хорошо обеспечивает созданию необходимой перегрузки для ЗУР. В результате чего скомпенсируется ошибка наведения, возникающаяся в ходе маневра цели, т.е в изменении динамических характеристк самой ракеты.

Заключение

На основе постановки задачи синтеза альтернативного регулятора, способного отработать ошибок регулирования контура теленаведения ЗУР в условиях неопределенности изменения динамических параметров объекта управления, математическим методом сформированы структура и алгоритм функционирования ожидаемого регулятора. Особенность разработанного универсально линейного адаптивного с эталонной моделью регулятора заключается в применении MIT закона, который позволяет постоянно обноновить параметры коррекции и улучшать качество контура наведения ЗУР.

Достоинствами данного регулятора являются простота по структуре и большая скорость сходимости выходного параметра к эталонному. Кроме того, работа регулятора оказывается устойчивой.

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ON THE APPLICATION OF INTELLIGENT MONITORING SYSTEMS IN PASSENGER TRANSPORT

Abstract. The article deals with the issues of solving many production problems related to the provision of daily comfort, safety and compliance with the schedule of transportation of passengers and ways to effectively solve such production problems. A rational solution of these issues requires careful and complete control over the progress of work at the enterprise. The article considers the ways of solution through the use of modern satellite monitoring system and the introduction of GPS-terminal monitoring of any type of transport.

Keywords: intelligent, systems, monitoring, sensor, passenger transport, GPS, bus, passenger flow, control, transportation

Each head of the transport company daily solves many production tasks related to comfort, safety and compliance with the schedule of transportation of passengers. And achieving effective solutions to production problems requires careful and complete control over the progress of work. Today, the use of modern satellite monitoring systems and the introduction of GPS monitoring terminals for all types of urban and intercity transport are being widely established.

Installation of trackers does not require intervention in the operation of the main components of vehicles, contributing to their rapid payback.

Advantages of satellite monitoring system for passenger transportation:

* Real-time tracking of all fleet objects.
* Reports on route and Parking traffic.
* Passenger traffic control.
* Fixation of the real fuel consumption.
* Guaranteed license acquisition or renewal.

Almost all professionals associated with the passenger transportation market are aware of three key problems of the industry:

1. High accident rate during transportation of passengers due to the driver's non-compliance with traffic rules. This problem is especially relevant for suburban and intercity routes.

2. Not the schedule of routes. Complaints of passengers urban and district authorities that drivers do not always drive on a set schedule, especially during rush hour, too long standing at the last stop, do not go gently, etc. As a consequence of the dissatisfaction of passengers in the quality of services provided.

3. The low profitability of the traffic. Carriers are forced to balance between the state requirements of the cost of a ticket and the need to maintain a fleet of

equipment, personnel and pay for fuel costs. At the same time, carriers need to earn at least something else. Naturally, this situation does not allow improving the quality and safety of passenger transportation [1].

To date, no one will be surprised by GPS monitoring, such technologies are widely used in Kazakhstan. But the world does not stand still, modern requirements for urban infrastructure and transportation require modern information technologies that can be integrated into a single urban management network. When developing a monitoring system, it is necessary to take into account the current needs of domestic passenger carriers, modern trends for the future "smart bus for a smart city" and ensuring greater comfort and safety for passengers. The main requirements for the equipment will be reliability and vandal resistance".

As part of the project implementation, each new bus and truck is equipped directly on the factory conveyor with an on-Board terminal of the monitoring system. With its help, each owner will be able in real time to monitor the location of their vehicles and driving style of the driver, and if necessary, to respond to emergency messages. The modern monitoring system automatically detects and reports abnormal situations, such as delays in the schedule or unauthorized departure from the route. If the customer wishes, it is possible to additionally connect to the system: a reading module for an electronic ticket, an information Board in the bus and at stops, a fuel level sensor, a driver's ID, external and internal cameras, Wi-Fi, and in the near future a passenger flow sensor.

The use of intelligent monitoring systems in passenger transport allows not only to take control of its work, but also to reduce the number of accidents. Improving road safety is essential for passenger transport and especially for the transport of children on school buses. In addition, the modern transport monitoring system allows to control fuel consumption and prevent its theft, control the real mileage and prevent "left" flights, which for any fleet means a significant reduction in operating costs [2]. And thanks to the connection of the on-Board terminal to the car bus, the bus owner can remotely obtain information about the parameters of the main systems of the car (for example, fuel consumption, temperature and engine speed, axle load, etc.).

