АНАЛИЗ УПРАВЛЕНИЯ МАТЕРИАЛЬНО-ТЕХНИЧЕСКИМИ ЦЕННОСТЯМИ ПРЕДПРИЯТИЙ

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Аннотация. Изменчивость спроса на товар в зависимости от его наличия и стоимости - это часто наблюдаемое явление в сфере производства и потребления. В данной работе рассмотрена возможность применения ABC-анализа для системы управления производственно-товарными запасами, позволяющего применять различные методы управления запасами с целью увеличения дохода и снижения затрат производителей того или иного товара.

В данной статье представлена реалистичная модель производства товара и его инвентаризации, поскольку ABC-анализ или ABC-классификация -это неотъемлемая часть управления материальными потоками, при котором инвентарь подразделяют на три отдельные категории в зависимости от получения дохода. ABC-анализ помогает предпринимателям определять основные виды продукции на складе, расставлять приоритеты управления ими на основе стоимости, а также анализировать потребительский спрос в конкретном продукте.

Ключевые слова: запасы, управление запасами, ABC-анализ, хранение товаров, расходы по хранению товаров, заказ, прибыль.

КӘСІПОРЫНДАРДЫҢ МАТЕРИАЛДЫҚ-ТЕХНИКАЛЫҚ ҚҰНДЫЛЫҚТАРЫН БАСҚАРУДЫ ТАЛДАУ

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Аңдатпа. Өнімге сұраныстың өзгеруі оның қол жетімділігі мен құнына байланысты өндіріс пен тұтыну саласында жиі байқалатын құбылыс болып табылады. Бұл жұмыста белгілі бір өнімді өндірушілердің кірісін арттыру және шығындарын азайту мақсатында қорларды басқарудың әртүрлі әдістерін қолдануға мүмкіндік беретін өндірістік және тауарлық қорларды басқару жүйесі үшін ABC талдауын қолдану мүмкіндігі қарастырылған.

Бұл мақалада өнімді өндірудің және оны түгендеудің нақты моделі келтірілген, өйткені ABC талдауы немесе ABC классификациясы материалдық ағындарды басқарудың ажырамас бөлігі болып табылады, онда түгендеу кіріс алуға байланысты үш бөлек санатқа бөлінеді. ABC талдауы кәсіпкерлерге қоймадағы өнімнің негізгі түрлерін анықтауға, оларды шығындар негізінде басқаруға басымдық беруге, сондай-ақ белгілі бір өнімдегі тұтынушылық сұранысты талдауға көмектеседі.

Түйінді сөздер: қорлар, қорларды басқару, ABC-талдау, тауарларды сақтау, тауарларды сақтау шығындары, тапсырыс, пайда.

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LIGHT REGULATION SYSTEMS IMPROVEMENT ANALYSIS TO FORECAST THE TRANSPORT FLOWS IN ALMATY

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Abstract. The number of vehicles on the roads of Almaty, Kazakhstan is growing from year to year. This brings about an increasing intensity and density of traffic flows in the streets which leads to congestion, decreasing speed of the traffic flow, increasing environmental pollution caused by car emissions, and which can potentially lead to the road traffic accidents (RTA), including fatalities.

While the number of injuries grows up mainly due to drivers' non-compliance with the speed limit, the environmental pollution is caused by longer traffic jams. Therefore, to reduce the

level of road traffic injuries and emissions into the environment it is necessary to ensure the uniform movement of traffic flows in cities. Currently, one of the effective ways to do it is the use of transport telematics systems, in particular, control systems for road signs, road boards and traffic lights.

The paper presents an analysis of existing systems and methods of traffic light regulation. The analyses of the systems and methods are based on the use of homogeneous data, that is the data on standard parameters of traffic flows. The need in collecting and analyzing additional semi-structured data on the factors that have a significant impact on the traffic flows parameters in cities is shown as well.

