TATA ELXSI

TEL Consolidated Automotive Patent Portfolio

SEP 16, 2025

Contents

OVERALL PATENT FILING METRICS

Countries	Patents Filed	Approved
Total	135	79
India	110	63
Europe	16	13
USA	6	3
International PCT Filings	3	NA

TEL AUTOMOTIVE PATENT METRICS

Countries	Patents Filed	Approved
Total	53	40
India	34	25
Europe	14	13
USA	3	2
International PCT Filings	2	NA

STRATEGIC PATENT PORTFOLIO

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AI ML & Gen AI

11

V2X & Connected Vehicle Technology

10

Sustainable Tech

23

Automotive Test & Validation

28

ADAS

4

EV & BMS

TEL AUTOMOTIVE PATENT GRANTS

Patent No : US12328090B2 | IN513858

BU : TBU

Grant Date : 10-Jun-2025(US) | 22-Feb-2024(IN)

1st Application Date : 29-Dec-2020

Current Status : Granted Granted Filed

Title : SYSTEM AND METHOD FOR CONTROLLING OPERATION OF A MOTOR

Inventors : Anush G, Krishna Priya Ganesh, Reshma Ravi

BLDC motors are used in a variety of devices such as vehicle windows and seats, and ceiling fans. Typical **sinusoidal and trapezoidal motor control approaches produce torque ripple** at different speeds resulting in vibrations that **deteriorate life and performance** of devices. **FOC approach**, on the other hand is **complex and expensive**.

The invention relates to an **improved BLDC motor controller that uses a modified trapezoidal control with a single current controller designed to gradually vary motor speed to minimize torque ripple**. The system can potentially enable positioning BLDC-based applications for **EV adoption in the small passenger vehicle category** as well as applications traditionally served by conventional Permanent Magnet Direct Current (PMDC) motor drives.

- Simplified control approach to reduce torque ripple at low speeds
- Reduces wear and tear, increases motor life

Technology & Industry Focus : Automotive, BLDC Motor, Motor Control Algorithm

Patent No : IN566154

Grant Date : 13-May-2025

Current Status : Granted

BU : TBU

1st Application Date : 15-Dec-2022

Title : DRIVER ASSISTANCE SYSTEM AND AN ASSOCIATED METHOD

Inventors : Jyotsana Singh, Sumit Subhashrao Parable, Rijoy Valiyapurakkal

The patent outlines a **power-efficient Driver Monitoring System (DMS) that dynamically controls LED states based on the driver's position relative to the NIR camera and ambient lighting**. It features intelligent lighting control to ensure the NIR camera captures facial features clearly, **enabling accurate driver state detection without excessive energy use**. The DMS also functions as an adaptive front lighting system, enhancing road visibility without causing glare to oncoming drivers. Additionally, it serves as a security system by identifying registered drivers and disabling vehicle operation for unregistered users, improving safety and efficiency in various driving conditions.

- Accurately monitors driver behavior in all ambient lighting conditions
- Suitable for different types and variants of vehicles irrespective of their sizes and dimensions
- Alerts inattentive drivers and automatically stops vehicle in a safe area

Technology & Industry Focus : Automotive, ADAS, Active Safety, Driver Drowsiness Monitoring, Machine Learning

Patent No : IN557607

BU : MEBU

Grant Date : 8-Jan-2025

1st Application Date : 30-Nov-2022

Current Status : Granted

Title : ACCELERATION OVERRIDE SYSTEM

Inventor : Rajendra Sahoo

Conventional acceleration override systems are adapted to identify unintended acceleration when driven by certain types of drivers but fail to adapt to changing drivers and driving conditions.

The patent application describes an **intelligent and effective acceleration override system** that includes an identification unit that **identifies a driver and associated demographic data.** A calibration unit then determines **personalized threshold ranges for the steering pressure and the accelerator pressure specific to the identified driver.** The system **accurately identifies and automatically overrides unintended acceleration based on personalized thresholds** and prevents mishaps.

- Accurately identifies unintended acceleration of vehicle
- Customizes thresholds for detecting unintended accelerations based on drivers and conditions.
- Automatically disengages accelerator and activates brake during emergency scenarios

Technology & Industry Focus : Automotive, ADAS, Active Safety, Emergency Braking, Personalization, Machine Learning, AI

Patent No : IN543205

Grant Date : 26-Jun-2024

Current Status : Granted

BU : TBU

1st Application Date : 5-Jan-2018

Title : SYSTEM AND METHOD FOR IDENTIFYING A STATE OF MIND AND AUTOMATICALLY RESPONDING TO A SITUATION

Inventors : Sharath Yadav, Sivaprasad Nandyala, Gayathri K., Mithun Bhaskar

Emergency response systems identify if a user is in an emergency by comparing physical data of the user with baseline parameters that are not customized to the user. Therefore, a baseline-based comparison may not accurately identify an emergency involving the user.

The present application describes a **new psychology-inspired State Of Mind (SOM) algorithm that employs Artificial Intelligence (AI) to analyze emotions of a user to monitor occurrence of emergency situations such as cardiac arrests, violent clashes, or accidents**.

- New psychology-inspired AI algorithm
- Learns from successful past responses for faster emergency response

Technology & Industry Focus : Automotive, ADAS, Machine Learning, AI, Video Analytics, Diagnostic Solution, Healthcare

Patent No : IN541964

Grant Date : 14-Jun-2024

Current Status : Granted

BU : TBU

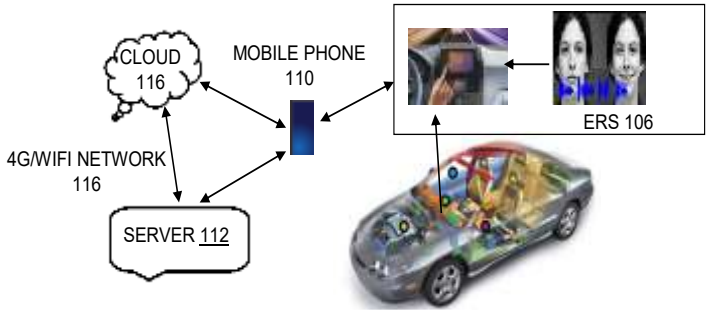
1st Application Date : 31-Mar-2017

Title : METHOD AND SYSTEM FOR IMPROVED EMOTION IDENTIFICATION

Inventors : Sivaprasad Nandyala, Muralidhar K. V., Sriramkumar Varanasi

Present day data analytics approaches attempt to process data to generate insights using various data processing algorithms, which are **often time-intensive due to the large size of the data.**

The invention describes a system that uses a modified BAT algorithm with a deep belief network and a GMM-UBM classifier to **extract a set of optimal features from an overall set of biometric information** measured emotion identification. As the GMM-UBM classifier detects the emotion based on the set of optimal features, **accuracy and speed of emotion identification is improved**, allowing for rapid personalization of services.



