UNITED STATES PATENT AND TRADEMARK OFFICE

NONPROVISIONAL UTILITY PATENT APPLICATION

Under 35 U.S.C. §111(a)

ByRyde

AI-Powered Rideshare Intelligence Platform

System and Method for AI-Driven Rideshare Driver Optimization with Integrated Real-Time Decision Intelligence, Predictive Demand Analytics, Dynamic Fare Computation, Autonomous Vehicle Fleet Management, and Multi-Modal Safety Monitoring

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investors@byryde.com | byryde.com

TITLE OF THE INVENTION

System and Method for AI-Driven Rideshare Driver Optimization with Integrated Real-Time Decision Intelligence, Predictive Demand Analytics, Dynamic Fare Computation, Autonomous Vehicle Fleet Management, and Multi-Modal Safety Monitoring

Filing Information

Field	Value
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International Patent Classification

IPC Code	Classification
G06Q 10/04	Forecasting or Optimization for Administrative Purposes
G06Q 50/30	Transportation / Logistics
G06N 20/00	Machine Learning
G08G 1/123	Traffic Control Systems

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to transportation network systems and, more particularly, to an integrated artificial intelligence platform for optimizing rideshare driver operations through real-time decision intelligence, predictive demand analytics, dynamic fare computation, autonomous vehicle fleet management, multi-modal safety monitoring, and comprehensive driver wellness assessment.

2. Description of Related Art

The transportation network company (TNC) industry has grown into a $150+ billion global market. However, existing platforms suffer from fundamental architectural deficiencies that result in high driver churn (exceeding 60% annually), suboptimal earnings allocation, and inadequate safety infrastructure.

2.1 Limitations of Prior Art Systems

Conventional rideshare platforms, including those described in U.S. Pat. No. 8,768,753 (Kalanick et al.), U.S. Pat. No. 9,928,571 (Green et al.), and U.S. Pat. No. 10,156,450 (Xu et al.), exhibit the following deficiencies:

- Reactive pricing models: Prior art systems adjust pricing only after demand surges occur, failing to provide drivers with forward-looking intelligence for position optimization. Dynamic pricing in existing systems operates on a demand-response curve without incorporating multi-variate predictive signals including event calendars, weather patterns, historical temporal data, and real-time traffic conditions simultaneously.
- Absence of AI-driven earnings optimization: No existing system provides a comprehensive AI copilot suite that integrates earnings prediction, route optimization, wellness monitoring, voice-activated assistance, and post-ride analysis into a unified decision engine with fifteen (15) or more distinct AI inference endpoints operating concurrently.
- No integrated fatigue and wellness monitoring: Existing platforms lack real-time driver fatigue detection systems that correlate driving session duration, time-of-day factors, break intervals, and physiological indicators to generate actionable wellness

recommendations and mandatory break enforcement.

- Limited vehicle integration: Prior art provides no mechanism for deep integration with autonomous and semi-autonomous vehicle fleets, particularly Tesla Fleet API integration for real-time telematics, battery monitoring, climate control, and vehicle command execution through a unified rideshare interface.
- No multi-parameter ride filtering: Existing systems present rides to drivers on a binary accept/reject basis without configurable multi-dimensional filtering that evaluates fare-per-mile ratio, fare-per-minute ratio, pickup distance, trip distance, minimum fare thresholds, rider rating minimums, and surge multiplier requirements simultaneously.
- Inadequate mileage and tax compliance: No existing rideshare platform provides IRS-compliant automatic mileage tracking with real-time tax deduction calculations, trip categorization (business vs. personal vs. medical vs. charity), and exportable tax-ready documentation conforming to IRS Publication 463 requirements.
- Missing crash detection and emergency response: Prior art systems lack automated crash detection using device accelerometer and gyroscope data with configurable G-force thresholds, automatic emergency contact notification, and SOS integration with local emergency services.

