AUTOMOTIVE PATENTS BY

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INNODARE

INNODARE Innovation, Technology and R&D Platform Ltd. Co.

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INTRODUCTION

This booklet gives concise explanations of the patents granted for which the inventor is mainly Prof. Alankuş and some shared. These patents have been developed during the studies of Prof. Alankuş at Istanbul Okan University, so the owner of the patents is Istanbul Okan University.

They bring innovative solutions to real problems and the application of these patents will bring a competitive edge to the companies. If you are interested in these patents for application or development, please contact info@innodareplatform.com

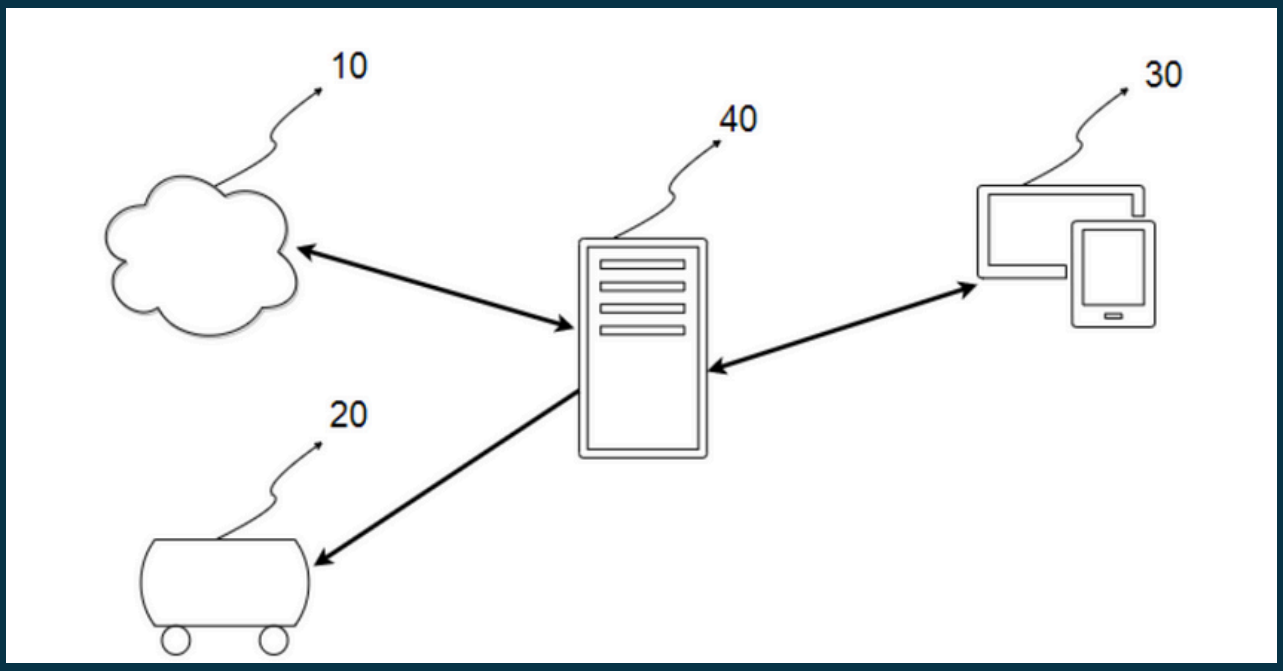
Prof. Alankuş has around other 10 pending patents for which you can get information through info@innodareplatform.com

A REMOTELY-DIRECTED BATTERY LIFE CYCLE OPTIMIZATION SYSTEM CAPABLE OF COMMUNICATING AND A METHOD THEREOF

The System consists of cloud, battery and/or energy management ECU, calculation system and HMI system for the LCA optimization application

In Italy and in Turkey, Patent has been granted

IT112021000162497 –Italy
TR 2020 04424 –– Turkey
Inventor Orhan B. Alankuş
Applicant: Istanbul Okan University



• All the battery pack component details including the cell type is on the vehicle ECU and are sent to the main computer and the main computer calculates the starting carbon footprint of the battery system

• Battery charging positions and their carbon footprints in line with the time of the day and the electric grid characteristics are in the database of the cloud

• The best battery charging cycle according to the specific battery and electric vehicle type is also in the cloud

• Vehicle ECU or the main computer gives suggestions for the best charging protocol and the best charging position and timing in line with the state of charge of the battery

• The system suggests the best mode of driving to reach the best point for charging in line with the state of charge