- Rapidly processes biometric information
- Personalized services for premium in-vehicle experience.

Technology & Industry Focus : Automotive, ADAS, Video Analytics, Machine Learning

Patent No : IN534940

BU : IDV

Grant Date : 25-Apr-2024

1st Application Date : 12-Jun-2020

Current Status : Granted

Title : PARKING BRAKE SYSTEM

Inventor : Srikumar Srinivasan

Present day parking brakes typically use pawl or rack and pinion arrangements, which often fail under intense loads when parked on a steep inclined plane**. Failure of the parking brakes may cause the vehicle to skid off the road, and endanger the life of occupants and pedestrians.**

The invention relates to a single speed planetary gearbox. The gearbox includes a locking gear that locks the planetary gears in the gearbox when the parking brake is engaged. The locking gear is actuated by a solenoid valve which also takes **input from a speed sensor to ensure-non deployment of locking gear** when the vehicle is in running condition.

- Dedicated locking gear for reliable parking on different terrains and gradients.
- Multiple points of engagements to mitigate brake failure due to intense loads on hills and steep inclined planes.

Technology & Industry Focus : Emergency Braking Systems, Automotive Safety, Heavy Vehicle Safety, Product Design

Patent No : IN508545 | US10303817B2 | EP3121729B1

Grant Date : 8-Feb-2024 (IN) | 28-May-2019 (US) | 26-Sep-2018 (EP)

Current Status : Granted Granted

BU : MCV

1st Application Date : 21-Jul-2015

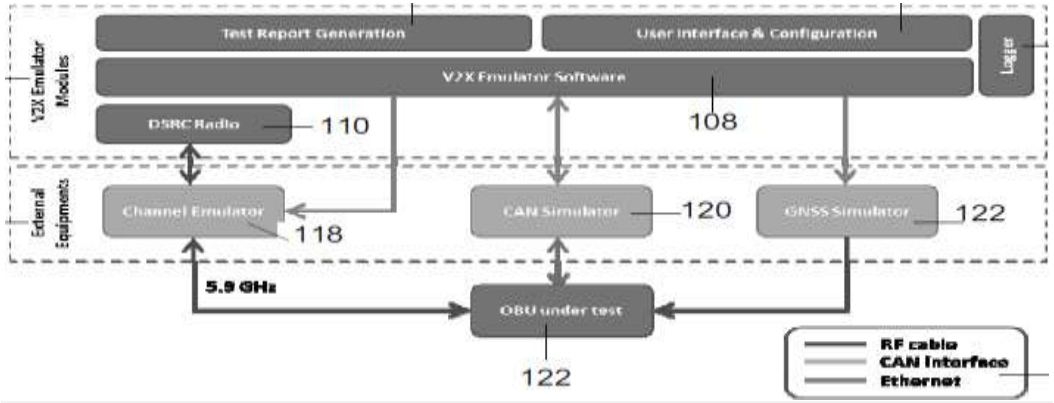
Granted in EP & 7 EP countries

Title : SYSTEM AND METHOD FOR ENHANCED EMULATION OF CONNECTED VEHICLE APPLICATIONS

Inventors : Gnanaprakash Sebastian, Karthikeyan P, Biswajit Biswas Rajagopalan R

With the advent of V2X technology, identifying specification flaws, design flaws, and implementation defects over the entire lifecycle has become a critical part of vehicle development.

The patent mentions a V2X emulator that integrates conventional V2X emulation modules with certain external emulation modules such as a channel emulator, a CAN simulator, and a GNSS simulator to **provide synergistic and holistic testing of V2X application scenarios, such as testing for safety, in a single system.**



- Real-Time GPS, CAN, GPS Emulation
- Multiple Standards Supported
- User Friendly GUI

Technology & Industry Focus : Automotive, Automotive Testing and Validation, V2X, Connected Vehicles, ADAS, Network and Communications

Patent No : IN506888

Grant Date : 5-Feb-2024

Current Status : Granted

BU : TBU

1st Application Date : 31-Mar-2017

Title : SYSTEM AND METHOD FOR AUTOMATIC OBJECT LOCALIZATION

Inventors : Nijesh P S, Sreejith Pai, Revathi T S

Present day vehicles use Reeds-Shepp approach to determine the shortest path to reach a vacant slot, which in practice, require substantial amount of maneuvering space to navigate to the vacant slot, which makes the approach unsuitable for tight parking spaces.

The patent application describes a **camera-based object localization system for driver assistance functions such as automatic parking and lane detection.** The midpoint of the rear axle of the vehicle is accurately identified from camera images to determine an exact location of the vehicle. The system also identifies vacant parking slots and provide autonomous navigational guidance to the vehicle.

