



T.C. SANAYİ VE
TEKNOLOJİ BAKANLIĞI

#MILLİ
TEKNOLOJİ
HAMLESİ



OPEN INNOVATION AUTONOMOUS VEHICLE DEVELOPMENT AND TESTING PLATFORM

CONNECTED AND AUTONOMOUS VEHICLES

TRAINING CATALOGUE

COURSE CATALOGUE / 2026

2026



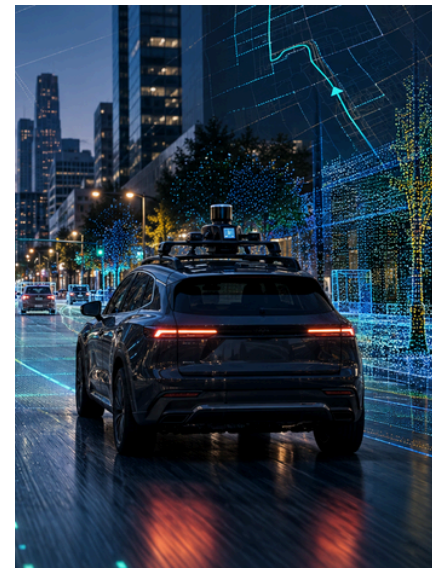
ABOUT OPINA

OPINA is an open innovation autonomous vehicle (AV) development and testing platform committed to accelerating intelligent mobility software development within a comprehensive, dynamic and agile automotive innovation ecosystem.

OPINA receives co-financing from the European Union and the Republic of Türkiye. The Ministry of Industry and Technology implements the project under the Competitive Sectors Programme. Istanbul Okan University manages the project.

Unlock the Power of Collaboration!

The OPINA Platform provides developers with technical support for development, benchmarking and performance evaluation. OPINA aims to create Europe's leading environment where innovators can focus on automotive mobility technologies within a supportive, networked community.



A shared platform for connected and autonomous mobility research, testing and cooperation

Technology, testing and collaboration in one platform

01 CCAM TECHNOLOGY

Cooperative, Connected and Automated Mobility technology

02 OPINA PLATFORM

Software development and testing, technical support, benchmarking and software toolchains

03 OPINA TESTBED

Cutting-edge HIL, SIL and PIL test systems

04 R&D GUIDANCE

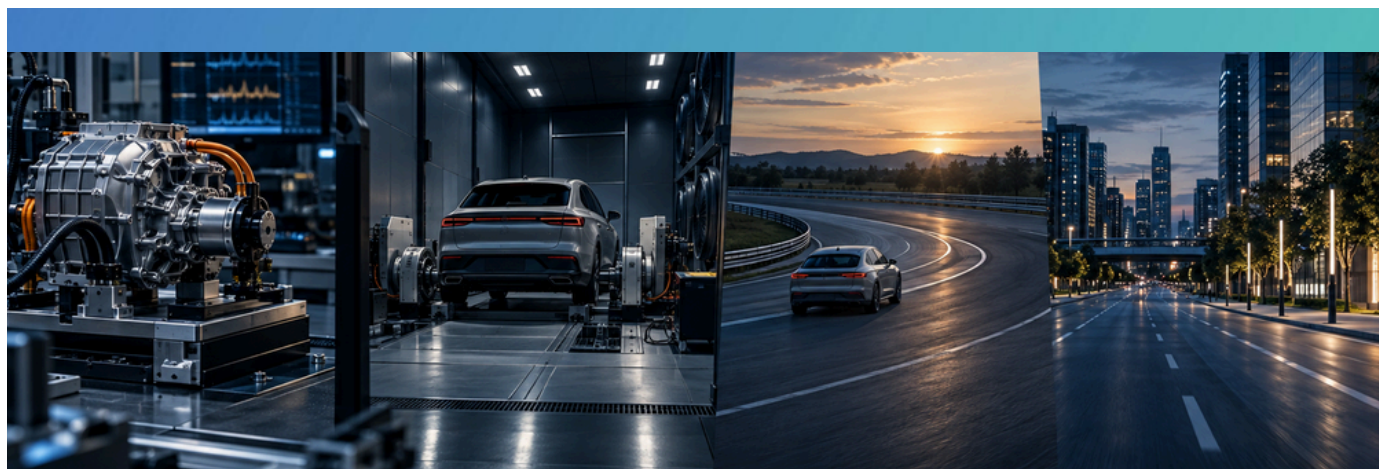
Software methods, functional safety, intellectual property rights and consultancy