The work is dedicated to solving the problem of analysis and forecast of traffic flows in the city of Almaty, Kazakhstan. GPS data on the location of individual vehicles is used as the initial data for solving this problem. By projecting the obtained information onto the graph of the city's transport network, as well as using additional filtering, it is possible to obtain an estimate of individual parameters of traffic flows. These parameters are used for short-term forecast of the changes in the city's transport network.

Keywords: GPS, traffic flow, traffic network, traffic accidents.

Introduction. The number of vehicles on the roads of Kazakhstan increases every year, so that the intensity and density of traffic flows bring about a growing number of road traffic injuries as well as the further environmental pollution problems.

According to the Central Communications Service under the President of the Republic of Kazakhstan, the number of injured in 13 391 road traffic accidents was 17,794 people in 2019, from January to October, which exceeded by 8.2% the number of injured in the same period of 2018. It was also reported that about 2,000 people die in road accidents in Kazakhstan every year, which is about 5 people a day, more than half of this amount being pedestrians. About 20,000 more people are annually exposed to non-fatal injuries as a result of accidents, which cause disability [1].

While the number of injuries grows mainly due to drivers' non-compliance with the speed limit, the environmental pollution is caused by longer traffic jams. Therefore, to reduce the level of road traffic injuries and emissions into the environment it is necessary to ensure the uniform movement of traffic flows in cities. Currently, one of the effective ways to do it is the use of transport telematics systems, in particular, control systems for road signs, road boards and traffic lights. The paper presents an analysis of existing systems and methods of traffic light regulation. All analyzed systems and methods are based on the use of homogeneous data, that is the data on standard parameters of traffic flows. The need in collecting and analyzing additional semi-structured data on the factors that have a significant impact on the traffic flows parameters in cities is shown as well.

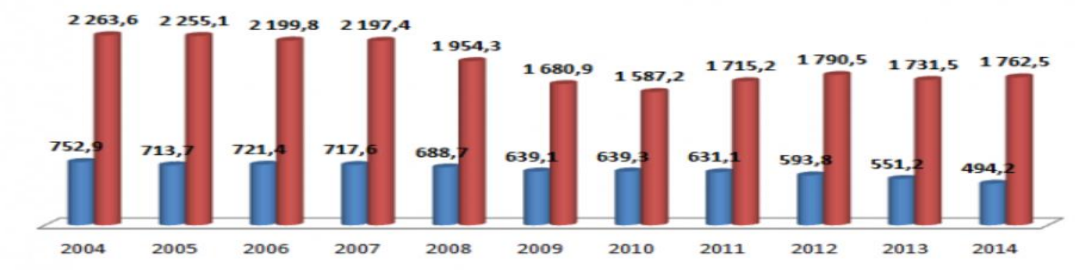


Figure 1- The dynamics of volumes of liquid (blue) and solid (red) emissions of pollutants into the atmosphere for 2004-2014.[2]

Рисунок 1- Динамика объемов жидких (синих) и тело (красных) выбросов загрязняющих веществ в атмосферу для 2004-2014. [2]

Analysis of methods and means of managing the city transportation system.

So far, the possibilities of improving traffic conditions by way of the optimal organization of traffic, in particular, the management of intersections, have been largely underestimated. The term “development of transport infrastructure” was often understood as measures related to the construction of new roads and highways, and reconstruction of existing overpasses and junctions.

At the same time, introduction of the modern technologies of Automated Traffic Management Systems (ATMS), otherwise called Intelligent Transport Systems (ITS), makes it possible to significantly improve the transport situation on the already existing road network .

The greatest effect is provided by an integrated approach, which consists in creating a single closed system that implements the functions of collecting, processing, optimization analysis, control of information and control devices.