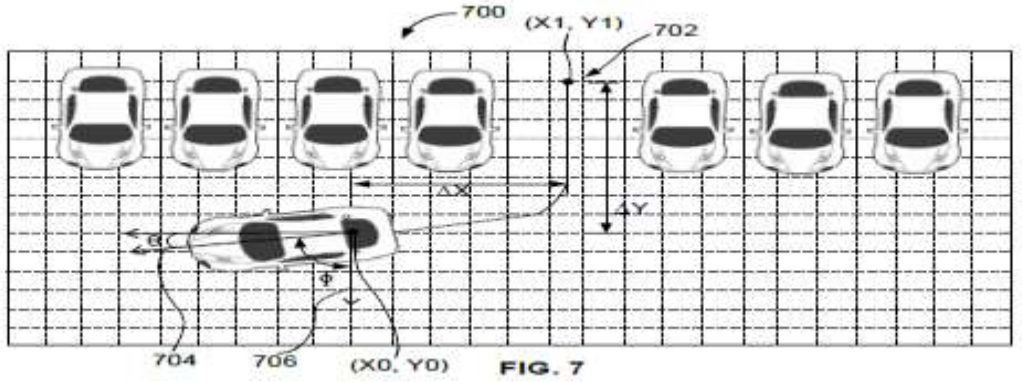


FIG. 7

- Cost-effective autonomous valet parking
- Navigation guidance for different types and sizes of vehicles

Technology & Industry Focus : Automotive, Automated Parking, Vehicle Path Planning, ADAS

Patent No : IN504936

Grant Date : 30-Jan-2024

Current Status : Granted

BU : IDV

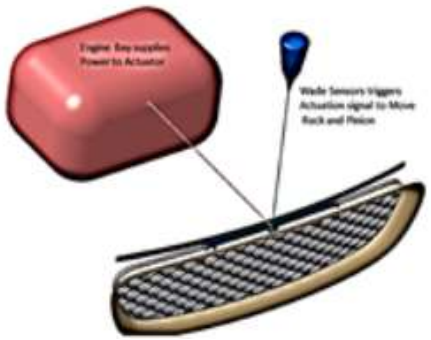
1st Application Date : 31-March-2022

Title : PROTECTIVE GRILLE SHUTTER SYSTEM FOR VEHICLES

Inventor : Harsha HA

The protective front grilles on vehicles that provide thermal management via ensuring air flow to the engine also allow entry of water when parked during floods, or when traveling through flooded paths, thus damaging vital electrical and engine components.

The patent application describes **an active grille system that automatically deploys a shutter to block the grille vents only upon detecting the water level to be above a wade line** of the vehicle to prevent entry of water into the engine compartment



- Simple and Lightweight components
- Retrofittable solution to prevent engine hydrolock

Technology & Industry Focus : Automotive, Vehicle Packaging, Flood Safety, ESG, Product Design

Patent No : IN483378

BU : IDV

Grant Date : 15-Dec-2023

1st Application Date : 22-Nov-2016

Current Status : Granted

Title : GEARED FLUID TRANSMISSION DEVICE

Inventors : Gurudutt, Prakash Rao, Manoz

Conventionally, a single non-split type housing **accommodates a gear assembly having one specific size** and operating only at **one specific flow rate**. When a change in the flow rate is needed, a completely new or another gear assembly needs to be installed with extreme caution to prevent damage.

The patent describes a geared fluid transmission device with multiple split housings **capable of being uncoupled and coupled to accommodate gear assemblies of different sizes**. The device also includes a non-split type flow insert of variable thickness adapted to obtain multiple flow rates, thus preventing a need for frequent overhauls. The device can be used for **circulating the oil for lubrication of external devices such as heavy machineries and automobiles efficiently.**

Technology & Industry Focus : Automotive, Pump, Sustainability, Product Design

- Gear assembly with multiple flow rates
- 50% less wastage by preventing replacements
- Reduced service & maintenance cost and time

Patent No : IN482773

Grant Date : 14-Dec-2023

Current Status : Granted

BU : IDV

1st Application Date : 7-Jun-2016

Title : HOOD ASSEMBLY FOR REDUCING AERODYNAMIC DRAG ON A VEHICLE AND A METHOD THEREOF

Inventors : Srikumar Srinivasan

High-end vehicles are custom designed to include long airfoil-like shape suited for optimal aerodynamics. Conventional vehicles, in contrast, are **designed to be compact, making them aerodynamically inefficient**.

The patent describes a new hood assembly suited for any vehicle for reducing aerodynamic drag without affecting vehicle aesthetics. **At high speeds**, the hood automatically rotates, while extending under-hood devices to cover any gaps resulting from the rotation to **adapt end portions of the vehicle into an airfoil-like shape**, that allows for smooth airflow. This can reduce up to 10-25% aerodynamic drag and associated fuel usage.

- Improved aerodynamics for cost effective cars
- Hood rotation at high speeds to adapt shape
- Reduced fuel usage

Technology & Industry Focus : Automotive, Vehicle Design, Aerodynamics, Fuel Efficiency, ESG, Product Design

Patent No : IN475581

Grant Date : 30-Nov-2023

Current Status : Granted

BU : TBU

1st Application Date : 30-Mar-2018

Title : SYSTEM AND METHOD FOR MONITORING AND CONTROLLING ELECTROMAGNETIC RADIATIONS

Inventors : Niranjan Jeyapandian, Jaganath Venkatesh

Electric vehicles include multitude of sensors and electronic components that emit significant **electromagnetic radiations**. Current approaches at the most detect unsafe radiation levels and generate alerts to be addressed during servicing, thereby continuing to expose the occupants and other vehicle components to unsafe radiation levels.

The patent describes a radiation monitoring system that detects components emitting unsafe radiation levels, and **intelligently adjusts operation of the components within the car to reduce overall radiation** levels based on whether the faulty component and other active components are critical or non-critical for prevailing driving conditions.

- Real-time radiation monitoring
- Active safety system to mitigate risk of radiation exposure to driver & passengers

Technology & Industry Focus : Automotive, Electric Vehicles, Active Safety, Radiation Level Monitoring, ESG

Patent No : IN475405

Grant Date : 30-Nov-2023

Current Status : Granted

BU : TBU

1st Application Date : 29-Mar-2019

Title : SYSTEM AND METHOD FOR ENABLING ACCESS TO SECURED SYSTEMS

Inventors : Rajesh Koduri, Sivaprasad Nandyala, Mithun Bhaskar M, Sreelakshmi V S, Ashwini S

Conventional security systems typically store such sensitive information in a centralized database, which may be vulnerable to cyber attacks.

The present invention relates to a **blockchain network-based security system for authenticating users**. The blockchain network validates an access request by comparing a hash received from a user device with a reference hash pre-stored in the blockchain network. **Upon successful authentication, the blockchain network initiates authentication by comparing a reference biometric template of the user** with a test biometric template generated by a secured system to provide user access to the secured system.