05 COMMUNITY

Technical discussion, specialist access, industry collaboration and solution showcases

06 CERTIFICATION

Performance evaluation, compliance reviews and pre-certification assessments



INTENTIONS HAVE NO LIMITS AT OPINA

A connected innovation ecosystem

The project aims to build a dynamic industry-university-SME ecosystem through the Innovative Autonomous and Connected Vehicle Technology Development Center and the BOA Cluster, supporting AV-focused start-ups and strengthening BOA members' global competitiveness.



Who should explore the possibilities within OPINA?

- 01 **Software developers and engineers**
- 02 **Researchers and scientists**
- 03 **Small and medium-sized enterprises (SMEs)**
- 04 **R&D organizations**
- 05 **University labs**
- 06 **Industry partners**

At OPINA, software developers and engineers from all industries who work on CAM technologies are welcome, including automotive, intra-logistics, precision farming, navigation and railway.

**INNOVATION, SUSTAINABILITY
AND EFFICIENCY IN CAM**

COURSES

01

INTRODUCTION TO AUTONOMOUS AND CONNECTED VEHICLES

1. Intelligent Transportation Systems and Smart Mobility
2. AIV Hardware Technology: Components and Industrial Computers
3. Autonomous and Intelligent Vehicles Sensor Technology
4. AIV Integration: Software/Hardware Integration Methods
5. Connected and Autonomous Vehicle Technologies
6. Connected Vehicle Technologies Application: Case Studies

02

COLLABORATIVE, COMMUNICATING AND AUTONOMOUS VEHICLE (CCAV) MODELLING

1. Introduction to Applied Deep Learning in Autonomous Vehicles & Computer Vision
2. AIV Software Technology and Architectures
3. Autonomous Vehicle (AV) Programming
4. Sensor Fusion Methods and Software Implementation
5. Path Planning Techniques
6. Mapping and Environment Recognition

03

COLLABORATIVE, COMMUNICATING AND AUTONOMOUS VEHICLE (CCAV) MODELLING

1. Introduction to Vehicle Modeling
2. Introduction to Autonomous Wheeled Robot Control
3. Introduction to AIV Control: Low-Level Control

04

SIMULATION & TESTING ENVIRONMENT

1. MIL/SIL/HIL Simulation Environment
2. Simulation and Testing Phase of Autonomous Vehicle

OPINA

COURSES

05 IDEATION AND VALUE PROPOSITION DESIGN (EXPLORATION)

1. Innovation and Creativity Methodologies
2. Innovative Idea Development Methodologies
3. Institutional Entrepreneurship
4. Mentoring a Technological Entrepreneur
5. Technology Analysis and Technology Forecasting

06 BUSINESS MODEL CANVAS AND MODEL VERIFICATION (EXPLOITATION)

1. Managing Technology-Based Companies
2. Team Building: Empowering Teams for Success
3. Business Plan Preparation
4. Lean Design and Development

07 CUSTOMER DISCOVERY, CUSTOMER VALIDATION AND PRODUCT/MARKET FIT (OPTIMIZATION)

1. Patent Search and Mapping Techniques
2. Startup Financing and Exit Strategies
3. Entrepreneurial Marketing and Sales
4. Innovative Product Market Analysis

Training content developed for OPINA's learning platform

COURSES

INTRODUCTION TO AUTONOMOUS AND CONNECTED VEHICLES

01 Intelligent Transportation Systems and Smart Mobility

This course provides the necessary background information about intelligent transportation systems (ITS), smart mobility and their relation. ITS training materials cover modules on architectures, sensor/communication tech, applications, policies, and ethics, focusing on connected/autonomous vehicles.

Prepared by Prof. Dr. Klaus Werner Schmidt.