• The system also warns of possible repair or maintenance need before a breakdown and keep track of the repairs' carbon footprints

• The system tracks down the useful remaining life and warns the user for second use

• The system also records the carbon footprint during recycling at EOL

Benefits

- Optimize Range : give the best route and best velocity profile to reach the charging point

- Optimize Battery life : use the best charging cycle through data analysis and machine learning and determine the best second use timing with precise RUL calculations and also through predictive maintenance procedures

- Optimize Carbon emissions : Through carbon emissions data of the charging stations

BATTERY SYSTEM FOR ELECTRIC VEHICLES AND MANUFACTURING METHODOLOGY

The System suggests innovative methodologies for battery packaging to decrease the cost, timing and also improve the maintenance.

Patented in Italy

IIT102020000032675 –Italy
Inventor Orhan B. Alankuş
Applicant: Istanbul Okan University

•After battery cell selection, battery modules are designed in such a way that cell connection terminals are elastic and/or reproachable so that cells can easily be mounted.

•Cell cooling points have to be designed also previously

•Module casing is designed in such a way that cell wiring and cooling channels can be embedded in line with the module design.

•Modules are obtained with easy mounting of cells and also the casing which bears the wiring and cooling channels.

•Battery pack is designed in such a way that modules can easily be inserted on elastic and or reproachable connection terminals.

•Battery module cooling system connections are also to be designed in such a way that cooling channels can be embedded on the casing of the pack

•Battery pack casing also includes embedded wiring for the modules.

•In this way, battery modules can and battery packs can be assembled in a faster way

•Benefits

- Faster assembly

- Lighter (eliminating separate wiring and cooling systems)

- Less costly

- Easier to maintain

SAFE, CLOSE FOLLOW-UP SYSTEM FOR CAVS

- Automated calculation of vehicle model parameters through real-time data collection and cloud information for precise lead and ego-vehicle behaviour estimation
- Brake and accelerator actuation signals passed through V2V for pro-active gap distance calculation
- Lead vehicle sensor data passed through V2V for proactive danger detection

TR 2016 20323 B
Inventor Orhan B. Alankuş
Applicant: Istanbul Okan University

It is a vehicle tracking system in accordance and its feature is that it includes the following process steps of the method that provides dynamic calculation of vehicle speeds and automatic control of the minimum vehicle following distance;

• Dynamically obtaining information such as wind, rain, sea level, air temperature, snow and leading vehicle model information from sensors and measurement stations on the vehicles,

• Measurement of vehicle acceleration and braking characteristics by the measuring station with the received sensor information,

• Calculation of the friction coefficient by the central computer using the vehicle's deceleration after braking and acceleration after accelerating,

• Simultaneously with the calculation of the friction coefficient, the tire rolling coefficient is calculated by using the vehicle's deceleration after braking and acceleration after accelerating information by central computer,

• Calculation of the vehicle weight by the central computer using the vehicle's deceleration after braking and acceleration after accelerating simultaneously with the calculation of the friction coefficient and wheel rolling coefficient,

• Calculation of the close following distance according to the vehicle model with calculation of the friction coefficient, wheel rolling coefficient and vehicle weight by central computer,

• Transmitting the vehicle distance information to all vehicles with the communication card according to the calculations made by the central computer,

• Activation of the brake system by the control card In case of approaching the vehicle in front according to the calculated vehicle distance information,

• According to the calculated vehicle distance information, in case of moving away from the vehicle in front and approaching the vehicle behind, the command for acceleration is transmitted to the vehicle via the control card.

•Benefits

- Automated correction and update of the vehicle model and digital twin in line with the changing environment conditions

- Safe driving and convoy

- Closest and safe distance during convoying

MODEL BASED VEHCLE FOLLOW-UP METHODOLOGY FOR CONVOYS

- Each vehicle has a detailed database of the vehicle models
- The vehicles in the convoy transmit the vehicle parameters and data to the other vehicles, so that each vehicle can update the models with the data
- The vehicles will also send the braking and acceleration signals and the real-time velocity
- The following vehicles will calculate the dynamics of the leading vehicles and using the model will adjust for the right braking and acceleration as to optimize the distance

Patent Application No: 2019/21115

Inventors: Orhan Alankuş; Elif Toy; Kaan Çakın

Applicant: Istanbul Okan University

•Benefits

- Possibility of having a detailed model library for different types of vehicles

- Real-time digital twin creation

- Safe and close distance convoying

SENSOR FOR INTELLIGENT AND AUTONOMOUS VEHICLES

- Sensors on an autonomous vehicle are to be integrated to the related plastic parts at the right positions during the injection phase so tedious assembly work after the production will be avoided

- Sensors will have either wireless communication or the related cables will also be inserted inside theplastic parts so that assemble and communication will be with less cost and fewer maintenance problems

- Autonomous vehicle ECU will have wireless communication capabilities to get the data fromthesensors.