- Additional authentication level using reference biometric template
- Unique template that improves accuracy

Technology & Industry Focus : Security, Blockchain, Machine Learning, AI, Cryptography, Authentication, ADAS

Patent No : IN444514

Grant Date : 1-Sep-2023

Current Status : Granted

BU : TBU

1st Application Date : 14-Nov-2016

Title : SYSTEM AND METHOD FOR VALIDATION OF A STEREO VISION

Inventors : Jihas K., Aravind Nath, Manu Murali, Ranjith S.

Stereo camera systems (SCS) are used for object tracking in vehicles to trigger safety features. Conventional validation methods involve testing a SCS by dismantling the system into individual cameras via on-road testing, which is unsafe and expensive.

The patent application describes a new in-lab validation system that includes a mirror and/or a prism assembly to project pre-recorded or virtually-generated laterally shifted views displayed on two separate displays towards the two cameras in a SCS. **The SCS, thus, captures laterally shifted views without any overlap and uses the views to accurately determine depth information.**

- No disassembly of stereo camera system
- Exhaustive, repeatable, safe and cost-effective in-lab validation

Technology & Industry Focus : Automotive, Automotive Testing and Validation, Stereo Camera Validation, ADAS

Patent No : IN447307

BU : TBU

Grant Date : 25-Aug-2023

1st Application Date : 29-Dec-2020

Current Status : Granted

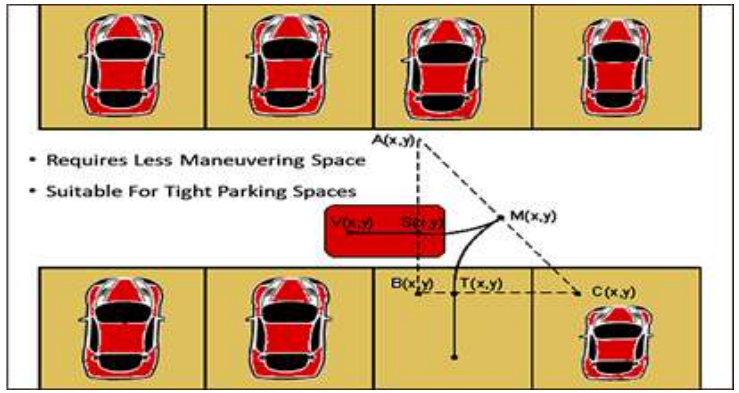
Title : SYSTEM AND METHOD FOR VEHICLE NAVIGATION

Inventors : Jyotsana Singh, Mansi S P

When using sensors, such as ultrasonic sensors for vacant slot detection, the vehicle needs to be properly aligned with the available slot. Further, this approach requires extensive driver inputs and often fails when the vehicle speed is above a certain threshold value.

The invention relates to a method for finding a path using vehicle current position and a turning radius greater than or equal to the minimum turning radius during perpendicular reverse parking of the vehicle. **Usage of minimum turning radius for calculation ensures identification of the shortest possible adjustment distance**. The method also prevents the need for multiple awkward curved maneuvering for automated parking.

Technology & Industry Focus : Automotive, Autonomous Vehicle, Automated Parking, ADAS



- Requires less maneuvering space
- Suitable for tight parking spaces

Patent No : IN442432

Grant Date : 02-Aug-2023

Current Status : Granted

BU : TBU

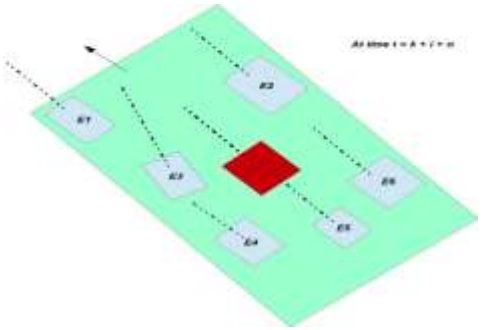
1st Application Date : 23-Nov-2018

Title : APPARATUS SYSTEM AND METHOD FOR VEHICLE NAVIGATION

Inventors : Rajesh Koduri, Sivaprasad Nandyala, Mithun Bhaskar Manalikandy

Low-end vehicles that do not have sophisticated computing capabilities often process only partial sensor-information, leading to inaccurate motion prediction, and in turn, endangering the life and health of the occupants of the vehicles.

The present invention describes a **navigation system that quickly and accurately predicts the future motion behavior of dynamic objects in the surroundings of a host vehicle without needing high computing capabilities**. The navigation system predicts the future motion behavior based on MPC solutions generated during off-line training of the navigation system.



- Future motion behavior prediction relies on off-line training data
- Fast and accurate prediction

Technology & Industry Focus : Automotive, Trajectory Prediction, Path Planning, ADAS, Machine Learning, AI

Patent No : IN421107

Grant Date : 09-Feb-2023

Current Status : Granted

BU : TBU

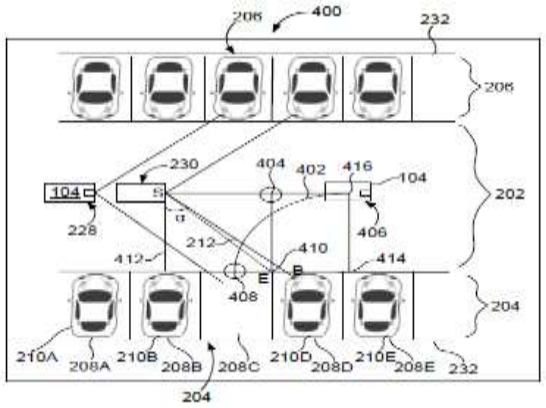
1st Application Date : 26-Sep-2017

Title : SYSTEM AND METHOD FOR VEHICLE NAVIGATION

Inventors : Jyotsana Singh, R L K Sarath Chandra

When using sensors, such as ultrasonic sensors for vacant slot detection, the vehicle needs to be properly aligned with the available slot. Further, this approach requires extensive driver inputs and often fails when the vehicle speed is above a certain threshold value.