02 AIV Hardware Technology: Components and Industrial Computers

This course introduces hardware components and industrial computer systems used in autonomous intelligent vehicles (AIV). It systematically covers nine modules, including sensors, actuators, computing units (GPU, CPU), communication, data storage and power-energy systems, all essential for AIVs' autonomous and intelligent functions.

Prepared by Prof. Utku Köse.



03 Autonomous and Intelligent Vehicle Sensor Technology

This course introduces sensor technologies used in autonomous vehicles and explains their functions, usage, collaboration and integration within systems. Detailed course covering modules on cameras, LiDAR, radar, ultrasonic, GPS/GNSS, ESC, AI/Computer Vision and Sensor Fusion.

Prepared by Prof. Dr. Utku Köse.



COURSES

INTRODUCTION TO AUTONOMOUS AND CONNECTED VEHICLES

04 AIV Integration: Software/Hardware Integration Methods

This course covers software and hardware interoperability in autonomous vehicle systems, introducing embedded systems perspectives, operating systems, and infrastructure frameworks. Across seven modules, it explores methodologies for software and hardware validation, addressing integration challenges in intelligent vehicle development.

Prepared by Prof. Dr. Utku Köse.



05 Connected and Autonomous Vehicle Technologies

Driver perception limits and reaction delays remain major traffic safety challenges in intelligent transportation systems. In order to increase perception limits and simultaneously decrease reaction delays, inter-vehicle communication (IVC) or road-to-vehicle communication (RVC) have been proposed. This course provides an introduction to the wireless technologies and standards used for connected and autonomous vehicles exploring V2V/V2I wireless standards and technologies (802.11p and C-V2X), focusing on concepts like VANETs and applications such as Adaptive Cruise Control to improve traffic safety.

Prepared by Prof. Dr. Ümit Özgüner.



06 Connected Vehicle Technologies Application: Case Studies

This course provides an overview of a selected number of key examples using Connected Vehicle Technologies and covers use cases across five modules, including on-demand transport systems, speed adjustment at intersections (traffic lights and stop signs), obstacle and pedestrian warnings, mixed vehicle traffic and merging scenarios utilizing V2V and V2I communication.

Prepared by Prof. Dr. Ümit Özgüner.



COURSES

Embedded Systems and Software Development

01

Introduction to Applied Deep Learning in Autonomous Vehicles & Computer Vision

The course covers essentials of Artificial Intelligence, Machine Learning and Deep Learning with a specific focus on Computer Vision and image-based applications for autonomous vehicles (AVs) across eight modules. Key application-focused topics include Image Classification, Object Detection, Image Segmentation and Modeling Car Behavior in AVs ensuring up-to-date application ways in different scenarios for autonomous vehicles, through the Computer Vision perspective.

Prepared by Prof. Dr. Utku Köse.

**02**

AIV Software Technology and Architectures

This course provides an overview of Autonomous Intelligent Vehicle (AIV) software technology and architecture. It covers the evolution of automotive architectures, the need for new software-defined vehicle (SDV) approaches, and the role of DevOps in modern automotive software development.

Prepared by Ramu Mothukuri.

**03**

Autonomous Vehicle (AV) Programming

This course provides the necessary background to begin programming tasks for autonomous driving functions. To this end, the curriculum covers autonomous vehicle hardware, real-time system classifications (Hard, Soft, and Firm), and modular software architectures for self-driving vehicles. Practical applications are emphasized through Robot Operating System 2 (ROS2) in C++ and Python, featuring hands-on examples in image data processing, CAN communication, and object detection using YOLOv8.

Prepared by Prof. Klaus Werner Schmidt.



COURSES

Embedded Systems and Software Development

04 Sensor Fusion Methods and Software Implementation

This course introduces the essential methods and technical implementations of sensor fusion for autonomous vehicles, linking theoretical foundations with practical application. Course modules cover vehicle sensors and perception, Bayesian inference, Kalman filters, gating methods, data association, and multi-target tracking, featuring hands-on software implementation, real-world challenges, and simulation examples.

Prepared by Prof. Dr. Klaus Werner Schmidt.