Typification of initial data for traffic light control systems

The analysis of the given calculation formulas makes it possible to distinguish the following groups of data used in traffic light control systems:

• traffic flow parameters - intensity, flow rate, number of vehicles in the flow (flow mass), number of traffic stops, traffic flow or vehicle delay time (loss of time), times when the flow (vehicle) starts or stops;

• traffic light control parameters - the duration of the traffic light control cycle, the duration of the individual phases of the traffic light control cycle;

• estimates and coefficients - relative or absolute estimates of delays, vehicle stops and congestion on the road network;

• parameters of the road network - throughput, number, and length of sections of the road network.

Algorithms for predicting traffic flows using machine learning methods

The following machine learning methods and algorithms are usually used for solving the problem of short-term forecasting of traffic flows:

- linear regression algorithm;
- support vector regression;
- method of potential functions;
- method of nearest neighbors;
- neural networks.

In this work, the support vector method and the method of potential functions were used to construct individual elementary forecasts and study their effectiveness. The prediction result obtained as a result of applying the SVR method for all segments in a specific k-th subgraph of the network will be further denoted as follows:

$$\frac{\sum_{m=0}^{N-1} v_0^k(t-m\Delta+n\Delta)R_0\left(v_M^k(t), v_M^k(t-m\Delta)\right)}{\sum_{m=0}^{N-1} R_\sigma(v_M^k(t), v_M^k(t-m\Delta))} \quad (1)$$

$$\emptyset \quad (2)$$

(1) $\sum_{m=0}^{N-1} R_\sigma\left(v_M^k(t), v_M^k(t-m\Delta)\right) > 0$

(2) $\sum_{m=0}^{N-1} R_\sigma\left(v_M^k(t), v_M^k(t-m\Delta)\right) = 0$ [3]

where $R_\sigma\left(v_M^k(t), v_M^k(t-m\Delta)\right)$ is the kernel of the estimate being formed, which monotonously goes down while the discrepancy between the $v_M^k(t), v_M^k(t-m\Delta)$ vectors goes upwards.

The σ parameter defines the maximum distance between the description vectors that will be used in the forecast. By varying the value of the parameter, we will obtain different values of the predictions of the traffic flow parameters. In the case with a finite kernel, the method of potential functions has specific features: for small values of the σ parameter, a result can be formally obtained

with the value indicated by the symbol "Ø", that is, there is no result. This situation arises if there is no close prototype in the historical data for the current state of the network.

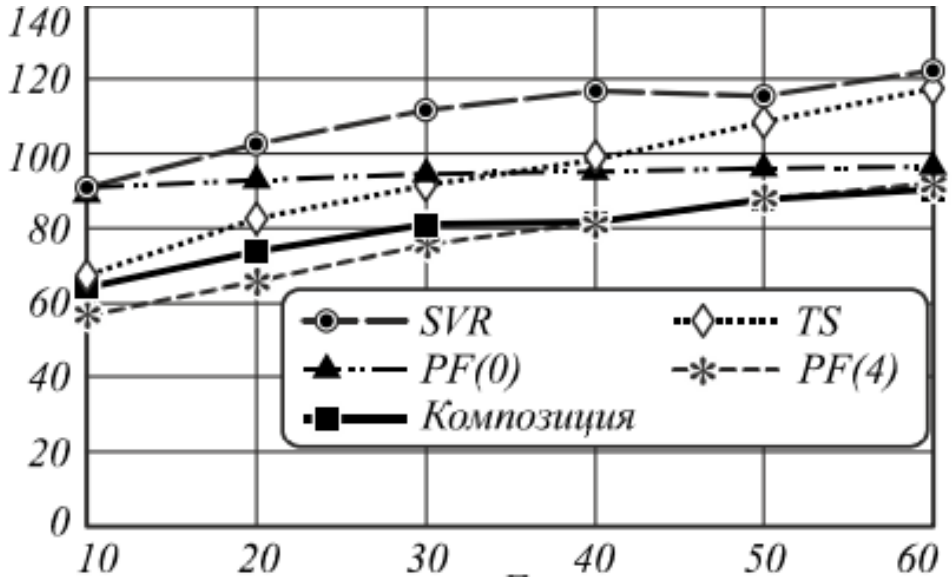
Experimental research

The objectives of the experimental studies were as follows:

Experiment 1. Evaluation of the effectiveness of the proposed adaptive composition and its comparison with the quality of individual algorithms.

