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GLOT: MONITORING APPLICATION

Abstract

Standard telematics solutions often lack intuitive accessibility, hindering fleet managers' decision-making.To address this issue, the GLOT app was developed as an integrated platform for GPS/GLONASS monitoring and asset connectivity. Innovative data access and management features implemented in the GLOT system, which is currently protected by a copyright certificate for inclusion in the state register of rights to objects protected by copyright No. 19746 dated August 13, 2021. This article examines and presents the technical architecture and functional benefits of the GLOT mobile app, a GPS/GLONASS and IoT monitoring solution. This study highlights the app's ability to provide highly accurate real-time tracking and advanced data management for transportation systems. Particular attention is paid to the integrated fuel consumption monitoring module, which allows users to visualize refueling and potential fuel drains through detailed graphical reports. The app was developed with cross-platform compatibility (iOS and Android) in mind and utilizes advanced encryption protocols to ensure data privacy.

Key words: GPS/GLONASS monitoring, IoT, GLOT application, fuel consumption control, advantages, telematics, data management, real-time tracking.

Inroduction

Transport monitoring systems play a key role in modern logistics and fleet management. They enable real-time tracking of vehicle location, status, and parameters, optimize routes, and improve transportation efficiency and safety. Currently, there are numerous similar systems on the market, each with its own features and characteristics.

Transport monitoring systems are comprehensive solutions that enable remote monitoring and management of fleets of vehicles, special equipment, and freight and passenger transportation. They provide continuous tracking of vehicle location, speed, route, and other parameters in real time [1-3].

The key elements of such systems are:

- Onboard navigation and communication devices—special sensors and terminals installed on vehicles that transmit data about their status and location;
- Server infrastructure—software and computing power required to collect, process, and store incoming information;
- Management interface—a web platform or mobile app that provides users with access to monitoring data and fleet management capabilities.

Modern vehicle monitoring systems offer a wide range of functionality, including:

- Vehicle location and route tracking;
- Monitoring speed, fuel consumption, operating time, and idle time;
- Collection and analysis of engine parameters, unit and component performance data;
- Driver performance monitoring (driving style, compliance with work and rest schedules);
- Mobile team management, route optimization, and transportation planning;
- Automatic reporting and data archiving;
- Integration with other corporate information systems.

Materials and methods

Currently, there are numerous products and software platforms for monitoring offered by various manufacturers. They enable tracking the location, fuel consumption, cargo status, and driver behavior of vehicles, special equipment, and stationary objects worldwide [4].

How it works. Equipment: A GPS/GLONASS tracker is installed on the vehicle, to which additional sensors (fuel, temperature, etc.) are connected. Communication: The tracker transmits telematics data via a cellular network (GSM/LTE) to the platform servers. Data processing: The Wialon system analyzes the data and provides it to the dispatcher in the form of convenient graphs, reports, and notifications.

The main functions of these applications allow connection to devices and interaction with them over short and long distances [5]:

- displaying telemetry in real time;
- downloading a TMI file (black box data) from the device;
- setting a basic set of parameters for device monitoring;
- time synchronization;
- updating device firmware;
- sending standard and custom commands to the device.

In today's environment, many manufacturers and consumers (car owners) find it convenient to use modern sensors operating using Bluetooth LE technology. These devices connect to GPS trackers for wireless telemetry collection. This equipment allows for easy data collection without unnecessary wires in the cabin or cargo compartment. Advantages of BLE sensors [6]:

- Easy installation: The absence of wires reduces installation time and eliminates the risk of damage;
- Autonomy: Powered by built-in replaceable batteries, the charge of which, depending on the model and data transmission frequency, can last from 1 to 5+ years;
- Range: A stable Bluetooth Low Energy signal transmits data to the tracker at a distance of up to 25–50 meters.

This application allows you to program and adapt universal control scenarios separately for connected devices, allowing you to expand and subsequently enable features that provide full control over devices with notifications, as shown in Figure 1.