2.2 Unresolved Technical Problems

The above limitations create several unresolved technical problems in the field:

Technical Problem	Prior Art Approach	Deficiency
Driver earnings optimization	Simple heat maps	No predictive capability
Ride acceptance decision	Binary accept/reject	No intelligent filtering
Driver safety monitoring	Time-based limits	No real-time fatigue detection
Surge pricing prediction	Current-state multipliers	No forward-looking prediction
Vehicle fleet management	Basic GPS tracking	No autonomous vehicle API
Tax compliance	Manual mileage logging	Non-automated, non-compliant
Crash response	Manual emergency buttons	No automatic detection
Multi-language comm.	Pre-set phrases only	No real-time AI translation

There exists a long-felt and unmet need for an integrated AI-driven platform that addresses all of these deficiencies in a unified system architecture, providing rideshare drivers with comprehensive decision intelligence, predictive analytics, safety monitoring, vehicle integration, and compliance automation.

BRIEF SUMMARY OF THE INVENTION

The present invention overcomes the limitations and deficiencies of the prior art by providing a comprehensive AI-driven rideshare driver optimization system comprising fifteen (15) distinct artificial intelligence inference endpoints, a multi-parameter smart ride filtering engine, predictive demand forecasting, dynamic fare computation with cryptographic integrity verification, autonomous vehicle fleet management via Tesla Fleet API integration, multi-modal safety monitoring including crash detection and fatigue assessment, IRS-compliant automatic mileage tracking, real-time language translation for cross-linguistic rider-driver communication, and a gamified driver engagement system with streak bonuses, tier-based rewards, and competitive leaderboards.

Key Inventive Aspects

- AI Copilot Suite (Claims 1-5): A unified AI system comprising fifteen (15) GPT-model-powered inference endpoints operating across distinct functional domains including earnings optimization, surge prediction, wellness assessment, passenger behavior prediction, smart insights generation, carbon footprint analysis, vehicle maintenance prediction, natural language voice command processing, live event analysis, contextual smart briefing, ride acceptance decision support, conversational chat assistance, shift planning, post-ride intelligence analysis, and weekly performance coaching.
- Smart Ride Filtering Engine (Claims 6-8): A novel multi-parameter ride evaluation system that simultaneously applies seven (7) configurable threshold criteria to incoming ride requests before presentation to the driver, enabling autonomous ride pre-screening based on dollars-per-mile ratio, dollars-per-minute ratio, maximum pickup distance, minimum trip distance, minimum fare amount, minimum rider rating, and surge multiplier requirements.
- Dynamic Fare Computation with Cryptographic Integrity (Claims 9-11): A fare calculation system that generates signed fare quotes using HMAC-SHA256 cryptographic signatures with temporal expiration validation, preventing fare manipulation while enabling transparent pricing.
- Autonomous Vehicle Fleet Management (Claims 12-14): A deep integration with the Tesla Fleet API providing real-time telematics monitoring, battery state-of-charge tracking, remote vehicle command execution, and bi-directional data synchronization

between the rideshare platform and autonomous vehicle systems.

- Multi-Modal Safety Monitoring (Claims 15-17): An integrated safety system comprising automated crash detection via device sensor analysis, real-time fatigue monitoring with configurable session duration and break interval enforcement, and SOS emergency response with automatic contact notification.
- IRS-Compliant Mileage Tracking (Claims 18-19): An automated mileage tracking system using background GPS location services at five (5) second intervals during active rides, providing real-time tax deduction calculations based on current IRS standard mileage rates.
- Real-Time Cross-Linguistic Communication (Claim 20): An AI-powered translation system integrated into the rider-driver messaging interface, providing per-message translation, auto-translate mode, translate-before-send functionality, and language detection.

Technical Improvement Statement (35 U.S.C. §101 / Alice)

The claimed invention provides specific technical improvements to the field of transportation network optimization by: (1) reducing computational latency in ride-matching through predictive pre-filtering, (2) improving the accuracy of fare calculations through multi-variate dynamic pricing with cryptographic integrity verification, (3) reducing driver fatigue-related incidents through real-time physiological monitoring and automated session management, and (4) enabling autonomous vehicle fleet integration through a novel API orchestration layer. These improvements are not merely abstract ideas applied to a generic computer, but rather specific technical solutions to identified problems in the transportation technology field.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated herein and constitute a part of this specification, illustrate embodiments of the invention and, together with the detailed description, serve to explain the principles of the invention.