The patent is about **an improved navigation system that includes a LeddarTM sensor**. The sensor measurements are used to determine a suitable arc-path or a non-arc path for **automatically parking the vehicle into tight parking slots with limited maneuvering space efficiently and accurately.**



- Uses cost effective LeddarTM sensor for automated parking
- Suitable for tight parking spaces

Technology & Industry Focus : Automotive, Autonomous Vehicle, Automated Parking, ADAS

Patent No : IN415526

Grant Date : 27-Dec-2022

Current Status : Granted

BU : IDV

1st Application Date : 23-Nov-2017

Title : CLAMPING SYSTEM FOR A FUEL INJECTOR

Inventors : Raneesh Mukundan, Bensigar Selvan

Vehicles include fuel injectors attached to the engine via elaborate clamping arrangements with multiple components. These **increase engine weight, occupy a lot of space, increase complexity, assembly and disassembly times**, and overall cost of the engine and the vehicle.

The patent describes a lightweight clamping system for locking the fuel injector with a custom cam cover in the vehicle engine. The clamping system includes a **minimal set of small locking components,** resulting in reduced weight, costs, and optimized packaging. The clamping system includes an **innovative unlocking sleeve** that enables quick locking & unlocking of the fuel injector, significantly reducing engine assembly & servicing times.

Technology & Industry Focus : Automotive, Manufacturing & Assembly, Servicing & Maintenance, ESG, Product Design

- 65% lesser weight, minimal component clamp
- Easy locking and unlocking for faster engine assembly & servicing by even low-skilled mechanics

Patent No : IN409371

Grant Date : 14-Oct-2022

Current Status : Granted

Title : BATTERY BOX

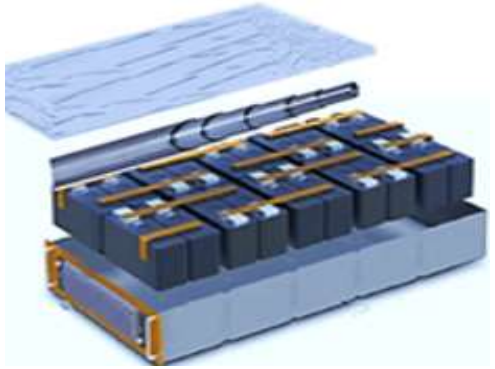
BU : IDV

1st Application Date : 14-Jun-2019

Inventor : Srikumar Srinivasan

Typical battery cooling systems include a **lattice of multiple fixed fluid ducts**, each to cool a corresponding row of battery elements. This **adds significant weight**, which hinders the fuel efficiency and driving range of the vehicle.

The patent describes a **simple, light-weight and cost-effective cooling mechanism** employing a telescopic duct for precise and localized management of individual battery cells in a battery pack. The telescopic duct can carry coolant fluid to any region within a battery box having the battery pack and perform **localized battery cooling** to achieve optimal temperature for individual battery cells to prevent malfunctioning.



- Lightweight telescopic duct for localized cooling
- Reduces risk of battery malfunctioning or fire
- Improved battery life and driving range

Technology & Industry Focus : Automotive, Electric Vehicles, Hybrid Vehicles, Battery Cooling System, ESG, BMS, Product Design

Patent No : IN388593

Grant Date : 07-Feb-2022

Current Status : Granted

BU : TBU

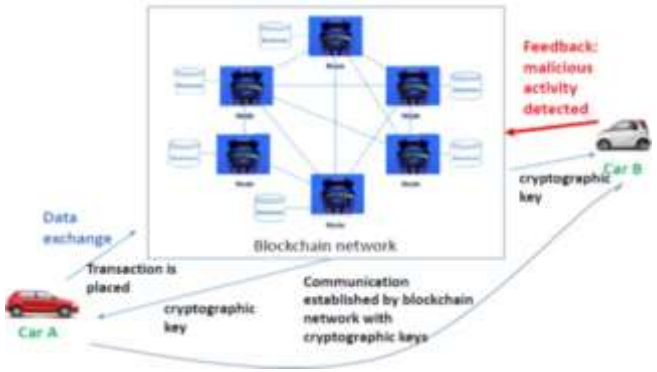
1st Application Date : 5-Mar-2019

Title : SYSTEM AND METHOD FOR ESTABLISHING SECURE COMMUNICATIONS BETWEEN CONNECTED SYSTEMS

Inventors : Rajesh Koduri, Sivaprasad Nandyala, Mithun Bhaskar Manalikandy

Connected vehicles are prone to cybersecurity threats due to the ad-hoc nature of V2X networks. A **single security-compromised vehicle may be used to compromise other vehicles** to cause accidents or steal information via transmission of **malware and Trojans.**

The patent describes a novel solution for securing V2X communications using a highly decentralized blockchain network. The solution provides **intelligent vehicle profiling via peer feedback to identify and disable malicious vehicles**. The solution also **restricts cybersecurity threats** by allowing only communication requests specifying predefined codes.



- Intelligent vehicle profiling
- Identify and disable malicious vehicles

Technology & Industry Focus : Automotive, V2X, Connected Vehicles, Blockchain, Cybersecurity, ADAS, Network and Communications

Patent No : IN388346

Grant Date : 02-Feb-2022

Current Status : Granted

BU : TBU

1st Application Date : 23-Aug-2016

Title : SYSTEM AND METHOD FOR VALIDATING FUNCTIONALITIES OF AN EMBEDDED SYSTEM AND ONE OR MORE SENSORS THEREOF

Inventors : Jihas Khan

Validation of embedded systems and sensors implementing safety-critical functionalities typically occurs via road testing, which delays development, and is often dangerous to test drivers.

The patent describes about a new test system and an Embedded Simulator (ES) to simulate all testing scenarios inside a lab environment. The system includes actuators that **accurately move an object in front of the Device Under Test (DUT) in 3D space with precise control of position and velocity.** The DUT detects and tracks the object under control of the ES to simulate a predefined action. Based on whether the predefined action matches an expected outcome, the DUT is validated, **ensuring comprehensive testing and validation processes**.