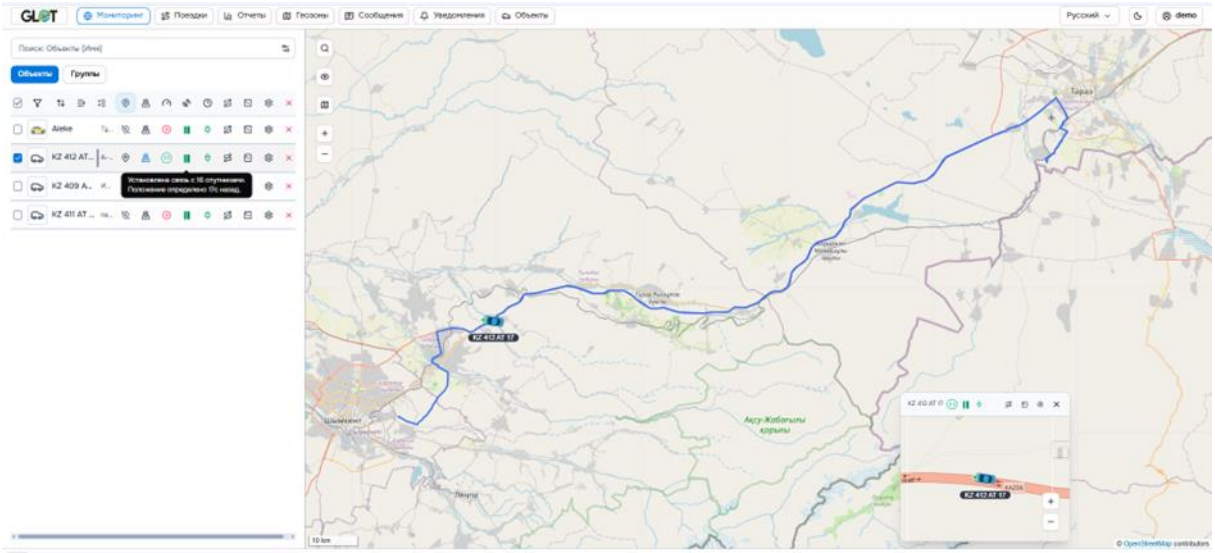

Figure 1 – GLOT monitoring system

The GLOT application is built on a microservices architecture, ensuring high fault tolerance, efficient load handling, and horizontal scalability. The system is designed to process large volumes of telemetry data and is integrated with hardware such as GPS trackers and wireless sensors [7].

Distinguishing features of the monitoring system:

1. Platform compatibility: Designed for iOS (14.0+) and Android, ensuring broad accessibility for professional users.

2. Data processing: The internal Apache Kafka infrastructure handles massive data streams using batch processing (up to 500 messages per batch) and latency in the hundreds of milliseconds, enabling near-real-time data updates.

The GLOT infrastructure is implemented in accordance with modern architectural practices for developing high-load and scalable systems. Figure 2 shows the architecture, which includes a mechanism for hot caching of geohashes in RAM, enabling fast access to addresses. Geofence indexing for geohash sublevels is also included for high-performance computing of telematics data.