FIG. 1 — System Architecture Overview

```
CLIENT LAYER: Expo React Native (87 Screens) + React Navigation + Map/Location Services
         |  HTTPS / WebSocket / Firebase Realtime
SERVER LAYER: Auth Module (Token Mgr) | AI Service (15 Endpoints) | Pricing Engine
              Fleet Engine (Vehicle Mgmt) | Tesla Fleet API Bridge | Payment Service
         |           |           |
DATA LAYER: PostgreSQL (106 Tables, Drizzle ORM) | Firebase Firestore | Stripe (Payments)
```

FIG. 2 — AI Copilot Suite Architecture (15 Endpoints)

```
AI Service Layer (GPT-5.2 Model)
  |-- Earnings Optimizer  (POST /api/ai/earnings-optimizer)
  |-- Surge Predictor     (POST /api/ai/surge-prediction)
  |-- Wellness Assessor   (POST /api/ai/wellness)
  |-- Passenger Predictor (POST /api/ai/passenger-prediction)
  |-- Smart Insights      (POST /api/ai/insights)
  |-- Carbon Footprint    (POST /api/ai/carbon-footprint)
  |-- Vehicle Maintenance (POST /api/ai/vehicle-maintenance)
  |-- Voice Command       (POST /api/ai/voice-command)
  |-- Live Events         (POST /api/ai/live-events)
  |-- Smart Briefing      (GET  /api/ai/smart-briefing)
  |-- Ride Decision       (POST /api/ai/ride-decision)
  |-- Chat Copilot        (POST /api/ai/chat)
  |-- Shift Planner       (POST /api/ai/shift-plan)
  |-- Post-Ride Analysis  (POST /api/ai/post-ride)
  +-- Weekly Coach        (POST /api/ai/weekly-review)
```

FIG. 3 — Smart Ride Filtering Engine Flowchart

```
Incoming Ride Request
  --> Calculate $/Mile Check     --> FAIL: Reject
  --> Calculate $/Min Check      --> FAIL: Reject
  --> Pickup Distance Check      --> FAIL: Reject
  --> Trip Distance Check        --> FAIL: Reject
  --> Minimum Fare Check         --> FAIL: Reject
  --> Rider Rating Check         --> FAIL: Reject
  --> Surge Multiplier Check     --> FAIL: Reject
  --> ALL PASS: Present Ride to Driver
```

FIG. 4 — Dynamic Fare Computation with Cryptographic Integrity

```
Ride Parameters --> Fare Calculator (Base+Distance+Time+Surge+Fees)
  --> HMAC-SHA256 Signature (fare + userId + timestamp + SESSION_SECRET)
  --> Signed Fare Quote {fare, signature, expires, userId}
  --> On Completion: Recompute HMAC, Timing-Safe Compare, Verify Expiry
```

FIG. 5 — Tesla Fleet API Integration

```
ByRyde Server --> OAuth2 PKCE --> Tesla Auth Server
  --> Access Token --> GET /vehicles --> Vehicle Telemetry
  --> POST /command (climate, lock, frunk, charge) --> Vehicle Executes
  --> Store in tesla_integrations DB table
```

FIG. 6 — Crash Detection and Emergency Response

```
Device Sensors (Accelerometer, Gyroscope) --> Continuous Sampling
  --> G-Force Threshold Analysis (> configurable g)
  --> EXCEEDED: Countdown Timer (30 sec, dismiss option)
  --> NOT CANCELLED: Emergency Protocol
       1. Notify emergency contacts  2. Share GPS coordinates
       3. Call 911 (if enabled)      4. Log to crash_detection_events
```

FIG. 7 — Gamification and Streak Bonus System

```
Ride Completed --> Streak Evaluator (daily/weekly/accept/complete)
  --> Bonus Calculator (streak $ + tier benefits + stackable %)
  --> Tier System: Bronze(0-49) | Silver(50-99) | Gold(100-199) | Platinum(200+)
```

FIG. 8 IRS-compliant mileage tracking system with GPS sampling, Haversine computation, trip categorization, and tax deduction computation.

FIG. 9 Real-time language translation architecture for rider-driver messaging with per-message translation, auto-translate, and language detection.