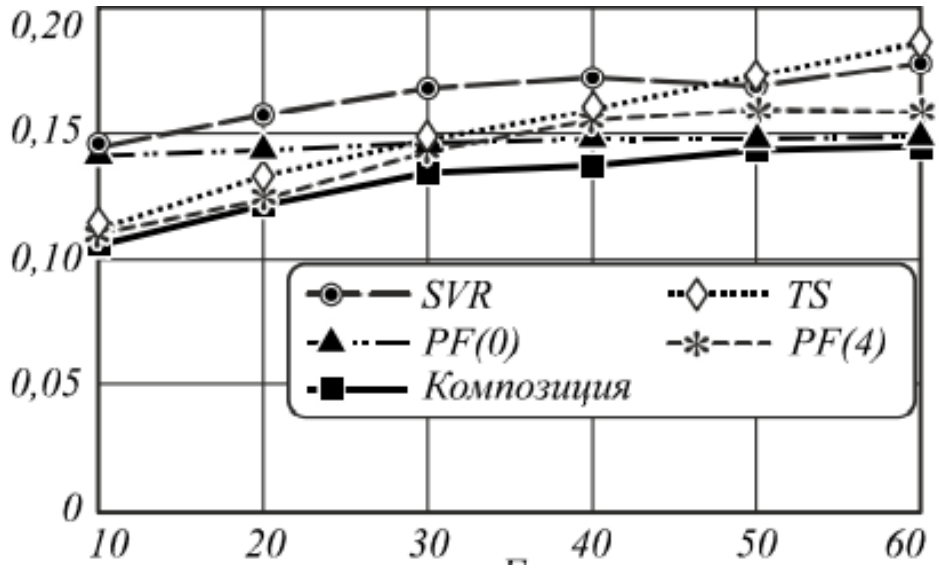
Experiment 2. Calculation of the dependence of the operating time of the proposed adaptive composition on the number of principal components used in the PCA method to describe the vector of the space-time distribution of flows. Experimental studies of the developed method were carried out for the UDS of the city of Almaty. The road network consists of 3325 segments. The number of GPVs connected to the monitoring system is more than 1500, new coordinates of the GPV position are received with an average frequency of 30 seconds. The motion monitoring system is described in more detail in [8]. For experimental studies, the road network graph was divided into subgraphs over an area of 1 km². Each subgraph contained 55 arcs on average. The number of archived values of TP parameters used in the vector of signs for each network segment is M = 5, the value of the time interval is Δ = 10 minutes, i.e. the feature vector contains historical data for the last hour. The recalculation of the new values of the TP parameters was carried out every 10 minutes.

The study of the quality of forecasts was carried out on a sample consisting of the values of the TP parameters on road segments for 12 weekdays. The study was carried out by a cross-validation method, the size of one part of the control sample was one day. The graph of the dependence of the average absolute error on the forecast horizon on the control sample is shown in Figure 2, and the average relative error in the control sample is given in Figure 3.



[3]

Figure 2- Dependence of the mean absolute error on the forecast horizon on the control sample
Рисунок 2- Зависимость средней абсолютной погрешности от горизонта прогноза на контрольной выборке



[3]

Figure 3- Dependence of the average relative error on the forecast horizon on the control sample
Рисунок 3- Зависимость средней относительной погрешности от горизонта прогноза на контрольной выборке

It can be seen from the above that the adaptive composition model gives a better result practically over the entire forecast horizon. A more detailed analysis of the results showed that the greatest contribution to the error values is made by those moments of the street road network

that correspond to congestion on the segment. This fact makes it relevant to develop both methods of preliminary filtering of data for training and evaluating the effectiveness of methods, which is used in some existing works, as well as the methods of "detecting" these situations with a subsequent change in the forecasting method**.**

Conclusion.