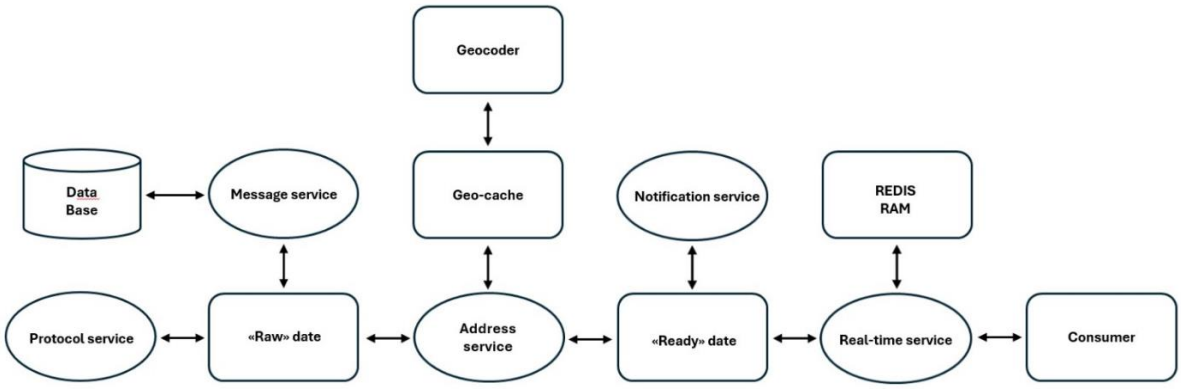

Figure 2 – High-fault tolerance architecture

3. Security Measures: The implementation includes advanced obfuscation and encryption techniques (similar to LIAPP protocols) to protect sensitive user credentials and location data from unauthorized access [8].

Results and Discussion

A performance analysis of the GLOT system demonstrates excellent data visualization capabilities. One key result is a multi-level fuel monitoring system that provides users with automated reports on fuel levels in different tanks. A functional comparison of GLOT's monitoring features is shown in Table 1.

Table 1 - Functional comparison of GLOT monitoring functions

Function	Realization details	Advantages for users
Real-time tracking	GPS/GLONASS integration	Accurate and efficient location detection
Fuel analysis	Fuel filling and draining schedules	Theft prevention and consumption control
Geozoning	Automatic zone entry/exit notifications	Improved facility security
Route management	Visualization and analysis of optimal routes	Logistics optimization and cost reduction
Monitoring of various objects	Support for vehicles, people, and animals	Versatility of system application
Report generation	Automatic generation of analytical reports	Simplified analysis and decision-making
Mobile access	Smartphone apps	System control from anywhere
Notifications and alerts	Customizable event alerts	Rapid incident response

Table 1 describes the GLOT system as a “digital dispatcher” that transforms fleet management from guesswork to precise numbers. Here are a few key aspects that this table details:

1. Combating the “human factor”. Fuel analysis and geofencing functions work together to prevent improper use of vehicles. The system not only monitors the fuel level in the tank but also correlates it with the location: if a fuel drain occurs outside an authorized zone or refueling station, the dispatcher immediately receives an alert.

It works without human intervention according to the following scheme:

Event: For example, a sensor in the tank detects a sharp drop in fuel level, or the car leaves the permitted area (geofence).

Trigger: The program compares the current data with the “norm”. As soon as a deviation occurs, the system generates a signal.

Delivery: The dispatcher receives a notification within 1-3 seconds. This could be:

- A pop-up window on the computer monitor in the control center (often accompanied by a siren).
- A push notification in the mobile app on a smartphone.
- A message in Telegram/WhatsApp (if integration is configured).
- An email.

Why is this important? Without alerts, the dispatcher would have to manually monitor hundreds of vehicles on a map. With alerts, they can focus on other tasks: the system will automatically notify them if something goes wrong. What do you mean by “instantly”? Data from the vehicle's tracker is transmitted via mobile internet (GSM). If the connection is stable, the delay between a fuel drain in the field and the notification on the owner's phone is less than a second.

2. Flexibility of assets (from trucks to couriers). GLOT is more often associated with trucks; the asset monitoring section involves the use of not only stationary trackers but also mobile beacons or smartphones. This allows for tracking employees on foot or valuable cargo moving between different vehicles.

3. Analytics instead of raw data. Report generation is the “brain” of the system. Instead of staring at a map 24/7, the manager receives a concise summary at the end of the day or week:

a) how long the vehicle was parked with the engine running (idling);

b) whether there were any speeding violations (driving quality assessment);

c) how much the actual route deviated from the planned one.

4. Efficiency through Mobile-first. The presence of a mobile app transforms the system from an office tool into a personal assistant. This is critical for small businesses: the owner can monitor the performance of drivers directly on the road, receiving push notifications about critical events (for example, pressing a panic button or sensor failure), as shown in Figure 3.