FIG. 10 Fatigue monitoring system with session duration tracking, break interval enforcement, and wellness metric visualization.

FIG. 11 Demand forecasting system with hourly predictions, surge multiplier forecasts, and hotspot identification via spatial clustering.

FIG. 12 EV charging integration with battery monitoring, range estimation, charging station routing, and carbon footprint tracking.

DETAILED DESCRIPTION OF THE INVENTION

The following detailed description, taken in conjunction with the accompanying drawings, describes preferred embodiments of the invention. This description is not intended to limit the scope of the invention, which is defined by the appended claims.

I. System Architecture Overview (FIG. 1)

Referring now to FIG. 1, the invented system comprises a three-tier architecture consisting of a client layer, a server layer, and a data layer, interconnected through encrypted HTTPS communications, persistent WebSocket connections for real-time bidirectional data flow, and Firebase Firestore for event-driven synchronization.

A. Client Layer

The client layer is implemented as a cross-platform mobile application built using the Expo React Native framework, providing native performance on both iOS and Android platforms with a shared codebase. The client application comprises eighty-seven (87) distinct screens organized through React Navigation 7+ with stack, tab, and modal navigators.

- Authentication Module: Implements a TokenManager singleton class providing unified authentication token handling with automatic refresh, persistent storage via AsyncStorage, and token injection into all API requests via request interceptors.
- Map and Location Module: Utilizes react-native-maps for interactive map rendering with demand heat map overlays, surge pricing zone visualization, and driver position tracking. Background location tracking is implemented via expo-task-manager with five (5) second GPS sampling intervals during active rides.
- Real-Time Communication Module: Implements a useWebSocket custom hook for persistent WebSocket connections enabling live ride request notifications, location broadcasting, and bidirectional messaging.
- State Management: Employs @tanstack/react-query for server state management with automatic cache invalidation, optimistic updates, and background refetching, combined with React Context API (AuthContext) for authentication state.

B. Server Layer

The server layer is implemented as an Express.js application executing on Node.js runtime, bound to port 5000 for HTTP/HTTPS and WebSocket communications. The server comprises AI Service (15 GPT-5.2 AI inference endpoints plus 65+ Google Cloud API integrations), Pricing Engine (dynamic fare computation, surge calculation, bonus stacking), Fleet Engine (vehicle management, trip lifecycle), Tesla Fleet API Bridge (autonomous vehicle integration), Payment Service (Stripe Connect), Google Cloud Services (Google Cloud Fleet Engine for real-time vehicle tracking, Routes Preferred API for optimal routing, Places API for location intelligence, Address Validation, Roads API for snap-to-road, Mobility Billing, Air Quality, Translation), and Safety Module (crash detection, emergency contacts).

C. Data Layer

The data layer comprises three complementary storage systems: (1) PostgreSQL relational database with one hundred six (106) tables managed through Drizzle ORM for persistent structured data; (2) Firebase Firestore for real-time document-oriented data including active ride states, driver locations, chat messages, and call sessions; and (3) Stripe for financial transaction records.

II. AI Copilot Suite (FIG. 2) — Inventive Feature

Referring now to FIG. 2, the AI Copilot Suite comprises fifteen (15) distinct artificial intelligence inference endpoints, each receiving domain-specific input data and generating structured JSON responses through carefully engineered prompt templates submitted to a large language model (currently GPT-5.2).

- Earnings Optimization (POST /api/ai/earnings-optimizer): Receives driver location, active hours, day of week, and historical earnings. Returns recommended actions, estimated additional hourly earnings, optimization tips, and confidence score. Gated by subscription tier middleware.
- Surge Prediction (POST /api/ai/surge-prediction): Receives location, time, day of week. Generates forward-looking surge multiplier predictions by analyzing historical patterns, event schedules, weather conditions, and demand curves. Returns predicted surge areas with coordinates and optimal positioning.
- Wellness Assessment (POST /api/ai/wellness): Evaluates hours driven, last break time, rides completed, stress indicators. Returns fatigue risk level, break recommendations, hydration/nutrition reminders. Operates independently of subscription tiers for safety.
- Passenger Prediction (POST /api/ai/passenger-prediction): Receives pickup location,

time, rider rating, ride type. Returns predicted tip percentage, behavioral indicators, and conversation starters.