05 Path Planning Techniques

This course covers path planning methods for autonomous vehicles, from basic task classification to practical simulation. Key topics include route and motion planning, road representations, path optimization, parametric curve techniques including Bézier curves and polynomials, with practical applications demonstrated using MATLAB and Simulink.

Prepared by Prof. Dr. Klaus Werner Schmidt.



06 Mapping and Environment Recognition

Course covers an introduction to different map types, map layers and map generation, along with the fundamental concepts of vehicle localization and navigation. The modules include specific localization methods using GNSS data with RTK, LiDAR point clouds with Normal Distribution Transform (NDT), and Simultaneous Localization and Mapping (SLAM).

Prepared by Prof. Klaus Werner Schmidt.



COURSES

Collaborative, Communicating and Autonomous Vehicle (CCAV) Modelling

01 Introduction to Vehicle Modeling

This course introduces core vehicle dynamics modeling for autonomous driving functions. Topics include vehicle kinematics, Ackermann steering, longitudinal and lateral dynamics, tire models, and engine modeling, with an emphasis on deployment in MATLAB/Simulink and simulation environments like IPG TruckMaker and dSpace ASM.

Prepared by Prof. Dr. Klaus Werner Schmidt.



02 Introduction to Autonomous Wheeled Robot Control

This course introduces high-level control (HLC) architecture for autonomous wheeled robots, focusing on event-driven decision-making and finite state machines (FSM). Building upon low-level control fundamentals, it covers operational logic modeling for key autonomous behaviors including adaptive cruise control, convoy control, lane following, and intersection management, with practical insights drawn from the DARPA Urban Challenge.

Prepared by Prof. Dr. Ümit Özgüner.



03 Introduction to AIV Control - Low Level Control

This course introduces low-level control systems for autonomous vehicles, combining vehicle dynamics modeling with practical execution. It explores the distinction between high and low-level control, point-mass models, lateral control maneuvers, obstacle avoidance, and waypoint following techniques.

Prepared by Prof. Dr. Ümit Özgüner.



COURSES

Simulation & Testing Environment

01 MIL/SIL/HIL Simulation Environment

This course covers simulation frameworks for validating and testing autonomous driving functions across the system development V-model. It details the development workflows and practical applications of Model-in-the-Loop (MIL), Software-in-the-Loop (SIL), and Hardware-in-the-Loop (HIL) simulation, supported by illustrative examples including Driver-in-the-Loop (DIL) and Vehicle-in-the-Loop (VIL) methodologies.

Prepared by Prof. Dr. Klaus Werner Schmidt.



02 Simulation and Testing Phase of Autonomous Vehicle

This course introduces testing environments, certification systematics, and accreditation frameworks for autonomous vehicles. It explores virtual and real-world test scenario design, compliance with ISO 34502 and PAS 1883 standards, and validation of core ADAS/AD functions including ACC, AEB, ALKS, and LKAS using CARLA simulator integration.

Prepared by Prof. Dr. Utku Köse.



SIMULATION CONTINUUM

01—02



MIL

Model in the Loop



SIL

Software in the
Loop



HIL

Hardware in the
Loop



ROAD

Vehicle Testing

COURSES

Ideation and Value Proposition Design (Exploration)

01 Innovation and Creativity Methodologies

This course covers systematic innovation methodologies and creative problem-solving techniques for product and system design. Key topics include the Function Follows Form principle alongside core inventive techniques such as Subtraction, Division, Multiplication, Task Unification, and Attribute Dependency to systematically break cognitive barriers and generate innovative solutions.

Prepared by Sadik Vural.



02 Innovative Idea Development Methodologies

This course provides a structured framework for generating, refining, and evaluating innovative ideas. It dispels common creativity myths while introducing the RIGHT Thinking model and neuroscience-based approaches to idea evaluation, alongside practical strategies for refining and pitching concepts within organizations.

Prepared by Sadik Vural.



03 Institutional Entrepreneurship

This course covers intrapreneurship strategies and best practices for driving innovation within established organizations. Key topics include innovation framework analysis, Minimum Viable Product (MVP) development, resource acquisition strategies, and real-world implementations, featuring case studies such as Adobe Kickbox and Cisco Innovate Everywhere.

Prepared by Sadik Vural.