Modern monitoring systems provide new opportunities for operating enterprises. The bus with the use of intelligent transport technologies is transformed from the usual means of transportation of passengers on the "smart bus" and becomes a source of valuable information for decision-making motor transport enterprise. In turn, road carriers that use the monitoring system can quickly integrate into a single management system of the "smart city". Such projects on passenger transport are already being implemented in the cities of Astana, Almaty with the support of local administrations and show their effectiveness. It is possible that such initiatives will soon become a single state standard for all passenger carriers in each region of Kazakhstan.

GPS monitoring system improves the safety of passengers and saves the cost of carriers no less important problem is the accounting of passengers of public transport. In practice, there are many means of counting passenger flows. In order to solve the problem correctly, I propose to compare sensors and video recorders. A passenger flow sensor has been developed specifically for monitoring the number of passengers. With it, you can track the occupancy of the cabin taxi in real time. The passenger control system makes it possible to clearly know the amount of revenue that the driver must pass at the end of the shift.

The software of the GPS tracking and passenger accounting system includes comprehensive reports on the quality of traffic. The results of monitoring of critical accelerations or brakes, presented in the form of reports, will allow you to see how comfortable the passengers felt during the trip, and thus determine the professionalism of the driver. Exceeding the established traffic safety standards leads to premature wear of the transmission, brake pads, etc., and the parameters presented in the reports allow you to literally see how the vehicle is operated [3].

The accuracy of the passenger registration system, equipped with a sensor to control passenger traffic depends on the bus route load. The greater the number of passengers transported and the closer the occupancy of the bus cabin on the route to the operating standards, the more accurate the reading of the accounting system. For example, on the route with a length of 14 kilometers and the occupancy of the bus cabin 60-90 people, which is 500-800 passengers transported per day, the error relative to the actual transported passengers is 3-5%. this includes the so-called "gatherings" for the purpose of carrying passengers to exit. Most bus routes have just such indicators of occupancy of the passenger compartment.

The passenger counting system of control is made of the cumulative method, to the extent of filling and unloading of the cabin of passenger transport. The exact data we receive in the interval from the" empty "to the empty" interior of the bus. From the last stop to the last. Between the final stops of the bus route in real time, the passenger counting system shows at least how many passengers have been transported to date.

To date, this method of accounting for passengers is the most effective, completely eliminating the human factor and sources of corruption within the enterprise. The daily error of the system does not exceed 5%, even when transporting passengers with violations of operating standards, the error rate of the system is not more than 7%. Numerous all-season tests of the passenger registration sensor allow to create a reliable means of cost optimization and increase of profitability of the enterprise [4,5].

The GPS control system of passengers is a necessary tool for accounting the income of the transport enterprise. It looks like the interior of the bus taxi with installed sensor accounting the number of passengers (Fig. 1.3).

Figure 1. Installation of the sensor of control of passengers on the bus GROOVE. Side view.

Figure 2.View of the control sensor passengers, ready to work

The idea of developing modern passenger meters came to us not by chance. We had a chance to test a lot of existing passenger accounting systems on the market. As shown by the test tests, none of the submitted "applicants" for the correct registration of passengers did not show itself on the positive side. Sensors of different types and different accounting principles were tested. The error of the tested sensors of our competitors was not less than 30%, or the durability did not exceed two months of continuous operation. The issue of control of passengers in public transport remained open. It made us think and move to decisive actions on the way of realization of such an important product.

We realized that the second most important object of control with the use of GPS monitoring after fuel accounting is the accounting of passengers in urban transport – buses and taxis.

The passenger registration sensor is securely installed on the first step at the entrance to the bus. The sensor is designed with an anti-slip coating and has an imperceptible stroke of the contact platform for transmitting information to the connected GPS passenger accounting system. Stepping on the sensor, the passenger, without knowing it, launches a complex, multi-stage mechanism to control the occupancy of the bus. The sensor is activated only when the passenger actually entered or exited the vehicle.