- Smart Insights (POST /api/ai/insights): Cross-domain pattern recognition across driver stats, earnings history, and ride patterns. Returns prioritized actionable insights.
- Carbon Footprint (POST /api/ai/carbon-footprint): Quantifies rideshare-specific environmental impact from miles driven, vehicle type, and fuel consumption.
- Vehicle Maintenance (POST /api/ai/vehicle-maintenance): AI-predicted maintenance schedules from driving behavior, vehicle age, mileage, and last service dates.
- Voice Command (POST /api/ai/voice-command): Natural language understanding for rideshare-specific hands-free operation. Processes text or base64 audio.
- Live Events (POST /api/ai/live-events): Event-demand correlation analysis for optimal driver positioning near high-demand events.
- Smart Briefing (GET /api/ai/smart-briefing): Context-aware daily intelligence synthesis combining driver profile, recent performance, streaks, and market conditions.
- Ride Decision (POST /api/ai/ride-decision): Multi-factor ride profitability scoring (0-100) with accept/decline recommendation and reasoning.
- Chat Copilot (POST /api/ai/chat): Rideshare-domain conversational AI maintaining contextual conversation state across interactions.
- Shift Planner (POST /api/ai/shift-plan): Earnings-goal-driven schedule optimization based on availability and historical performance.
- Post-Ride Analysis (POST /api/ai/post-ride): Individual ride retrospective intelligence comparing performance to historical averages.
- Weekly Coach (POST /api/ai/weekly-review): Longitudinal performance coaching with trend analysis and next-week strategic recommendations.

III. Smart Ride Filtering Engine (FIG. 3) — Inventive Feature

The smart ride filtering engine implements a novel multi-parameter sequential evaluation pipeline that processes incoming ride requests against seven (7) driver-configurable threshold criteria stored in the smart_ride_filters PostgreSQL table. Parameters: dollars-per-mile (total fare / trip distance), dollars-per-minute (total fare / estimated duration), maximum pickup distance (Haversine), minimum trip distance, minimum fare, minimum rider rating, and surge-only mode. The inventive step is the simultaneous server-side application of all seven parameters before any ride notification reaches the driver's device, reducing network traffic and cognitive load.

IV. Dynamic Fare Computation with Cryptographic Integrity (FIG. 4)

The fare calculation uses a multi-variate formula: totalFare = (baseFare[rideType] + (distance * perMileRate[rideType]) + (duration * perMinuteRate[rideType])) * surgeMultiplier + bookingFee + safetyFee. The dynamic surge function evaluates demand-to-supply ratio, time-of-day curves, event multipliers, and weather impact, bounded between 1.0x and 5.0x with 0.1x increments.

Cryptographic integrity: generateFareQuote() creates a tamper-proof quote by computing HMAC-SHA256 over fare amount, user ID, and timestamp using the server's SESSION_SECRET. Validation uses crypto.timingSafeEqual() to prevent timing-based side-channel attacks. Quotes expire after 15 minutes.

V. Tesla Fleet API Integration (FIG. 5) — Inventive Feature

The integration implements OAuth 2.0 PKCE flow with Tesla's authentication endpoint. Capabilities include: vehicle state retrieval (battery, range, odometer, tire pressure, location), climate control (temperature, seat heaters), security (door lock/unlock, frunk/trunk, sentry mode), charging management (port open/close, limit setting, scheduling), and navigation (remote destination sharing with supercharger routing). Over 20 API endpoints under /api/tesla/*.

VI. Crash Detection (FIG. 6) — Inventive Feature

Automated crash detection via continuous accelerometer/gyroscope sampling during active rides. When computed G-force exceeds configurable threshold (default 4.0g): 30-second countdown with dismiss option; if not dismissed, automatic emergency contact notification via SMS with GPS coordinates, event logging to crash_detection_events table with severity classification.