Italian Patent no:IT102020000032678

Inventor: Orhan Alankuş

Applicant: Istanbul Okan University

•Benefits

- Easy and precise integration of sensors
- Less costly integration of sensors
- Easier maintenance
- Less breakdown

ACCELERATED VIRTUAL SIMULATION SYSTEM UNDER REAL ROAD CONDITIONS FOR AUTONOMOUS VEHICLES

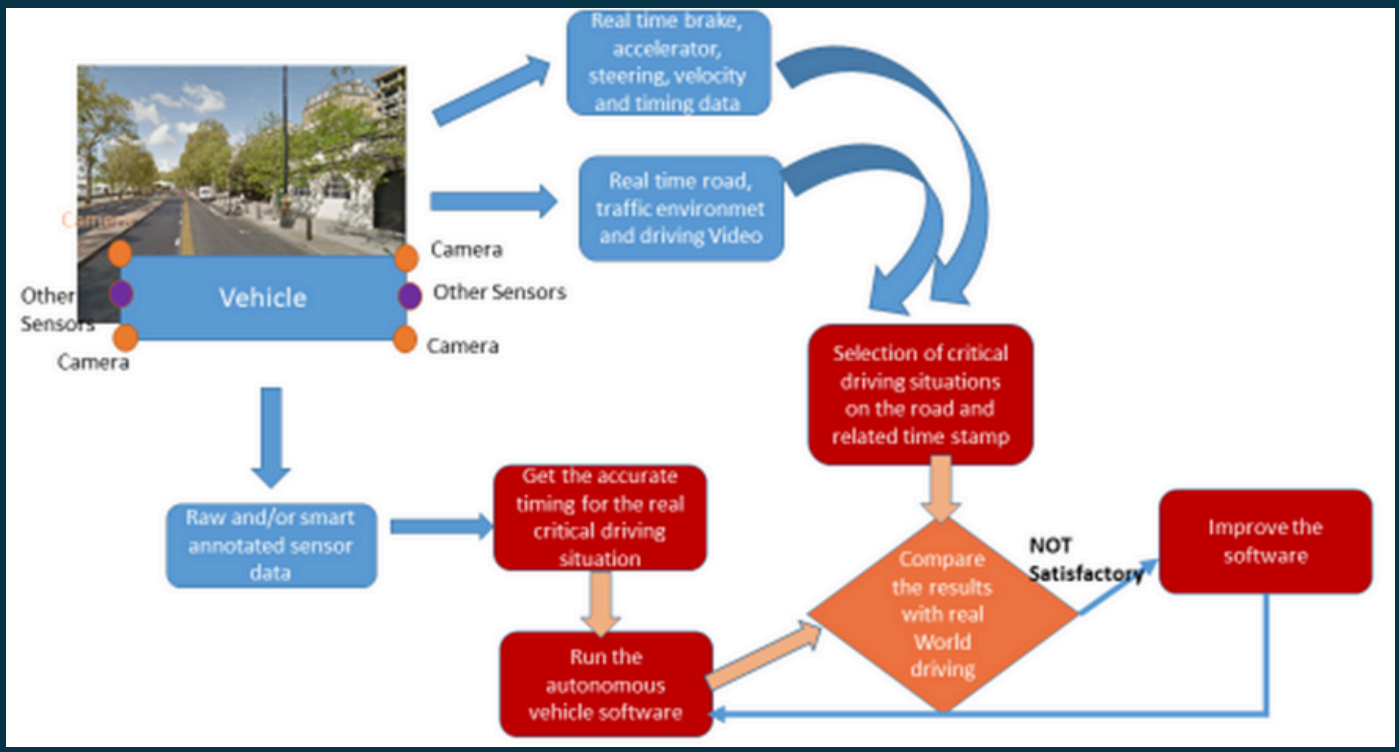
- Real-time road, traffic, weather conditions driving video capturing
- Real-time brake, accelerator, steering, velocity direction and other vehicle dynamics data recording
- Collection and storing of raw and smart/annotated sensor data
- Selection of the driving events from the video capture
- Timing of the events and running the sensor data through the autonomous vehicle software
- Comparison of the driver actions and the autonomous vehicle software actions and improvement
- Continuous comparison of the driver and autonomous vehicle software actions and creation of a report