- Accurate emulation of 3-D motion of an object
- In-Lab testing and validation of safety-critical sensors and embedded systems

Technology & Industry Focus : Automotive Testing and Validation, Emulation, ADAS, Product Design

Patent No : IN387248

Grant Date : 24-Jan-2022

Current Status : Granted

BU : MEBU

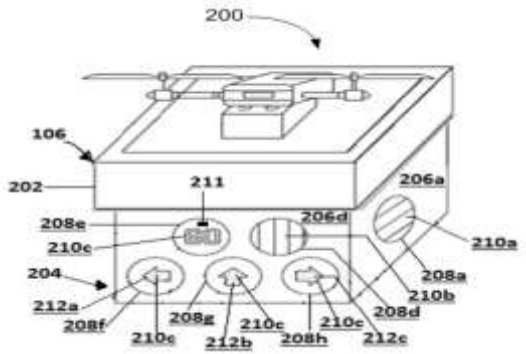
1st Application Date : 5-Sep-2018

Title : AN ALTERNATIVE TRAFFIC CONTROL SYSTEM

Inventor : Aniket Shriram Bodhke

Conventional traffic lights need 28 LEDs to display the 3 traffic lights, directions, and a timer for managing traffic at 4-way junctions. However, the areas of peak traffic congestion may vary based on time of the day, ongoing constructions, or accidents.

A drone that can be deployed on demand as a **lightweight traffic light in the event of a power failure of a conventional traffic signal, or at a site of an accident, or a traffic jam**.



- On-demand lightweight drone-based traffic light
- Reduces cost of permanent traffic light installations

Technology & Industry Focus : Automotive, Drone-based Mobile Traffic Light, Traffic Signaling System, ESG, Product Design

Patent No : IN387255

Grant Date : 24-Jan-2022

Current Status : Granted

BU : MEBU

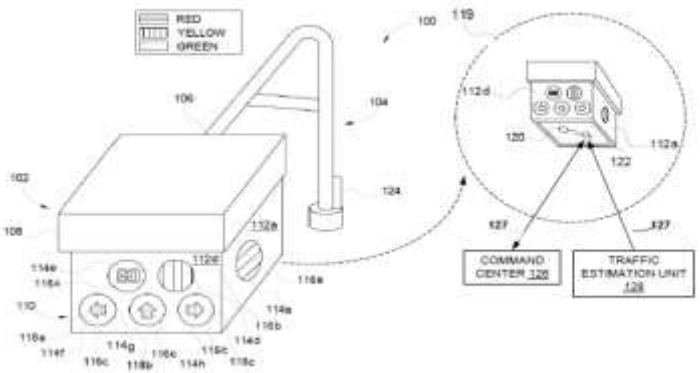
1st Application Date : 5-Sep-2018

Title : ENERGY-EFFICIENT TRAFFIC CONTROL SYSTEM

Inventor : Aniket Shriram Bodhke

Conventional traffic lights need **28 LEDs** to display the 3 traffic lights, directions, and a timer for managing traffic at 4-way junctions, and therefore are **bulky and difficult to service and repair.**

A lightweight traffic light with an associated failure mitigation system that deploys a drone with backup battery to supply power to the traffic light in the event of a power failure.



- 70% lesser weight and significantly reduced cost
- On-demand drone-based power backup in the event of power failure

Technology & Industry Focus : Automotive, Drone-based Mobile Traffic Light, Traffic Signaling System, ESG, Product Design

Patent No : IN373858

Grant Date : 05-Aug-2021

Current Status : Granted

BU : MCV

1st Application Date : 11-May-2016

Title : MANAGED NETWORK AND METHOD TO SECURE ENDPOINT DEVICES IN THE MANAGED NETWORK

Inventor : Biju Sadasivan

Service providers ensure authenticity of software in CPE devices using a **'chain of trust,'** in which cryptographic keys are stored in a one-time programmable (OTP) memory. However, in the event of key compromise, millions of CPE devices need to be replaced manually, incurring considerable loss of revenue, customer goodwill, & time.

The patent describes a **two-level authentication of root of trust** with a common code verification (CCV) key stored in a re-writable memory and a device specific key stored in the OTP memory. In the event of a compromise, only the CCV key is replaced. The protocol can be used to secure **STBs, vehicle ECUs, digital health devices & home appliances.**

- Prevents need for replacement of devices in the event of security breach
- Prevents unnecessary truck rolls

Technology & Industry Focus : Automotive, Cybersecurity, Cryptography, OTA, ESG, Network and Communications

Patent No : EP3076540B1 | IN496160

BU : TBU

Grant Date : 22-Apr-2020 (EP) | 8-Jan-2024(IN)

1st Application Date : 30-Mar-2015

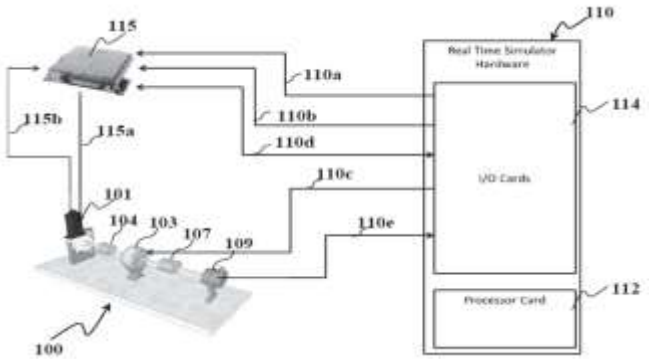
Current Status : Granted | Granted in EP and 4 other EP countries

Title : SYSTEM AND METHOD FOR THE AUTOMATIC VALIDATION OF MOTOR CONTROL FIRMWARE OF AN EMBEDDED SYSTEM

Inventors : Jihas Khan

Automobiles include over 70 ECUs and motors that need to be thoroughly tested to prevent catastrophic consequences for OEMs, or worse, for end-users. **Generic simulators fail to simulate specific hardware imperfections or motor aging accurately**, needing extensive and dangerous road testing.

The invention discloses a system and method that uses a new component configuration and an i**ntelligent algorithm for simulating various real-world scenarios in a test bench**, thus allowing **automated verification and validation of motor control firmware of an embedded system** and corresponding algorithms early in the EPD life cycle.