VII. IRS-Compliant Mileage Tracking (FIG. 8)

Background GPS sampling at 5-second intervals via expo-task-manager. Mileage computed using Haversine formula on sequential coordinate pairs. Stored with IRS-required fields per Revenue Procedure 2019-46: date, start/end location, total miles, business purpose, trip categorization. Real-time tax deduction at current IRS rate ($0.70/mile for 2026 business use). Exportable for Schedule C filing.

VIII. Gamification System (FIG. 7)

Streak bonuses across four categories (daily, weekly, acceptance rate, completion rate) with milestone intervals. Four-tier progression: Bronze (0-49 rides), Silver (50-99), Gold (100-199), Platinum (200+) with incremental benefits. Stackable bonus campaigns with cumulative multipliers. Custom time-bound challenges with progress tracking.

IX. Real-Time Translation (FIG. 9)

Four backend endpoints: POST /api/translate/translate (single), POST /api/translate/translate-batch (up to 50 messages), POST /api/translate/detect (language detection), GET /api/translate/languages (supported list). Client provides per-message translate buttons, auto-translate toggle, translate-before-send, and 12-language picker.

X. Demand Forecasting (FIG. 11)

Hourly demand predictions stored in demand_forecasts table with geographic zone coordinates, predicted demand level (0-100), predicted surge multiplier, confidence score, contributing factors, and temporal validity. Combines historical data, event calendars, weather, and temporal patterns. Updated every 15 minutes with spatial clustering for hotspot identification.

CLAIMS

What is claimed is:

1. A computer-implemented system for optimizing rideshare driver operations, the system comprising: (a) a server computing device comprising a processor and a non-transitory computer-readable memory storing instructions that, when executed by the processor, cause the server computing device to: (b) receive, via a network interface, real-time operational data from a plurality of driver computing devices, the operational data comprising at least a geographic location, a temporal context, a driver profile, and historical performance metrics; (c) execute an artificial intelligence copilot suite comprising fifteen (15) distinct inference endpoints, each endpoint configured to receive domain-specific input parameters and generate structured recommendation outputs by submitting engineered prompt templates to a large language model, wherein the fifteen endpoints comprise at least: (i) an earnings optimization endpoint that analyzes driver location and temporal context to generate zone-specific earnings recommendations, (ii) a surge prediction endpoint that generates forward-looking surge probability forecasts for geographic areas, (iii) a wellness assessment endpoint that evaluates driver fatigue indicators to generate safety recommendations, (iv) a ride decision endpoint that computes a multi-factor profitability score for individual ride requests, and (v) a conversational chat endpoint maintaining contextual conversation state across multiple interactions; (d) transmit the structured recommendation outputs to the respective driver computing devices via the network interface for presentation in a native mobile application user interface.

2. The system of claim 1, wherein the artificial intelligence copilot suite further comprises a passenger prediction endpoint that receives pickup location, time, and rider rating data to generate predicted tip percentage, behavioral indicators, and conversation starter recommendations.

3. The system of claim 1, wherein the artificial intelligence copilot suite further comprises a voice command processing endpoint that receives natural language text or base64-encoded audio data and returns parsed command types, extracted parameters, and synthesized response text for hands-free driver operation.

4. The system of claim 1, wherein the artificial intelligence copilot suite further comprises: (i) a shift planner endpoint that receives driver availability windows and earnings goals to generate optimized shift schedules with hourly breakdowns, (ii) a post-ride analysis endpoint that evaluates completed ride metrics against historical averages to generate performance scores and improvement suggestions, and (iii) a weekly performance coaching endpoint that synthesizes seven-day performance data into trend analyses and strategic recommendations.

5. The system of claim 1, wherein access to one or more of the fifteen inference endpoints is gated by a subscription tier middleware that evaluates the requesting driver's subscription level against a feature access matrix, the subscription tiers comprising at least a free tier, a professional tier, and an elite tier, each tier defining a set of accessible AI endpoints and feature capabilities.

6. The system of claim 1, further comprising a smart ride filtering engine configured to: (a) maintain, in a relational database table, a set of driver-configurable threshold parameters comprising at least: a minimum dollars-per-mile ratio, a minimum dollars-per-minute ratio, a maximum pickup distance, a minimum trip distance, a minimum fare amount, a minimum rider rating, and a surge-only mode flag; (b) evaluate each incoming ride request against the stored threshold parameters in a sequential cascading pipeline; (c) suppress transmission of ride requests to the driver computing device when any threshold parameter is not satisfied, thereby reducing network traffic, conserving device battery, and eliminating cognitive load from undesirable ride requests.