Patent no:TR2018 08608
Inventor: Orhan Alankuş

Applicant: Istanbul Okan University

•Benefits

- Real-world simulation
- Faster testing of autonomous vehicles
- Safer testing of autonomous vehicles
- Comparison with an experienced driver



REAL-TIME CONNECTED SIMULATION SYSTEM FOR VEHICLE DEVELOPMENT

- The objective of the patent is to ease collaborative vehicle software development. The development environment is also connected to cloud and gets data from the vehicle which is on the road to automatically correct the vehicle models created in the simulation system.

- Developed system and models can also be used after production to dynamically improve the vehicle models and optimize the velocity profile, charging cycle etc. according to the application

- The system enables fast and integrated development and LCA optimization during the whole life cycle of the product.

Patent no:TR2018 21306

Inventor: Orhan Alankuş; Engin Özatay

Applicant: Istanbul Okan University

•Benefits

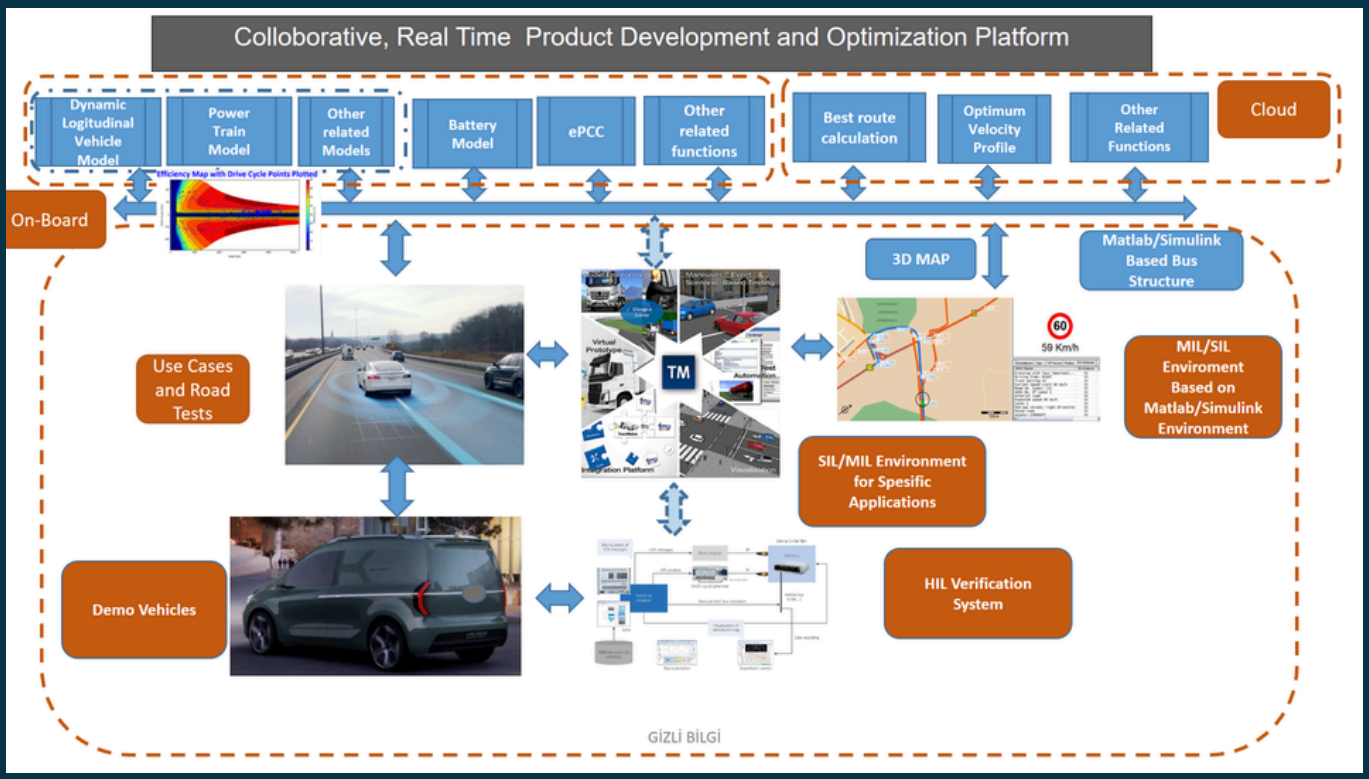
- Faster vehicle software development

- Easy and effective collaboration for software development

- Correction of the models with the real-world data

- Possibility of continuous improvement of the models during the life cycle

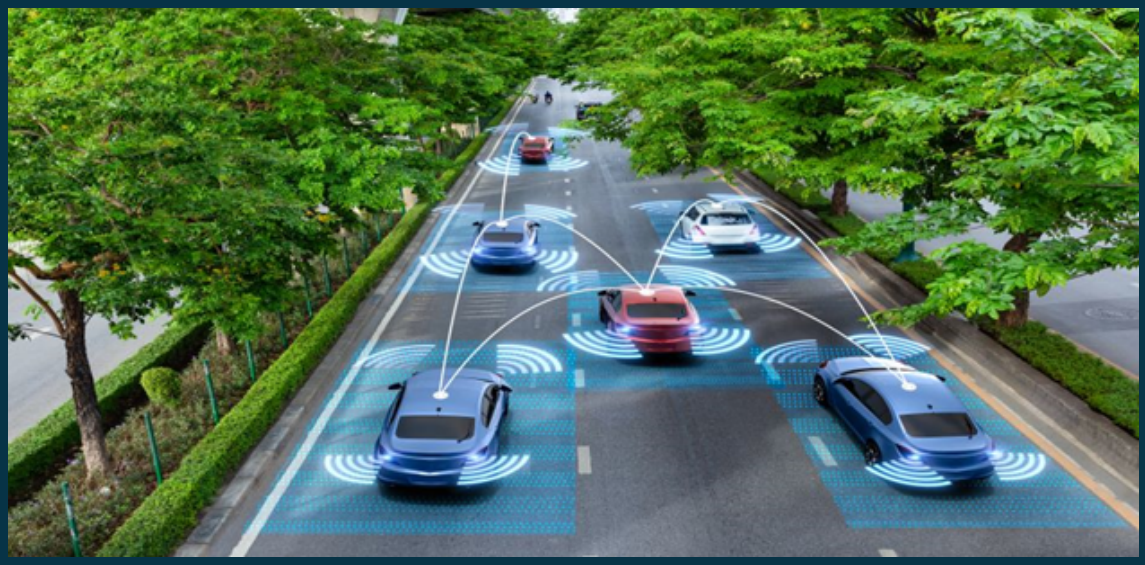
- Possibility of integration with optimization models during the life cycle of the vehicle



METHODOLOGY OF EMISSION OPTIMIZED DRIVING CONDITIONS DETERMINATION FOR AUTONOMOUS VEHICLES

- Determination of velocity profile to optimize the emissions from exhaust, brakes and tyres for autonomous vehicles
- Enables emission optimization for autonomous vehicles
- Uses an AI-based scoring algorithm for driving style to determine the optimized velocity profile