COURSES

Ideation and Value Proposition Design (Exploration)

04 Mentoring a Technological Entrepreneur

This course explores the role of mentorship in tech startup ventures. It covers strategies for identifying milestones, selecting suitable mentors, building effective mentor-mentee relationships, and navigating mentorship programs and incubation ecosystems in Türkiye.

Prepared by Sadık Vural.



05 Technology Analysis and Technology Forecasting

This course covers the foundations and practical applications of technology forecasting and strategic decision-making. Key topics include quantitative and qualitative forecasting methodologies, major technological trend drivers, technology roadmapping, innovation management, and ethical considerations surrounding emerging technologies.

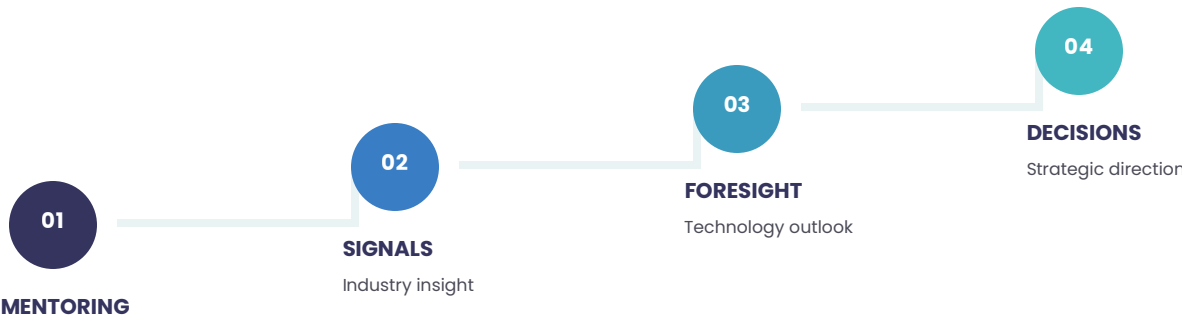
Prepared by Sadık Vural.



INNOVATION PATHWAY

From entrepreneurial guidance to future-ready decisions

04→05



COURSES

Business Model Canvas and Model Verification (Exploitation)

01 Managing Technology-Based Companies

This course explores operational and strategic leadership frameworks in the tech industry. It focuses on ten core domains, such as innovation management, Agile development and DevOps, talent retention, market analysis, data security, ecosystem partnerships, infrastructure scaling, ethical innovation, continuous learning, and customer-centric business design.

Prepared by Sadik Vural.



02 Team Building: Empowering Teams for Success

This course covers core principles of team building and leadership to optimize team dynamics and performance. Key topics include communication strategies, conflict resolution, performance enhancement, and methods for fostering a collaborative team environment.

Prepared by Sadik Vural.



03 Business Plan Preparation

This course focuses on developing actionable business plans for technology and growth-oriented ventures. It explores core elements such as market opportunity analysis, financial modeling, marketing strategy, and resource allocation to build sustainable business models.

Prepared by Sadik Vural.



COURSES

Business Model Canvas and Model Verification (Exploitation)

04 Lean Design and Development

This course explores practical Lean methodologies applied to design and development workflows. It focuses on customer-centric problem solving, rapid prototyping, iterative testing, and continuous improvement strategies leveraging Agile principles.

Prepared by Sadik Vural.



04

LEAN DESIGN DEVELOPMENT

A focused introduction to lean thinking within product and technology development.

COURSES

Customer Discovery, Customer Validation and Product/Market Fit (Optimization)

01 Patent Search and Mapping Techniques

This course covers key strategies for patent search, mapping, and intellectual property analysis. Key topics include trademark rights, utility model applications, brand design concepts, and technical frameworks for protecting intellectual property within competitive markets.

Prepared by Erdem Kaya.



02 Startup Financing and Exit Strategies

This course covers key financial frameworks for launching, funding, and scaling technology startups. Key topics include financing stages from Seed to Series C, equity and debt funding mechanisms, pitch deck development, startup financial management, investor relations, and exit strategy planning through IPOs and acquisitions.

Prepared by Sadik Vural.