7. The system of claim 6, wherein the dollars-per-mile ratio is computed by dividing the total estimated fare by the trip distance in miles, and the dollars-per-minute ratio is computed by dividing the total estimated fare by the estimated trip duration in minutes, each ratio being compared against the corresponding driver-configured minimum threshold.

8. The system of claim 6, wherein the smart ride filtering engine further applies a surge-only mode that, when activated by the driver, suppresses all ride requests having a surge multiplier of 1.0 or less, presenting only rides in active surge pricing zones.

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9. A computer-implemented method for generating cryptographically signed fare quotes in a rideshare transportation network, the method comprising: (a) receiving, by a server computing device, ride request parameters comprising at least a distance in miles, a duration in minutes, a ride type classification, and a surge multiplier; (b) computing, by the server computing device, a total fare amount by applying a multi-variate fare formula comprising a base fare indexed by ride type, a distance-based component computed as the distance multiplied by a per-mile rate indexed by ride type, a time-based component computed as the duration multiplied by a per-minute rate indexed by ride type, the product of the foregoing components and the surge multiplier, and additive fees comprising at least a booking fee and a safety fee; (c) generating, by the server computing device, a cryptographic signature by computing an HMAC-SHA256 hash over a canonical string comprising the computed fare amount, a user identifier, and a current timestamp, using a server-side secret key; (d) assembling a signed fare quote object comprising the computed fare amount, the cryptographic signature, an expiration timestamp, and the user identifier; (e) transmitting the signed fare quote object to a client computing device; (f) upon ride completion, receiving the signed fare quote object from the client computing device and validating it by: recomputing the HMAC-SHA256 hash, performing a timing-safe comparison of the recomputed hash against the received signature using a constant-time comparison function, and verifying that the current time does not exceed the expiration timestamp.

10. The method of claim 9, wherein the multi-variate fare formula further incorporates driver earnings computation as a configurable percentage of the total fare, stackable bonus amounts retrieved from an active bonus campaigns database table, and streak bonus amounts computed based on the driver's current consecutive-ride streaks.

11. The method of claim 9, wherein the surge multiplier is computed by a dynamic surge calculation function that evaluates: (i) a demand-to-supply ratio in a geographic zone, (ii) a time-of-day demand curve, (iii) active event multipliers for nearby events, and (iv) weather impact factors, the resulting multiplier being bounded between a minimum value of 1.0 and a configurable maximum value, with graduated increments of 0.1.

12. The method of claim 9, further comprising maintaining a counter of active fare quotes and enforcing a maximum concurrent quote limit to prevent system resource exhaustion.

13. The system of claim 1, further comprising a Tesla Fleet API integration module configured to: (a) authenticate with a Tesla authentication server using the OAuth 2.0 Authorization Code Flow with Proof Key for Code Exchange (PKCE); (b) retrieve real-

time vehicle telemetry data comprising battery state of charge, estimated range, odometer reading, tire pressure, and geographic coordinates; (c) transmit vehicle control commands comprising at least climate control activation, door lock/unlock, frunk/trunk open, and charge port control; (d) store vehicle state data and command history in a relational database table associated with the driver profile.

14. The system of claim 13, wherein the Tesla Fleet API integration module further provides: (i) battery range estimation that accounts for current state of charge, ambient temperature, and queued ride distances to predict remaining operational range, and (ii) charging station routing that identifies nearby charging stations with estimated charging times and costs.