Patent No: TR 2022 013903 B
nventor: Orhan Alankuş; Engin Özatay
Applicant: Istanbul Okan University



Method for determining driving conditions for total emission optimisation in autonomous vehicles, comprising the process steps of

- Collecting sensor data using smartphone sensors including GPS and accelerometer or information on the on-board computer,

- Combining accelerometer signals with GPS data including latitude, longitude, speed and direction information after the calibration parameters are determined,

- Detection of the areas where acceleration, deceleration, cornering and acceleration occur by the processor based on the stimulation of signals by analysing the sensor data in real-time,

- Calculation of brake wear particles and tire wear particles by the processor using the speed profile information in the database,

- Extracting features for driving characteristics by the processor,

- Categorisation of deceleration, cornering and acceleration drivingbehaviours by the processor using a random forest algorithm trained with ready test data,

- Calculation of the effect of the calculated tire and brake particle emissions by the processor using the emission effect information in the database,

- Calculation of more than one optimum speed profile with speed limit and time optimisation by the processor by obtaining cost, fuel consumption, brake and tire operations, and

- Selection of the speed profile with the highest score by the processor by scoring the calculated speed profiles according to the total emission values.

•Benefits

- Safe driving

- Total emission optimized velocity profile for autonomous vehicles

- Multi-objective optimization

- Green driving

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