In order for the system of accounting for the number of passengers to be as accurate as possible, several conditions must be met. The complex of equipment, and most importantly, the passenger metering sensor, must work accurately and reliably. Operational and technical characteristics must meet the requirements of work in an aggressive environment, as the sensor is the most physically exposed to the working node of the hardware complex GPS equipment. After the operation of the equipment is debugged, the turn comes to finalize the software. The correct result is achieved through the use of complex counting algorithms. Then the data is processed and stored in the computer for further construction of a variety of reports and statistics on bus routes.

For two years, tests were carried out and this sensor of passenger registration was improved, which confirmed the all-season use and reliability of the current model of the product.

The sensor is covered with a casing made of special hard-to-wipe rubber, which protects the working mechanism. Therefore, he is not afraid of rain or slush or icing. And now, when the sensor has passed the most severe tests, we can say with confidence that the project was a success.

Method of control of passengers in public transport with application (Fig.3) all kinds of options for DVRs is very interesting, because, at first glance, such a system should give accurate counting results.

Figure 3. Registration of passengers using the DVR

The DVR is installed in the interior of the bus and, in fact, is a small computer that records the video signal to the built-in hard drive. The DVR camera is located above the front entrance door outside the vehicle, so as to "see" both entrances to the interior of the bus. During the operation of the DVR, information about the

passenger's visit to the bus cabin is carefully stored on the hard drive.

Well, that's fine. We assume that the system is purchased and installed. It would seem that now we can accurately determine the number of passengers on the route.

Now consider the practical side of the acquisition of the DVR to account for passengers. Established, started, went. To obtain information about the number of passengers, it is necessary to remove the disk from the DVR to take readings, which requires direct access to transport. The frequency of these actions depends on how quickly you want to receive information about the number of passengers carried. After removing the disk, connect it to the computer and using a special program to get a picture of the entrance and exit of passengers in the bus. Consider them. So far everything looks great, clear and easy. Time passes – because in order to visually count the passengers, you need the same time that was spent on the record. We can use accelerated scrolling, but there is a risk of increasing the error in the calculation. About 30 stops on the bus route, lasting from about 0.5 to 1 minute. About 12 flights per shift. By simple calculations we calculate that about 3 (!) hours, we will assume passengers in a single (!) bus for one (!) change. But if recording in a week? We consider further, attention is dulled. We start making mistakes and missing people. Thus obtained "accurate" data recorded in a notebook or Excel table. Someday we'll use them for some kind of report or statistical evaluation.

All the taping was over! Well, finally you can relax the whole day left to do the hard work. What? Another disk, which need to view!? And another... Well, of course, we have the same fleet of 20 or even 50 buses!!! It is necessary to undertake something cardinal because it is inconceivable hard work demanding close attention. It begs the decision to hire a "human robot", which will be" responsible "approach to the issue of" accurate " accounting data DVR. Here you need to stop and ask yourself the question: who said that the account will be accurate? How is this person different from you? Plus sticks to the base for the growth of "corruption" within the enterprise. You will not be engaged in checking the accuracy of passenger records! How do you imagine that? And time for it, as a rule, simply isn't present.

What did we get in the end? As a result, we acquired the illusion of passenger control, which has nothing to do with the real situation. Yes, undoubtedly, for individual cases, the DVR is an acceptable way of accounting for passengers. But if we are talking about automation of accounting, convenience and practicality of solutions, this method is categorically not suitable.

Again, returning to the effective automation of the process of control of public transport passengers based on the online system and the use of the sensor, it is worth noting the following important advantages of their implementation:

- there is no need to attract additional personnel to service the system (remember the removal of disks and" questionable " counting of passengers);

- the absence of reasons for "corruption" and shortcomings within the enterprise (with the passenger control system, which includes a metering sensor, it is impossible to agree);

- monitoring the occupancy of the bus from anywhere in the world, where there is Internet in real time;

- fast and accurate formation of the necessary reports for any period of the fleet (reports on the indicators of professionalism of the driver: driving quality-unacceptable acceleration and braking);

- the ability to control the parameters of on-Board transport systems in a single complex (passenger accounting, control of fuel consumption, mileage, engine speed and temperature, real-time tracking, etc.).

Control of these parameters in online mode is possible only when using GPS technology.

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