03 Entrepreneurial Marketing and Sales

This course covers modern marketing and sales strategies tailored for entrepreneurial ventures and startups. Key topics include market research, customer segmentation, brand positioning, startup-focused sales funnels, digital marketing channels, and KPI tracking for evaluating marketing performance.

Prepared by Sadik Vural.



COURSES

Customer Discovery, Customer Validation and Product/Market Fit (Optimization)

04 Innovative Product Market Analysis

This course covers core methodologies for analyzing competitive markets for innovative products. Key topics include competitive landscape analysis, customer insights, unique value proposition design, market sizing, forecasting techniques, regulatory considerations, and end-to-end go-to-market execution.

Prepared by Sadık Vural.



MARKET FIT

04

INNOVATIVE PRODUCT MARKET ANALYSIS

01 RESEARCH

Market evidence

02 SEGMENT

Customer groups

03 POSITION

Distinct value

04 VALIDATE

Customer response

Customer insight connects every stage of market analysis.

ABOUT THE INSTRUCTORS

COURSE TUTORS

01	Erdem Kaya	With over 20 years of experience in intellectual property, the author is a qualified Turkish and European patent attorney. They founded a Turkish IP services firm and have served as Chair of the National Patent Union (UPB) and an Executive Board Member of Sistem Global Consultancy.
02	Klaus Werner Schmidt	Klaus Werner Schmidt's research focuses on making autonomous and cyber-physical systems reliable and predictable. At the ACTIVE Lab, he works on autonomous driving and connected mobility, combining real-time communication, control, and trajectory planning. His research in discrete event systems provides methods for analyzing and verifying safety-critical systems.
03	Ramu Motukuri	A PMP-certified program and project manager with over 15 years of experience in automotive embedded software development and testing, the author has led multinational projects for clients including Robert Bosch and TRW. Their work spans engine control, HVAC, body control, and braking systems, with responsibility for planning, coordinating teams, and delivering projects.
04	Sadık Vural	An entrepreneur, author, and international trade expert, the author builds brands combining craftsmanship, design, and technology. They hold an MBA from Çukurova University and a Ph.D. from St. Clements University, and have helped companies expand globally while developing luxury and e-commerce brands.
05	Utku Köse	Utku Köse is a Professor at Süleyman Demirel University, Türkiye. He holds a Ph.D. in Computer Engineering from Selçuk University and has authored or co-authored more than 350 publications. His research focuses on artificial intelligence, AI ethics and safety, biomedical applications, and e-learning. He was a visiting researcher at the University of North Dakota from 2023 to 2024.

ABOUT THE INSTRUCTORS

COURSE TUTORS

06

Ümit Özgüner

Professor Emeritus Ümit Özgüner taught electrical engineering at Ohio State University for over 35 years, specializing in autonomous vehicles. He earned his bachelor's degree from Istanbul Technical University and his Ph.D. from the University of Illinois. A Life Fellow of IEEE, he has authored or co-authored more than 400 publications, including a book on autonomous ground vehicles.

MULTIDISCIPLINARY EXPERTISE

EXPERTISE

The instructor team connects technical development with innovation and market application.

01

**AUTONOMOUS &
CONNECTED
VEHICLES**

02

**AI & SOFTWARE
SYSTEMS**

03

**TECHNOLOGY &
INNOVATION**

04

**ENTREPRENEURSHIP
&
MARKET
DEVELOPMENT**

A shared knowledge base for technology development, testing and commercialization



T.C. SANAYİ VE
TEKNOLOJİ BAKANLIĞI

#MİLLİ
TEKNOLOJİ
HAMLESİ



CONNECTED MOBILITY

CONTACT

OKAN OPINA TEKNO ARGE A.Ş

Tepeören Mah. Ballica Yolu Cad.
İstanbul Okan Üniversitesi Rektörlük
No: 11/11 Tuzla/İstanbul/Türkiye

PHONE

+90 (216) 677 16 30 / 2401

EMAIL

info@opinatekno.com

WEB

www.opinatekno.com

OPINA

OPINA TRAINING CATALOGUE

OPEN INNOVATION AUTONOMOUS VEHICLE
DEVELOPMENT AND TESTING PLATFORM