- Accurate motor position encoding
- Replicating desired loading and stopping effects
- Reduced time in customizing simulation models

Technology & Industry Focus : : Automotive, Automotive Testing and Validation, Motor Control

TEL AUTOMOTIVE PATENTS PENDING

Application No : IN202541033319

BU : TBU

Application Date : 4-Apr-2025

Current Status : Pending

Title : FUNCTIONAL SAFETY VALIDATION SYSTEM AND ASSOCIATED METHOD

Inventors : Jihas Khan, RajaG, Chandni Sapna Vijay, Abhiram Reghu

Current functional safety validation methods for software-defined vehicles face critical limitations. These methods lack access to kernel-level resource data, making it difficult to perform fault injection, test functional safety, verify freedom from interference, and assess mixed-criticality systems.

The proposed invention The patent application describes **a functional safety validation system that enables** early-stage, **kernel-level fault injection**, and resource monitoring. The system **validates service-oriented architecture (SOA) based applications by performing mixed criticality and freedom from interference testing and by detecting violations in memory and processing time constraints** essential for ISO 26262 compliance.

- Allows kernel-level fault injection and resource monitoring early in the development cycle
- Enhances the safety, reliability, and efficiency of SDV software, ensuring robust performance.
- Reduces reliance on complex hardware setups, saving time and costs.

Technology & Industry Focus : Automotive Testing & Validation, Software Defined Vehicles, Over-the-air update, Cybersecurity

Application No : IN202441102759

Application Date : 24-Dec-2024

Current Status : Pending

BU : IDV

Title : DUAL SPEED GEARTRAIN FOR AN ELECTRIC VEHICLE

Inventors : Karthikeyan Natesan, Mallor Sreenivas Vidya Sagar, Manikanta P V, Moorthy Ravindra

The proposed invention introduces a hybrid dual-speed geartrain designed to meet the evolving demands of the electric vehicle (EV) market. This gear train features a dual-speed architecture, where the first speed is optimized for maximum torque, facilitating low-speed acceleration, while the second speed enhances high-speed performance during cruising conditions. A notable aspect of this compact geartrain is its neutral provision, which disconnects the wheels from the e-Machine, functioning as an axle disconnector unit. Additionally, the **system incorporates an electronically actuated gear shift mechanism that utilizes a single shifter sleeve, ensuring seamless and effortless gear shifts.**

- Maximize torque for superior low-speed
- Enhance cruising efficiency with high-speed performance.

Technology & Industry Focus : Automotive, Electric Vehicle, Gear Shift Mechanism, Gear-train Control

Application No : IN202441097811

Application Date : 11-Dec-2024

Current Status : Pending

BU : CTO

Title : ADVANCED VEHICLE ANALYTICS SYSTEM AND ASSOCIATED METHOD

Inventors : Karthik Gandiban, Jesu Maria Antony Sebastian

The patent application describes an innovative **vehicle analytics system designed to evaluate driving behaviour and provide tailored recommendations.** This system includes a driving behaviour evaluation subsystem that calculates optimal vehicle parameters, generating a driving behaviour score for each trip. To improve accuracy, it aggregates data from multiple trips on the same route, adjusting the weight of parameters based on comparative analysis. The system features a recommendation engine that identifies areas needing improvement and offers personalized advice automatically adjust vehicle operations and issue alerts. **It enables driver performance comparisons and allows fleet managers to send instructions through an intuitive interface, enhancing overall driving safety and efficiency.**

- Automatically adjusts driver scores for personalized performance evaluation
- Automatically recalibrate parameter importance for accuracy in driver analytics

Technology & Industry Focus : Vehicle Analytics, ADAS, On-board Diagnostics, Fleet Management

Application No : IN202441088345

Application Date : 15-Nov-2024

Current Status : Pending

BU : IDV

Title : A DIFFERENTIAL UNIT FOR EFFICIENT TRANSFER OF TORQUE TO VEHICLE WHEELS AND ASSOCIATED DRIVETRAIN

Inventors : Kalaiprabhu Sakthivel, Karthikeyan Natesan, Pahalavan Kesavan, Raguram Senthilkumar

The patent application describes **a differential unit that operates and selectively switches between all three differential modes including an open differential mode, an ELSD mode, and a differential lock mode to offer superior traction abilities to vehicle wheels on all types of terrains**. To that end, the differential unit **employs custom designed components** such as a clutch pack, a ball ramp unit, a dog clutch, and an actuator. By default, the differential unit operates in the open differential mode. The differential unit automatically switches an operational mode to either the ELSD mode or the differential lock mode when a vehicle navigates on a slippery terrain or on an off-road terrain, respectively, to offer superior traction to the wheels on respective terrains.

- Integrates all of open, ELSD, and locking differentials into a single differential unit
- Offers superior traction to vehicle wheels on all types of terrains
- Prevents wheel slippage and thereby ensures the safety of the vehicle and its occupants

Technology & Industry Focus : Automotive, Drivetrain, Differential Unit, ADAS, Electric Vehicle, Product Design

Application No : IN202441072148

BU : TBU

Application Date : 24-Sep-2024

Current Status : Pending

Title : A TEST SYSTEM AND METHOD FOR VALIDATING FUNCTIONALITIES OF A SOFTWARE DEFINED SYSTEM

Inventors : Jihas Khan, Abhiram Reghu, Chandni Sapna Vijay, Aamir Sohail, Adithya B, Malavika Vasudevan

The proposed idea outlines an **SDV validation framework designed to operate on a high-performance system with advanced graphics rendering capabilities.** The framework consists of two main components: test infrastructure and vehicle edge devices, allowing any containerized application or source code to be tested. Standard communication protocols like SOME/IP, TCP, CAN, and LIN facilitate interactions within and between applications. Data simulators generate necessary input data, while application-specific validation techniques such as template matching and ground truth validation are integrated. A web portal grants user access, and a debugging section logs data for further testing within the **automation framework, ensuring thorough validation and debugging processes**.