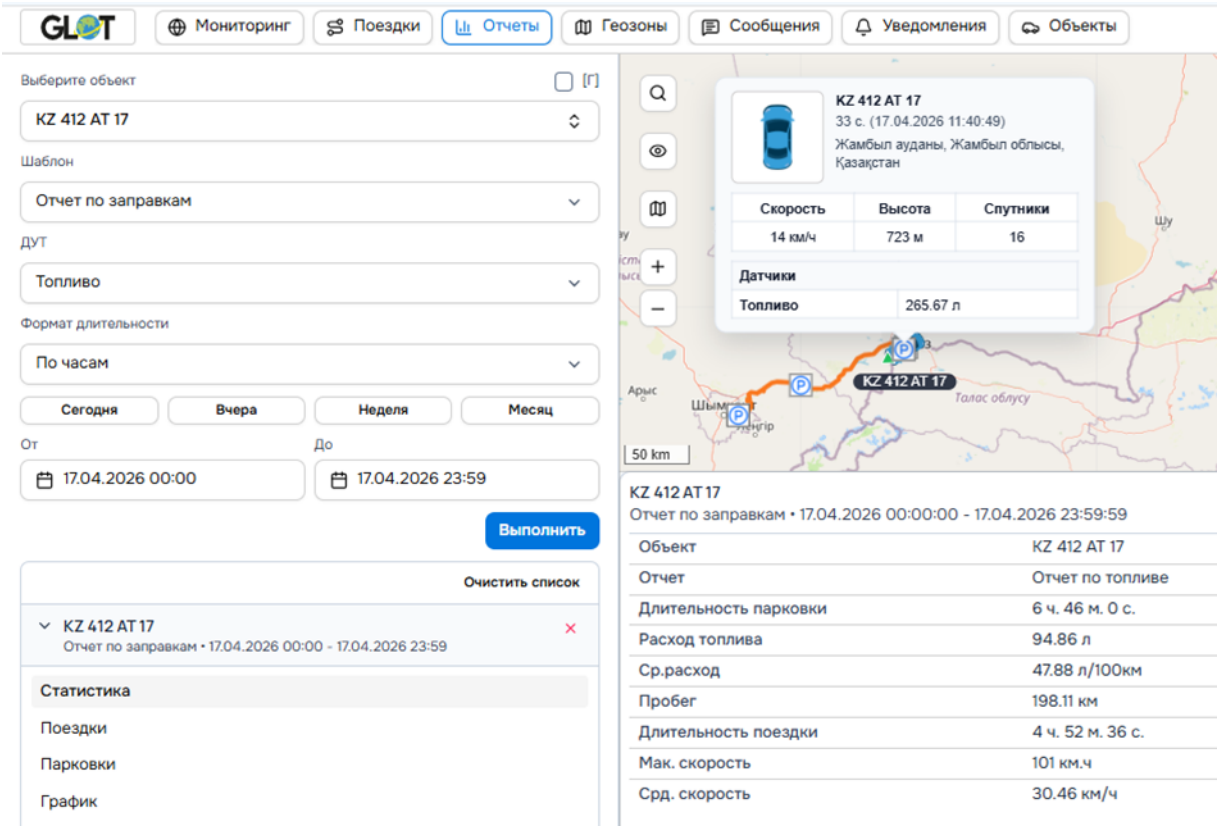

Figure 3 - Multi-level fuel monitoring system *(GLOT app developed)*

Figure 3 shows a daily report for a single object in the multi-level fuel monitoring system. It contains information on engine hours, mileage, and fuel consumption. This section (record) allows for generating reports in a clear and simple format for further analysis. Pre-defined report templates are also available, such as “Data Analysis”, “Engine Report”, and “Speeding”. As the name suggests, these templates provide different reporting areas; the user can create their own template if needed. The "FLS" field allows selecting the desired sensors for generating a report. The abbreviation “FLS” stands for fuel level sensor. The duration format can also be changed for more general or detailed reports. Group reports can be generated, allowing for multi-reporting across multiple objects [9].

Discussion of the version 1.1.3 updates indicates that security and user interface improvements have resulted in a 5.0 rating in the App Store, demonstrating high user satisfaction with the data management interface.

