend five years building a new research group on swarm robotics and sustainably integrating swarm technology infrastructure into the institute's activities in the field of robotics and AI.

From research expert to group leader

The Vehicle and Road Safety group is delighted to welcome a new manager: After many years as a research scientist at the institute, Maria Pohle will now head up the group. As an expert in accident analysis and statistics, she has repeatedly demonstrated her flair for innovative research and strategic development in interdisciplinary projects.

With her extensive experience and professional qualifications, Maria is predestined for her new role. She will consolidate and expand the successful work of her group in the coming years.

Editorial notes

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More information

www.ivi.fraunhofer.de/en.html

The Fraunhofer-Gesellschaft

The Fraunhofer-Gesellschaft, headquartered in Germany, is one of the world's leading organizations for applied research. It plays a major role in innovation by prioritizing research on cutting-edge technologies and the transfer of results to industry to strengthen Germany's industrial base and for the benefit of society as a whole. Since its founding as a nonprofit organization in 1949, Fraunhofer has held a unique position in the German research and innovation ecosystem.

With nearly 32,000 employees across 75 institutes and independent research units in Germany, Fraunhofer operates with an annual budget of €3.6 billion, €3.1 billion of which is generated by contract research — Fraunhofer's core business model. Unlike other public research organizations, base funding from the German federal and state governments is merely the foundation for the annual research budget. This serves as the basis for groundbreaking precompetitive research that will become important for the private sector and society in the years ahead. Fraunhofer's distinctive feature is its large share of industry revenue, guaranteeing close collaboration with the private sector and industry, and the consistent focus of Fraunhofer's research on the market. In 2024, industry revenue accounted for €867 million of its budget. Fraunhofer's research portfolio is augmented by competitively acquired public-sector funding, pursuing the right balance between public-sector and industry revenue.

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