- Efficiently tests software defined vehicle applications
- Performs testing faster by selective execution of test steps in test cases

Technology & Industry Focus : Automotive Testing, SDV Validation Framework, Generative AI, Test Automation, Testing and Validation

Application No : IN202341084299

Application Date : 11-Dec-2023

Current Status : Pending

BU : TBU

Title : A DEFECT INSPECTION SYSTEM AND AN ASSOCIATED METHOD

Inventors : Gopinath S and Radhakrishnan Annamalai

The patent application describes a **drone-based rail inspection system that uses a line scan camera and a telecentric liquid lens** instead of the area scan camera and fixed focus lens used in conventional systems. The system **dynamically varies parameters of the line scan camera and telecentric liquid lens** depending upon prevailing ambient lighting conditions and the camera-to-rail distance **to enable the line scan camera to capture high contrast images of the rails that are free from optical errors such as parallax and aberration errors**. Further, the system **processes such captured images using an intelligent computer vision technique and identifies defects if any in the rails accurately**.

- Captures high contrast rail images even in dynamically varying ambient lighting conditions
- Eliminates optical distortions at image acquisition level itself for accurate identification of rail defects
- Performs accurate and precision inspection of rail defects rapidly by employing line scan camera

Technology & Industry Focus : Automotive, Rail, Computer Vision/Image Processing, Drone, Object Detection

Application No : IN202341075692

Application Date : 6-Nov-2023

Current Status : Pending

BU : TBU

Title : METHOD AND SYSTEM FOR IMPROVED TESTING AND VALIDATION

Inventors : Jihas Khan and Abhiram Reghu

The patent application describes a **system that intelligently identifies and executes only specific test cases that are significantly impacted by changes made to a source code** of a product or an application. The system identifies such test cases using a novel approach based on modifications made to the source code, test case weights calculated using test cases pass or fail ratio, and function weights calculated based on magnitude of changes made in the source code. The proposed approach **saves time and money while retaining the rigor of software testing** by greatly streamlining the testing process and **guaranteeing that only the essential test cases are executed**.

- Intelligently selecting essential test cases that are significantly impacted by changes made to a source code using a novel approach
- Significant reduction in testing time and resources while retaining the rigor of software testing

Technology & Industry Focus : Test Automation System, Automotive Testing & Validation, Test Case Selection, SIL Testing

Application No : IN202341061659

Application Date : 13-Sep-2023

Current Status : Pending

BU : TBU

Title : METHOD AND SYSTEM FOR BENCHMARKING AND IMPROVING ACCURACY OF A PERCEPTION SYSTEM

Inventors : Jyotsana Singh and Sunitha Mishra

The patent application describes **a perception unit benchmarking system that provides an effective comparison of accuracy level of a newly developed perception system with state-of-the art perception systems** available in the market. In particular, the benchmarking system compares object-related information identified from different video sources that are captured simultaneously by the new and existing perception systems deployed in the vehicle. The benchmarking system converts outputs of these different perception systems to a common coordinate system and compares the outputs with ground truth information to **identify the perception system that provides most accurate results in different operating environments**.

- Compares accuracy levels of different makes of perception systems with each other
- Enables automotive OEMs to select the best perception system for their vehicles

Technology & Industry Focus : Automotive Testing and Validation, Automotive Safety, Perception System, ADAS, Machine Learning, AI

Application No : US18/259557 | PCT/IB2021/061810

BU : TBU

Application Date : 27-Jun-2023 (US) | 16-Dec-2021 (PCT)

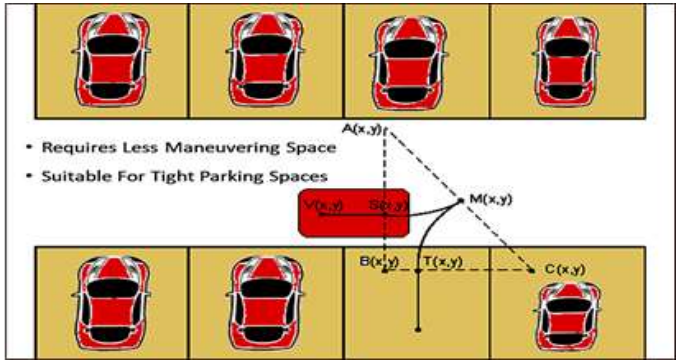
Current Status : Pending | FIled | Withdrawn

Title : SYSTEM AND METHOD FOR VEHICLE NAVIGATION

Inventors : Mansi Shrirang Patil, Jyotsana Singh

When using sensors, such as ultrasonic sensors for vacant slot detection, the vehicle needs to be properly aligned with the available slot. Further, this approach requires extensive driver inputs and often fails when the vehicle speed is above a certain threshold value.

The invention describes a method for finding a **path using the vehicle's current position and a turning radius equal to or greater than the minimum turning radius during perpendicular reverse parking**. This ensures the shortest adjustment distance and prevents multiple awkward curved maneuvers for automated parking.



- Requires less maneuvering space
- Suitable for tight parking spaces

Technology & Industry Focus : Automotive, Autonomous Vehicle, Automated Parking, ADAS

Application No : IN201741011809

Application Date : 31-Mar-2017

Current Status : Pending

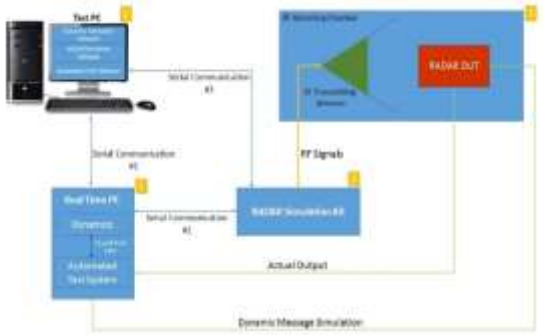
BU : TBU

Title : SIMULATION SYSTEM AND METHOD FOR VALIDATING FUNCTIONING OF A DEVICE UNDER TEST

Inventors : Jihas Khan, Jithin Jose, Anoop MS, Dan John Ozhathil, Srinivasa M

Present day validation systems are incapable of generating complex test scenarios and testing different variants of the object detection systems.

The invention describes a **simulation kit to test a Radar DUT**. The simulation system simulates a test scenario based on time-stamped object dynamics information of participating objects and vehicles. The simulation kit uses the times-tamped information to control generation of echo signals with **suitable offsets and noise for reception by the Radar DUT to emulate real-time operation for DUT validation.**



- Testing different RADAR types in the same kit
- Reduced testing time

Technology & Industry Focus : Automotive, Automotive Testing and Validation, RADAR Testing and Validation, ADAS

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