Conclusion

The development of the GLOT app represents a significant step in the evolution of mobile monitoring systems. Offering expanded data access and an authorized management system, the

system effectively addresses industry needs for transparent fleet operations. Further development will focus on integrating predictive AI algorithms for maintenance planning, further expanding the app's capabilities in the Internet of Things (IoT).

GLOT is more than just a “point on the map”, but a tool for minimizing operational costs. The system's primary focus is on cost transparency (fuel, time, mileage) and rapid response to emergencies.

The mobile app is recommended and suitable for a wide range of uses, including individual needs and specialized equipment, including rail transport and critical cargo. For example, the app is currently popular with quarry equipment and government inspectors in nature reserves. Our app provides services for ambulances, emergency response vehicles, and firefighting equipment.

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GLOT: БАҚЫЛАУ ҚОСЫМШАСЫ

Түйін

Стандартты телематикалық шешімдер көбінесе интуитивті қолжетімділікке ие емес, бұл автопарк менеджерлерінің шешім қабылдауына кедергі келтіреді. Бұл мәселені шешу үшін GLOT қосымшасы GPS/GLONASS мониторингі және активтерге қосылу үшін интеграцияланған платформа ретінде жасалды. GLOT жүйесінде инновациялық деректерге қол жеткізу және басқару мүмкіндіктері енгізілген, ол қазіргі уақытта 2021 жылғы 13 тамыздағы № 19746 авторлық құқықпен қорғалатын нысандарға құқықтардың мемлекеттік тізіліміне енгізу үшін авторлық құқық сертификатымен қорғалған. Бұл мақалада GPS/GLONASS және IoT мониторинг шешімі болып табылатын GLOT мобильді қосымшасының техникалық архитектурасы мен функционалдық артықшылықтары қарастырылады және ұсынылады. Бұл зерттеу қосымшаның көлік жүйелері үшін жоғары дәлдіктегі

нақты уақыт режимінде бақылауды және кеңейтілген деректерді басқаруды қамтамасыз ету мүмкіндігін көрсетеді. Пайдаланушыларға егжей-тегжейлі графикалық есептер арқылы жанармай құюды және ықтимал отын шығынын елестету мүмкіндігін беретін интеграцияланған отын шығынын бақылау модуліне ерекше назар аударылады. Қолданба платформааралық үйлесімділікті (iOS және Android) ескере отырып жасалған және деректердің құпиялылығын қамтамасыз ету үшін кеңейтілген шифрлау хаттамаларын пайдаланады.

Кілттік сөздер: GPS/GLONASS мониторингі, IoT, GLOT қолданбасы, отын шығынын бақылау, артықшылықтар, телематика, деректерді басқару, нақты уақыт режимінде бақылау.

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GLOT: ПРИЛОЖЕНИЕ ДЛЯ МОНИТОРИНГА

Аннотация

Стандартные телематические решения часто не обладают интуитивно понятным доступом, что затрудняет принятие решений менеджерами автопарков. Для решения этой проблемы было разработано приложение GLOT как интегрированная платформа для мониторинга GPS/GLONASS и подключения активов. Инновационные функции доступа и управления данными, реализованные в системе GLOT, в настоящее время защищены свидетельством об авторском праве для включения в государственный реестр прав на объекты, охраняемые авторским правом № 19746 от 13 августа 2021 года. В данной статье рассматривается и представляется техническая архитектура и функциональные преимущества мобильного приложения GLOT, решения для мониторинга GPS/GLONASS и IoT. В исследовании подчеркивается способность приложения обеспечивать высокоточное отслеживание в режиме реального времени и расширенное управление данными для транспортных систем. Особое внимание уделено интегрированному модулю мониторинга расхода топлива, который позволяет пользователям визуализировать заправку и потенциальный расход топлива с помощью подробных графических отчетов. Приложение разработано с учетом кроссплатформенной совместимости (iOS и Android) и использует передовые протоколы шифрования для обеспечения конфиденциальности данных.

Ключевые слова: мониторинг GPS/GLONASS, IoT, приложение GLOT, контроль расхода топлива, преимущества, телематика, управление данными, отслеживание в реальном времени.