The paper proposes an original method of short-term TP parameters forecasting for a large city's UTS, based on the model of adaptive composition of elementary forecasting algorithms. Adaptability implies the dependence of the parameters of the constructed composition on the facts of the presence or absence of prototypes for forecasting. In the studies carried out on the data of urban passenger transport traffic in the city of Almaty, the proposed forecasting algorithm showed a better result compared to individual algorithms used for short-term forecasting of traffic flows: ARIMA and VARMA models, SVR method, and potential function method.

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АНАЛИЗ СОВЕРШЕНСТВОВАНИЯ СИСТЕМ СВЕТОФОРНОГО РЕГУЛИРОВАНИЯ ПРИ ПРОГНОЗИРОВАНИИ ТРАНСПОРТНЫХ ПОТОКОВ ГОРОДА АЛМАТЫ

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Аннотация. Работа посвящена решению задачи анализа и прогнозирования транспортных потоков в городе Алматы (Казахстан). В качестве исходных данных для решения этой задачи используются данные GPS о местонахождении отдельных транспортных средств. Проецируя полученную информацию на график транспортной сети города, а также используя дополнительную фильтрацию, можно получить оценку отдельных параметров транспортных потоков. Эти параметры используются для краткосрочного прогнозирования изменения ситуации в транспортной сети города.

Ключевые слова: GPS, транспортный поток, транспортная сеть, дорожно-транспортные происшествия.

АЛМАТЫ ҚАЛАСЫНДАҒЫ КӨЛІКТІК АҒЫМДАРДЫ БОЛЖАУДАҒЫ БАҒДАРШАМДЫҚ РЕТТЕУ ЖҮЙЕЛЕРІН ЖАҚСАРТУДЫ ТАЛДАУЛАР

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Аңдатпа.Жұмыс Алматы қаласындағы (Қазақстан) көлік ағындарын талдау және болжау мәселелерін шешуге арналған. Мәселені шешуге арналған бастапқы деректер ретінде жеке көлік құралдарының орналасуы туралы GPS деректері қолданылады. Алынған ақпаратты қаланың көліктік желісінің графигіне шығарып, сонымен қатар қосымша сүзгілеуді қолдану арқылы трафик ағындарының жеке параметрлерін бағалауға болады. Параметрлер қаланың көлік желісіндегі жағдайдың өзгеруін қысқа мерзімді болжау үшін қолданылады.

Түйінді сөздер: GPS, көлік ағыны, трафик желісі, жол-көлік оқиғалары.

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AUTOMATION OF A SINGLE-ZONE AIR CONDITIONER IN A MOBILE COMPLEX WITH ADJUSTABLE PERFORMANCE

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Abstract. The article discusses the need for the use of automated air conditioning systems in mobile complexes. It is due to the need placing the mobile complex in the place that allows work to be carried out, and such places can be located in uncomfortable for human's conditions. The air conditioning system of the complex is investigated as an object of regulation, a generalized block diagram with the main input and output parameters, as well as components and processes occurring during air cooling and heating, is presented. The article provides an example of the implementation of automation of a single-zone air conditioner in a mobile complex by the method of performance adjustment. This method is realized by using a frequency inverter and is able to significantly reduce inrush currents, ensure efficient energy consumption and provide the highest level of component protection against unexpected accidents and breakdowns. The article describes in detail the main advantages of inverter performance control, and also shows the main elements of compressor protection using tuned automation. Considered in detail timing diagrams of fans speed in the process of inverter control of the air conditioning system. These diagrams show that in the inverter capacity control method, there can be quite a large number of operating speeds. Separately, a cyclogram of compressor overheating protection is given, which proves its high degree of protection. In the end of the article, gives conclusions and general results of the work that