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15. A non-transitory computer-readable storage medium storing instructions that, when executed by one or more processors, cause the one or more processors to implement a multi-modal driver safety monitoring system in a rideshare platform, the system comprising: (a) a crash detection module configured to: continuously sample accelerometer and gyroscope data from a driver computing device during active rides, compute a resultant G-force value from the sampled data, compare the computed G-force value against a configurable threshold, and upon the computed value exceeding the threshold, initiate a timed emergency response protocol comprising presenting a countdown timer on the driver computing device with a dismiss option, and if not dismissed within the countdown period, automatically transmitting the driver's GPS coordinates to pre-configured emergency contacts and logging the event to a crash detection events database table; (b) a fatigue monitoring module configured to: track cumulative driving session duration, monitor time since last break, evaluate the number of rides completed within a rolling time window, transmit fatigue indicator data to a wellness assessment AI endpoint, receive fatigue risk classifications and break recommendations, and enforce mandatory break intervals when the fatigue risk exceeds a configurable threshold; (c) an IRS-compliant mileage tracking module configured to: register a background location task that samples GPS coordinates at configurable intervals during active rides, compute trip mileage using the Haversine formula applied to sequential coordinate pairs, store mileage records with IRS-required fields comprising date, starting location, ending location, total miles, business purpose, and trip categorization, and compute real-time tax deduction amounts using the current IRS standard mileage rate.

16. The storage medium of claim 15, wherein the crash detection module further comprises a severity classification system that categorizes detected impacts as minor, moderate, or severe based on the computed G-force magnitude and duration of deceleration.

17. The storage medium of claim 15, wherein the fatigue monitoring module further stores wellness metrics in a dedicated database table, enabling longitudinal tracking of driver wellness trends across multiple driving sessions.

18. The storage medium of claim 15, further comprising a gamification module configured to: (a) maintain streak counters for at least four categories: daily consecutive driving days, weekly driving weeks, ride acceptance rate above a threshold, and ride completion rate above a threshold; (b) compute monetary streak bonuses at configurable milestone intervals; (c) evaluate a driver's tier classification based on cumulative lifetime ride count against a tier progression schedule comprising at least four tiers with increasing benefits; (d) aggregate stackable bonus amounts from active bonus campaigns and apply cumulative multipliers to completed ride earnings.

19. The storage medium of claim 15, further comprising a real-time language translation module configured to: receive text in a first language from a rider messaging interface, transmit the text to a cloud translation API, receive translated text in a second language, and present the translated text to the driver, with support for per-message translation, automatic translation of all incoming messages, and translate-before-send functionality.

20. The storage medium of claim 15, further comprising a demand forecasting module configured to: generate hourly demand predictions for geographic zones by combining historical ride data, event calendars, weather data, and temporal patterns; store predictions with confidence scores and contributing factor arrays; and update predictions on a rolling basis at configurable intervals.

ABSTRACT OF THE DISCLOSURE

A computer-implemented system and method for optimizing rideshare driver operations through an integrated artificial intelligence platform. The system comprises fifteen distinct AI inference endpoints providing earnings optimization, surge prediction, wellness assessment, passenger prediction, voice command processing, and conversational coaching. A multi-parameter smart ride filtering engine evaluates incoming ride requests against seven configurable driver thresholds, suppressing unsuitable rides before notification. Dynamic fare computation employs HMAC-SHA256 cryptographic signatures for tamper-proof fare quotes with temporal expiration validation. The platform integrates with the Tesla Fleet API for autonomous vehicle telemetry and command execution. A multi-modal safety system provides automated crash detection via accelerometer analysis with timed emergency response, fatigue monitoring with mandatory break enforcement, and IRS-compliant GPS mileage tracking. A gamification engine maintains streak bonuses, tiered driver rewards, stackable bonus campaigns, and competitive leaderboards.

[138 words]

INVENTOR'S DECLARATION UNDER 37 C.F.R. §1.63

"I hereby declare that: (1) I believe I am the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought; (2) I have reviewed and understand the contents of the above-identified specification, including the claims; (3) I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in 37 C.F.R. §1.56; (4) I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon."

Inventor Signature

Date

Printed Name

Application Summary

Field	Value
Total Claims	20 (3 independent, 17 dependent)
Drawings	12 figures (7 detailed, 5 described)
Fee Category	Standard (no excess claims fees)
Micro Entity Eligible	Yes — 37 C.F.R. §1.29
Estimated Filing Fee	$400 (micro) / $800 (small) / $1,600 (large)
Attorney Docket No.	BYRYDE-2026-001
Assignee	ByRyde LLC, Delaware Corporation
Contact	investors@byryde.com | byryde.com